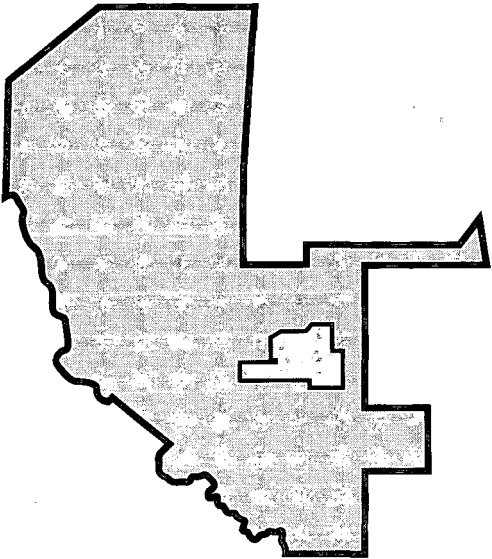


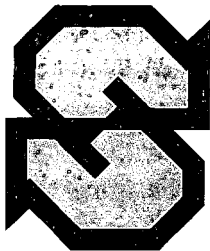
HARDEE

UNIT 3



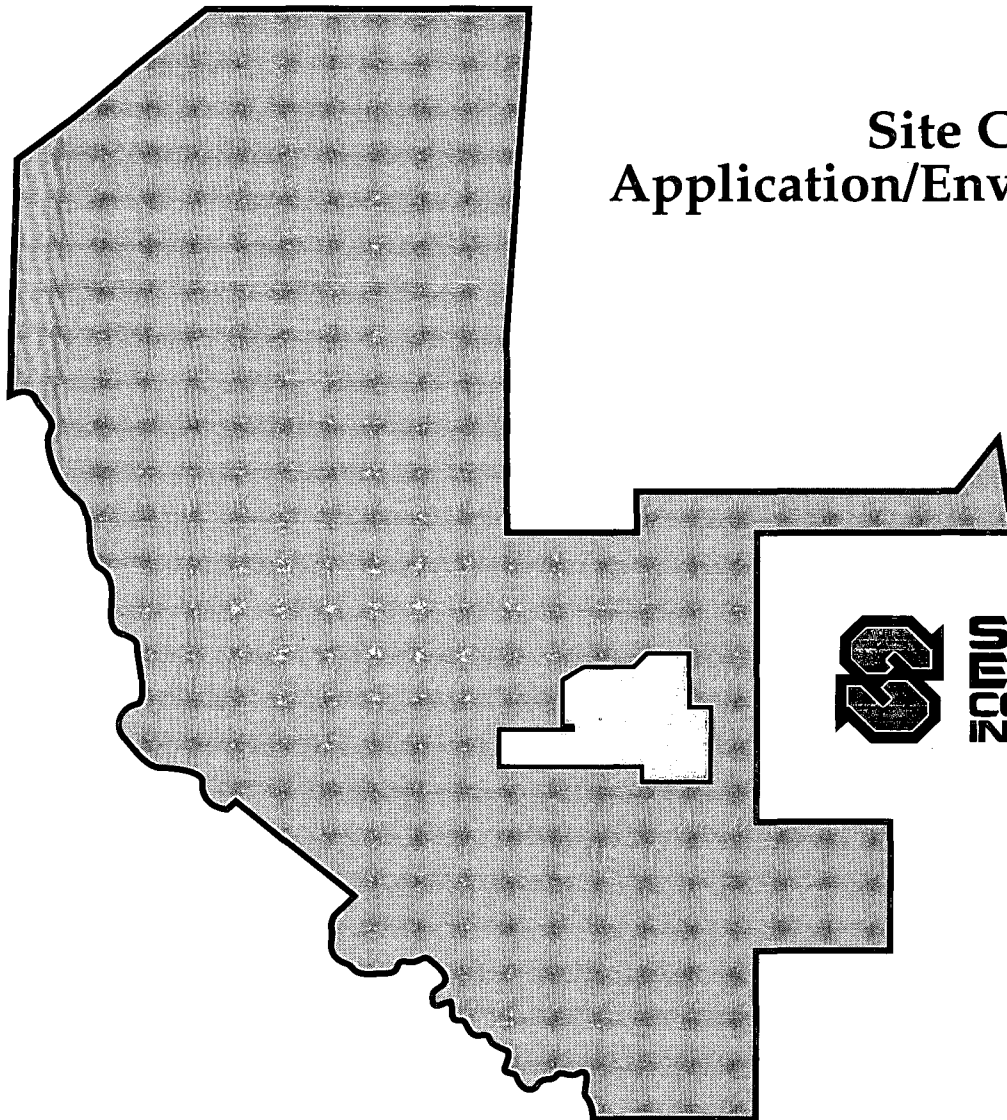
SITE CERTIFICATION APPLICATION/ ENVIRONMENTAL ANALYSIS

**Volume I
Chapters 1-9**

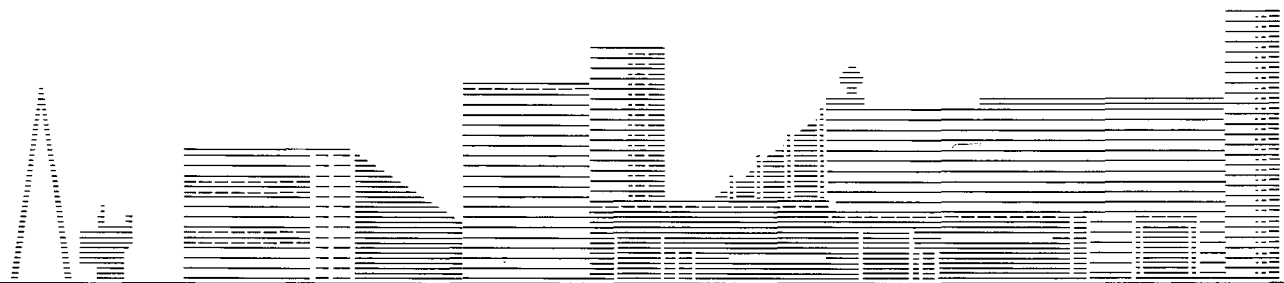


HARDEE UNIT 3

Site Certification
Application/Environmental
Analysis



**SEMINOLE
ELECTRIC
COOPERATIVE
INCORPORATED**



**HARDEE UNIT 3
SITE CERTIFICATION APPLICATION/ENVIRONMENTAL ANALYSIS
VOLUME I and II**

Please acknowledge receipt of this document by filling out the following information, sign and date, and return to:

Mike Opalinski
Seminole Electric Cooperative Incorporated
P.O. Box 272000
Tampa, FL 33688-2000

Name _____
Title _____
Affiliation _____
Mailing Address _____

I have received the Hardee Unit 3 Site Certification Application/Environmental Analysis document.

Signature

Date

APPLICANT INFORMATION

Please supply the following information:

Applicant's Official Name Seminole Electric Cooperative Incorporated

Address P.O. Box 272000 Tampa, FL 33688-2000

Address of Official Headquarters P.O. Box 272000 Tampa FL 33688-2000

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

Names, owners, etc. Seminole Electric Cooperative Incorporated

Name and Title of Chief Executive Officer William C. Walbridge
Executive Vice President

Name, Address, and Phone Number of Official Representative responsible
for obtaining certification: Michael Opalinski, P.O. Box 272000
Tampa, FL 33688-2000 (813) 963-0994

Site Location (county) Hardee, Polk

Nearest Incorporated City Bowling Green

Latitude and Longitude 27° 38' 30" N 81° 57' 45" W

UTM's Northerly 3057.7 km

Easterly 405.0 km

Section, Township, Range Section 1, Township 33S, Range 22E

Location of any directly associated transmission
facilities (counties) None

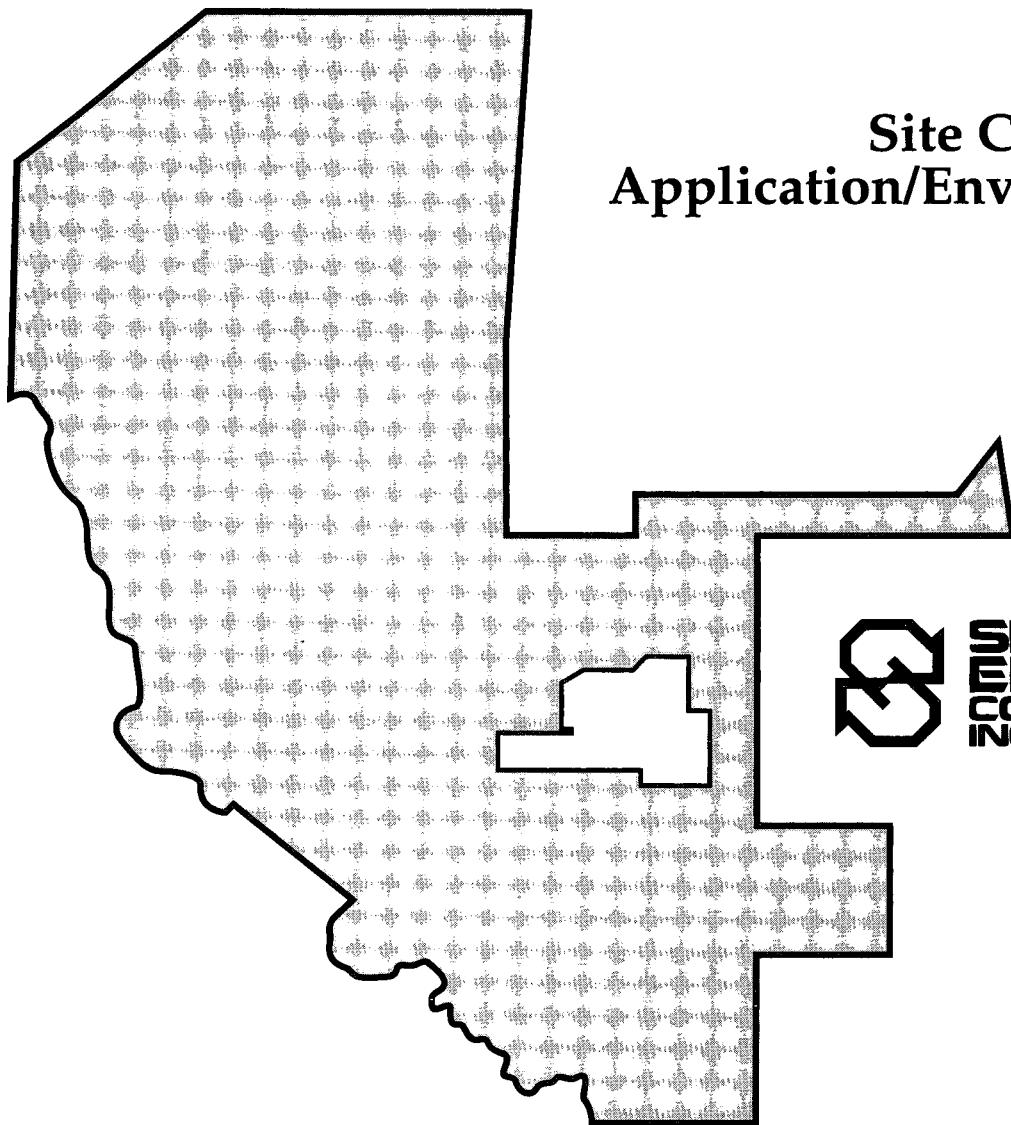
Name Plate Generating Capacity 440 Megawatts

Capacity of Proposed Additions and Ultimate Site
Capacity (where applicable) 440 Megawatts, 880 Megawatts

Remarks (additional information that will help identify
the applicant): _____

HARDEE UNIT 3

Site Certification
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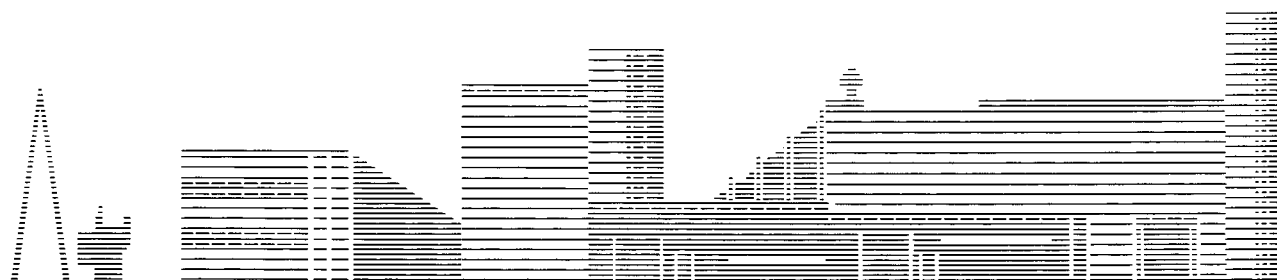


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LIST OF ABBREVIATIONS AND ACRONYMS

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AAQS	ambient air quality standards
ADA/DRI	Application for Development Approval/Development of Regional Impacts
ADT	average daily traffic
ANSI	American National Standards Institute
B&K	Bruel & Kjaer
BACT	best available control technology
BMP	best management practices
Btu	British thermal unit
Btu/kW	British thermal unit per kilowatt
CaCO ₃	calcium carbonate
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CFRPC	Central Florida Regional Planning Council
cfs	cubic feet per second
CH ₄	methane
cm	centimeter
cm/yr	centimeters per year
CO	carbon monoxide
CO ₂	carbon dioxide
COS	carbonyl sulfide
CR	County Road
CT	combustion turbine
CWCGP	Cool Water Coal Gasification Program
dB	decibels
dBA	A-weighted decibels
DHR	Division of Historical Resources
EA	environmental assessment
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ESE	Environmental Science and Engineering, Inc.
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FDLES	Florida Department of Labor and Employment Statistics
FDOT	Florida Department of Transportation
FEPPSA	Florida Electrical Power Plant Siting Act
FGFWFC	Florida Game and Fresh Water Fish Commission
FIPR	Florida Institute of Phosphate Research

LIST OF ABBREVIATIONS AND ACRONYMS (Page 2 of 4)

FLUFCCS	Florida Land Use, Forms and Cover Classification System
FNAI	Florida Natural Areas Inventory
FPC	Florida Power Corporation
FPL	Florida Power & Light Company
FS	Florida Statutes
ft/sec	feet per second
ft	foot
ft-msl	feet above mean sea level
ft ² /sec	square feet per second
ft ³	cubic feet
GEP	good engineering practices
gpd	gallons per day
gpd/ft	gallons per day per foot
gpm	gallons per minute
H ₂	hydrogen
H ₂ SO ₄	sulfuric acid
ha	hectare
HCN	hydrocyanic acid
HPP	Hardee Power Partners, Limited
HPS	Hardee Power Station
HRSG	heat recovery steam generators
Hz	Hertz
IPP	independent power producers
ISCST2	Industrial Source Complex Short-Term
KBN	KBN Engineering and Applied Sciences, Inc.
kg/cm ²	kilograms per square centimeter
km	kilometers
kV	kilovolt
kW	kilowatt
lb/day	pounds per day
LOS	level of service
Lpm/30 m	liters per minute per 30 linear meters
m	meters
m-msl	meters above mean sea level
m ³	cubic meters
mgd	million gallons per day
mg/L	milligrams per liter

LIST OF ABBREVIATIONS AND ACRONYMS

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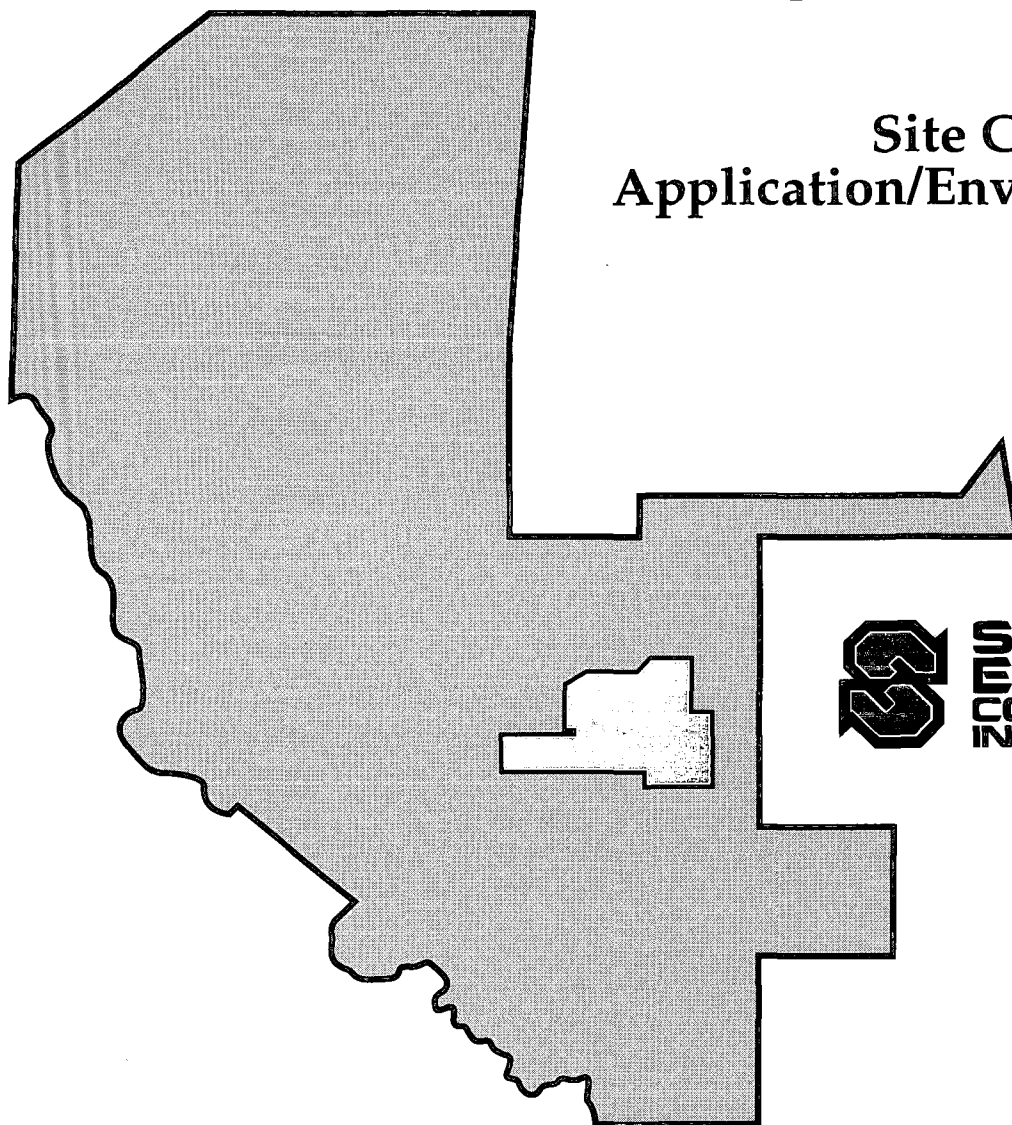
MIA	Most Impacted Areas
MMBtu	million British thermal units
MSSW	Management and Storage of Surface Waters
MW	megawatt
NEPA	National Environmental Policy Act
NO ₂	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NO _x	nitrogen oxide
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NTU	Nephelometric turbidity unit
NWS	National Weather Service
NYSDPS	New York State Department of Public Service
O ₃	ozone
Pb	lead
pC/L	picocuries per liter
PM	particulate matter
PM10	particulate matter with an aerodynamic diameter less than or equal to 10 micrometers
POS	Plan of Study
PR	partial requirements
PSC	Public Service Commission
PSD	prevention of significant deterioration
PWRR	present worth revenue requirements
QA	quality assurance
QA/QC	quality assurance/quality control
QF	qualifying facility
RCRA	Resource Conservation and Recovery Act
REA	Rural Electrification Administration
RIMS II	Regional Input-Output Modeling System
SCA/EA	Site Certification Application/Environmental Analysis
SCA	Site Certification Application
SCOT	Shell-Claus Offgas Treatment
SCS	U.S. Soil Conservation Service
SECI	Seminole Electric Cooperative Incorporated
SEL	sound exposure level

LIST OF ABBREVIATIONS AND ACRONYMS
(Page 4 of 4)

SO ₂	sulfur dioxide
SO ₄	sulfate
SPCC	Spill Prevention Control and Countermeasure
SPL	sound pressure level
SPPP	Stormwater Pollution Prevention Plan
SR	State Road
ST	steam turbine
SWFWMD	Southwest Florida Water Management District
SWUCA	Southern Water Use Conservation Area
Syngas	synthetic gas
TBEL	technology-based effluent limitation
TPD	tons per day
TPS	TECO Power Service
TPY	tons per year
USACE	U.S. Army Corps of Engineers
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compound
WQBEL	water-quality-based effluent limitation
μg/m ³	micrograms per cubic meter
μg/L	micrograms per liter
μmho/cm	micromhos per centimeter

HARDEE UNIT 3

Site Certification
Application/Environmental
Analysis



**SEMINOLE
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1.0 NEED FOR POWER AND THE PROPOSED FACILITIES

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1.1 INTRODUCTION

1.1.1 THE APPLICANT

Seminole Electric Cooperative Incorporated (SECI) is a generation and transmission cooperative which generates and transmits bulk supplies of electricity to 11 member distribution cooperatives throughout Florida (Figure 1.1.1-1). More than 1 million Floridians in 45 counties rely on SECI for their electricity. SECI's existing generating capabilities consist of two 600-megawatt (MW) coal-fired units near Palatka, Florida, and a 14.4-MW share of Florida Power Corporation's (FPC's) Crystal River Unit 3 nuclear power plant. In addition, SECI owns 70 miles of 230-kilovolt (kV) double-circuit transmission line, 140 miles of 230-kV single-circuit transmission line, and 157 miles of 69-kV transmission line connecting with its existing power plant, substations, and other distribution systems. SECI also purchases backup power from Hardee Power Partners, Limited (HPP), an affiliate of TECO Power Services (TPS). This backup power is obtained from the Hardee Power Station (HPS) existing combined cycle units.

1.1.2 PURPOSE OF SITE CERTIFICATION APPLICATION/ENVIRONMENTAL ANALYSIS

SECI is proposing to own and operate a new 440-MW combined cycle power plant [the Hardee Power Station Unit 3 (Hardee Unit 3) Project]. This facility will be constructed under a turnkey construction contract with Westinghouse Electric Corporation and Black & Veatch Construction, Inc. The Hardee Unit 3 Project will be located on the existing HPS site and will represent an incremental increase in the ultimate power-generating capacity of the HPS site from 660 MW to 880 MW. The HPS site was selected as the preferred location for the Hardee Unit 3 Project because this site has been previously certified for 660 MW of combined cycle power generation (Certification Number PA89-25) (TPS/SECI, 1989). Furthermore, the HPS site has adequate area to accommodate the proposed expansion from 660 MW to 880 MW. Locating the Hardee Unit 3 Project at the HPS site takes advantage of the existing infrastructure and onsite facilities, and minimizes potential environmental impacts that might otherwise be associated with the construction of a combined cycle power plant at a previously undeveloped site.

The licensing of power plants in Florida requires compliance with federal, state, regional, and local laws, regulations, and ordinances. The two primary laws governing the licensing of this project are the Florida Electrical Power Plant Siting Act [FEPPSA, 403.501-403.517-518, Florida Statutes (FS)] and the National Environmental Policy Act (NEPA).

FEPPSA establishes the state's policy toward balancing the needs for increased electrical power generation with the effects on human health, the environment and ecology of the lands and waters within the state. In the site certification process, the Florida Public Service Commission (PSC) is the exclusive forum for the determination of need, and the Florida Department of Environmental Protection (FDEP) acts as the central coordinator of the certification process. Certification begins with the submittal of a Site Certification Application (SCA) to FDEP by the applicant and culminates with approval by the Governor and Cabinet. Implementation procedures are set forth in FEPPSA and Chapter 17-17, Florida Administrative Code (F.A.C.), Electrical Power Plant Siting.

NEPA is the national charter for protection of the environment. It establishes policy, sets goals, and provides means for carrying out the policy. The Council on Environmental Quality (CEQ) promulgates regulations [40 Code of Federal Regulations (CFR) 1500] to guide federal agencies

in complying with the procedures and achieving the goals of NEPA. In meeting its responsibilities under NEPA and CEQ regulations, the U.S. Department of Agriculture's Rural Electrification Administration (REA) has determined that its loan guarantee commitments to SECI for bulk power generation such as Hardee Unit 3 are major federal actions significantly affecting the quality of the human environment. Therefore, these commitments are subject to NEPA and CEQ regulations. REA typically requires a borrower to prepare an environmental analysis (EA) document prior to REA preparing its own environmental impact statement (EIS). REA's environmental policies and procedures are presented in 7 CFR 1794. In the case of the Hardee Unit 3 Project, since an EA and EIS have been previously prepared for the HPS and since the Hardee Unit 3 Project represents an incremental increase to the overall generating capacity of the HPS site, it has been determined by REA that requirements under NEPA will be satisfied through the preparation of a supplemental EA and EIS for the proposed project.

This single environmental application, an SCA/EA, is being submitted to FDEP and REA describing the Hardee Unit 3 Project and the environmental conditions and impacts associated with the project. This SCA/EA has been prepared to meet the requirements of the two primary laws, i.e., FEPPSA and NEPA, which govern this project. This SCA/EA follows the scope, quantity, and specificity of information described in the SECI Hardee Unit 3 Environmental Licensing Plan of Study (KBN, 1993). Approvals and binding agreements were requested for this Plan of Study pursuant to Section 403.5063, FS, and Chapter 17-17.041(6), F.A.C. SECI has responded to agency comments on matters to be addressed in this SCA.

Agency and public comments regarding the project have been obtained through meetings, discussions, and presentations. State and federal interagency meetings and public scoping meetings regarding the Hardee Unit 3 Project were held in December 1993. Public informational meetings were held in March 1994.

1.2 NEED FOR THE PROJECT

SECI has determined that in order to continue to provide the most reliable, cost-effective service to its customers, it must replace 440 MW of power currently purchased on a partial requirements (PR) basis from Florida Power & Light Company (FPL) with power from another source beginning in 1999. Through a competitive bidding and negotiation process, SECI has determined that the best alternative for displacing that 440 MW of PR purchases is construction and operation of the proposed 440-MW Hardee Unit 3 combined cycle generating facility.

The Hardee Unit 3 Project will save SECI's members \$20 million during the project's first year of operation, and approximately \$299 million in present worth revenue requirements (PWRR) over a 30-year period, compared to continuing to purchase the replaced capacity and energy from FPL. The Hardee Unit 3 Project also enhances the reliability of SECI's system, defers the need for SECI to add combustion turbine capacity to meet its reliability criterion, and reduces the risk to SECI in the event that FPL seeks to significantly modify the current PR arrangement.

1.2.1 POWER SUPPLY PLANNING PROCESS

SECI uses its on-going power supply planning process to evaluate the adequacy of SECI's resources to meet its members' capacity and energy needs as well as the cost-effectiveness of displacing PR purchases by building or purchasing additional capacity.

SECI's 1989 Power Supply Study showed for the first time that there would be a substantial economic benefit to SECI to build or purchase combined cycle capacity to replace between 440 MW and 660 MW of PR purchases between 1998 and 2000.

Based on this study, SECI issued a Request for Proposals (RFP) in July 1990, soliciting both turnkey and purchased power proposals for capacity in the 1998 to 2000 timeframe. Turnkey bids were solicited for combined cycle capacity. Purchased power bids with no limitation on the type of capacity were solicited from qualifying facilities (QFs), independent power producers (IPPs), and other utilities. SECI received responses to the RFP from both turnkey bidders and purchased power bidders.

In 1991, SECI updated its power supply analysis based on then-current planning assumptions. The updated analysis (known as the Late 90s Power Supply Study) showed that the addition of 440 MW of combined cycle capacity in 1999 to replace PR purchases from FPL was the best alternative for SECI. Based on this updated analysis, SECI in December 1991 gave the required 7 years' notice to FPL that it intended to increase its capacity commitment in FPL's control area by 440 MW effective January 1, 1999. This notice relieved FPL of the obligation to plan to serve this portion of SECI's needs and placed this obligation on SECI.

In January 1992, SECI solicited updated responses to the RFP based on the revised timing of the unit additions that resulted from the Late 90s Power Supply Study. Responses to the revised solicitation were received in February 1992 from all of the original turnkey and purchased power bidders. Following a period of evaluation and negotiation with both turnkey and purchased power bidders, SECI selected a turnkey proposal by Black & Veatch/Westinghouse for a 440-MW combined cycle unit as the best project for meeting SECI's 1999 capacity need. A contract with Black & Veatch/Westinghouse for the construction of Hardee Unit 3 was executed in June 1993.

1.2.2 NEED FOR POWER STUDY

In preparing the application for a need determination, SECI reexamined the economics of displacing PR purchases with the 440-MW plant to be built by Black & Veatch/Westinghouse using SECI's most recent generation planning assumption. The analysis, which is detailed in the need for power document filed with the PSC on December 17, 1993, shows that using Hardee Unit 3 to replace 440 MW of PR purchases from FPL beginning in 1999 provides 30-year savings of \$299 million PWRR compared to a "no replacement" scenario under SECI's current base case planning assumptions.

SECI also performed numerous sensitivity analyses to determine if the construction of Hardee Unit 3 would provide benefits in the event of significant changes in planning assumptions. Those analyses show that the plan is robust in that it provides savings to SECI under a wide range of assumptions. For example, the plan provides savings even if:

- Projected increases in FPL's PR capacity charges to SECI do not materialize,
- Load growth is substantially lower than expected, or
- Fuel prices are either higher or lower than projected.

The Need Determination Study confirmed that SECI's decision in late 1991 to give 7 years' notice to FPL based on then-existing conditions remains sound under a wide range of planning assumptions, including those currently projected.

1.2.3 LOAD FORECAST AND RELIABILITY

The need for an additional 440 MW of capacity on SECI's system is not driven by projected load growth. Even after the addition of Hardee Unit 3, the growth in SECI's peak load (except in its direct serve area) will be met by FPL and FPC under the existing PR contracts. By serving an additional 440-MW increment of load with its own resources, rather than by continuing to purchase this capacity and energy from FPL, SECI expects to save \$299 million (PWRR) over a 30-year period while at the same time increasing reliability. Thus, while load forecasts are an important part of any utility planning process, load growth in this case is not the driving factor in the need for Hardee Unit 3.

1.2.4 CONSERVATION AND LOAD MANAGEMENT

Conservation and load management programs that provide significant demand and energy reductions are reflected in SECI's load and energy forecasts. These programs serve primarily to reduce the amount of SECI's load during peak hours. Even after the addition of Hardee Unit 3, SECI's loads during peak periods within the FPL and FPC control areas will continue to be met by PR purchases from those companies. Thus while additional conservation would further reduce the cost of SECI's operations by reducing its PR purchases from FPL and/or FPC, it would not affect either the amount or timing of SECI's need for capacity to cost-effectively replace PR purchases.

1.2.5 RELIABILITY AND STRATEGIC CONSIDERATIONS

The addition of Hardee Unit 3 enhances the reliability of the SECI system from both technical and strategic perspectives. First, the addition of Hardee Unit 3 increases the predicted reliability of the SECI system and defers for 5 years (from 1999 to 2004) the need to add combustion turbine capacity for reliability purposes. Second, under the current PR contract with FPL, FPL has the right, on 7 years' notice, to seek to terminate the contract effective on or after May 2004. By replacing a portion of the PR purchases from FPL with its own resources in 1999, SECI reduces the risk that it might have to replace significant amounts of capacity in 2004 in the event that FPL seeks to terminate the current PR contract.

1.2.6 CONSEQUENCES OF DELAY

Upon giving notice to FPL in December 1991, SECI assumed an obligation to provide an additional 440 MW of capacity to serve load in FPL's control area beginning January 1, 1999. SECI may no longer rely on FPL to meet this portion of its members' needs, and FPL has stopped planning to meet this need. SECI must therefore have 440 MW of additional capacity resources in place by January 1, 1999 to maintain reliable service to its members. Any delay in licensing the proposed plant would result in SECI being forced to seek power purchases from other sources, if available, or to add shorter lead time combustion turbine units in order to maintain acceptable system reliability. Either of these alternatives would be only a temporary solution and would result in increased costs to SECI's members.

1.2.7 IMPACT ON STATEWIDE NEED

The construction of Hardee Unit 3 will not result in excess generating capacity on a statewide basis. This lack of excess capacity is evidenced by the fact that no Florida utility responded to SECI's RFP with an offer to provide this capacity from existing resources.

Further, the load that Hardee Unit 3 will serve must be met either by SECI or by FPL. When SECI notified FPL that it would assume the obligation to meet this load, FPL took its reduced responsibility into account in its own generation planning process. FPL has reported that SECI's replacement of these PR purchases, along with other factors, has deferred FPL's need for additional generating capacity from 1998 and 1999 to the year 2000.

The addition of Hardee Unit 3 also defers SECI's need for 75 MW of backup capacity from 1999 to 2004. The need for this capacity exists because SECI has been unable to obtain long-term contractual commitments from other Florida utilities for additional purchased power in this timeframe. This inability to locate long-term purchases is further evidence that other Florida utilities do not expect to have excess capacity available in the late 1990s timeframe.

1.2.8 NEED PETITION FILING

On December 17, 1993, SECI filed a petition to determine need for a 440-MW combined cycle unit, having an in-service date of January 1, 1999, with the PSC, pursuant to Section 403.519, FS, Docket No. 931212-EC. SECI also submitted a comprehensive Need Determination Study and Need Determination Study Appendices to the PSC in support of that petition. Those documents contain the information required by the PSC's rule (Chapter 25-22.081, F.A.C.) in order for the PSC to make a determination of need for the facilities pursuant to FEPPSA. Copies of those documents are available for inspection at the PSC, Division of Records and Reporting, 101 East Gaines Street, Tallahassee, Florida, and at the SECI Corporate Offices, 16313 North Dale Mabry Highway, Tampa, Florida.

The PSC held public hearings on SECI's petition on March 30, 1994.

The PSC Order on Need Determination, which is expected to be issued by June 1994, will be furnished when available (see Appendix 10.8).

1.3 OVERVIEW OF HARDEE UNIT 3 PROJECT

1.3.1 INTRODUCTION

The Hardee Unit 3 Project will consist of a 440-MW (net capacity) combined cycle unit to be constructed at the previously certified HPS site, adjacent to the HPS existing units. The proposed project will utilize dry low nitrogen oxide (NO_x) combustors and will burn natural gas as the primary fuel with low sulfur fuel oil as backup fuel. Hardee Unit 3 will share a number of the existing onsite facilities, such as the cooling reservoir and existing transmission lines, with the HPS existing units. SECI is currently finalizing plans with TECO Power Services to share additional existing onsite facilities.

This document addresses the environmental aspects of the Hardee Unit 3 Project: Hardee Unit 3 facilities are described in Chapter 3.0. Terminology used through this SCA/EA document is presented in Table 1.3.1-1.

Table 1.3.1-1. Hardee Unit 3 Project Terminology

Terminology	Definition
Hardee Power Station Unit 3 (Hardee Unit 3)	Proposed power plant project consisting of a 440-MW combined cycle unit to be constructed on the Hardee Power Station site
Hardee Power Station (HPS)	Previously certified 660-MW combined cycle power plant located on the Hardee Power Station site
HPS Site	The 526-ha (1,300-acre) site located in Hardee and Polk counties
HPS Existing Units	Existing 295-MW power plant located at the HPS site
HPP	Hardee Power Partners, a subsidiary of TECO Power Services, formed to operate the TPS generation facility at HPS
Existing Cooling Reservoir	Existing 230-ha (570-acre) cooling reservoir originally certified and constructed as part of the HPS
Hardee Unit 3 Site	The 20-ha (50-acre) area and all facilities to be constructed for the Hardee Unit 3 project
Access Road	The access road between Fort Green Road and the Hardee Unit 3 site

Source: KBN, 1994.

1.3.2 GENERAL SITE LOCATION AND DESCRIPTION

The Hardee Unit 3 Project will be located on the 526-hectare (ha) (1,300-acre) HPS site in Hardee and Polk counties approximately 14 kilometers (km) (9 miles) northwest of Wauchula, 26 km (16 miles) south-southwest of Bartow, and 64 km (40 miles) east of Tampa Bay (Figures 1.3.2-1 and 1.3.2-2). The entire HPS site is owned by the Acuera Corporation, Inc., a subsidiary of SECI. The HPS site is bordered on the east by County Road (CR) 663, a CSX right-of-way, and CF Industries' Hardee Complex. IMC-Agrico properties surround the remaining portions of the site. Payne Creek flows along the southern and western boundary of the HPS site. The Hardee Unit 3 facility will occupy approximately 20 ha (50 acres) of the HPS site as depicted in Figure 1.3.2-3. An aerial photograph of the proposed site location with a simulation of the proposed facility is presented in Figure 1.3.2-4.

In 1990, a final certification order issued pursuant to the FEPPSA was obtained from the Governor and Cabinet (Certification Number PA89-25). The certification authorized construction and operation of 295 MW of combined cycle facilities for TPS and established a 660-MW ultimate site capacity for the HPS site. In 1991, REA issued a final EIS for the project which allowed for the construction and operation of up to 660 MW of combined cycle power generating capacity at the HPS site.



Sources: SECI, 1994; KBN, 1994.



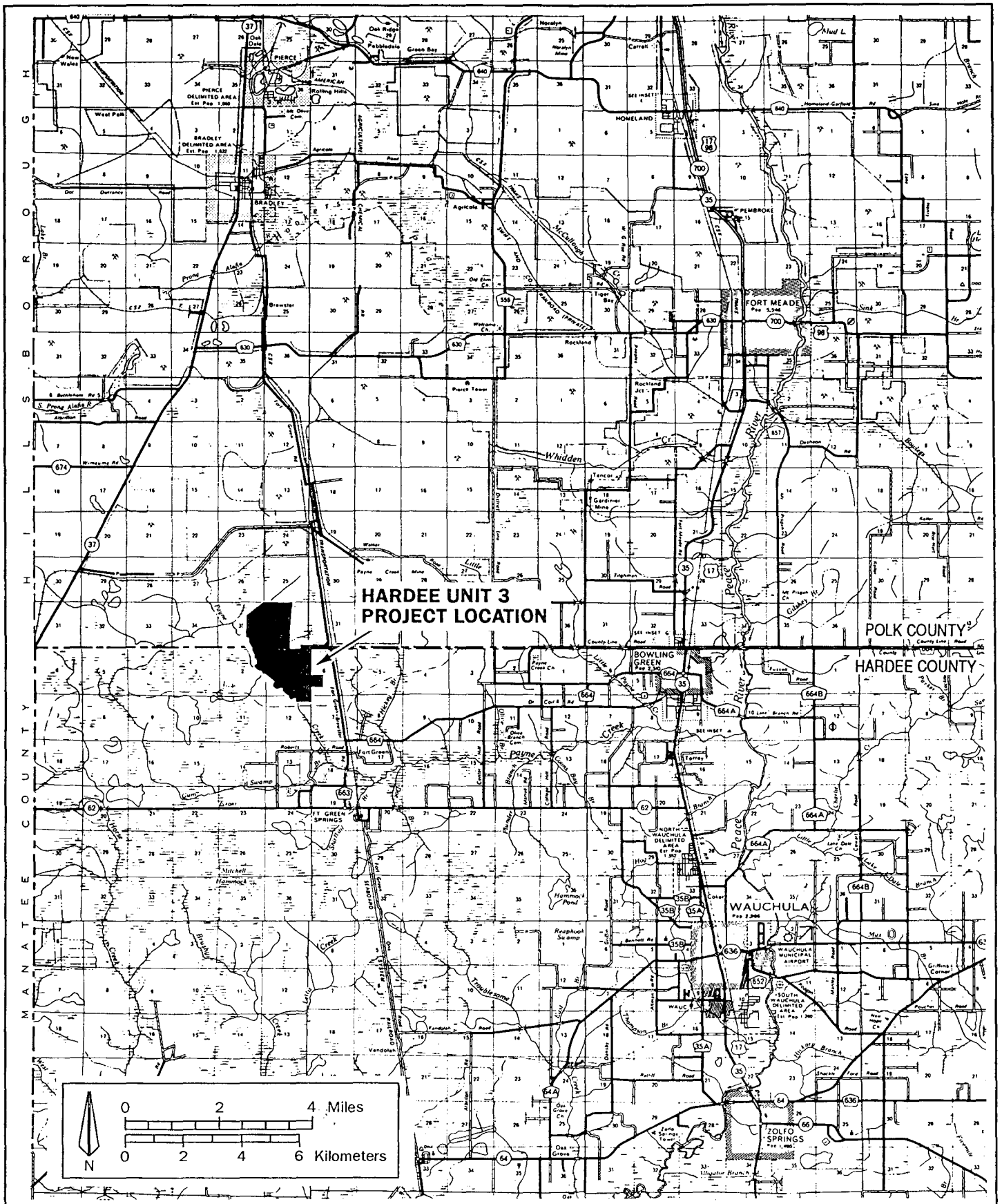


Figure 1.3.2-2
Location of Hardee Unit 3 Project

Sources: FDOT, 1990 and 1992; KBN, 1994.



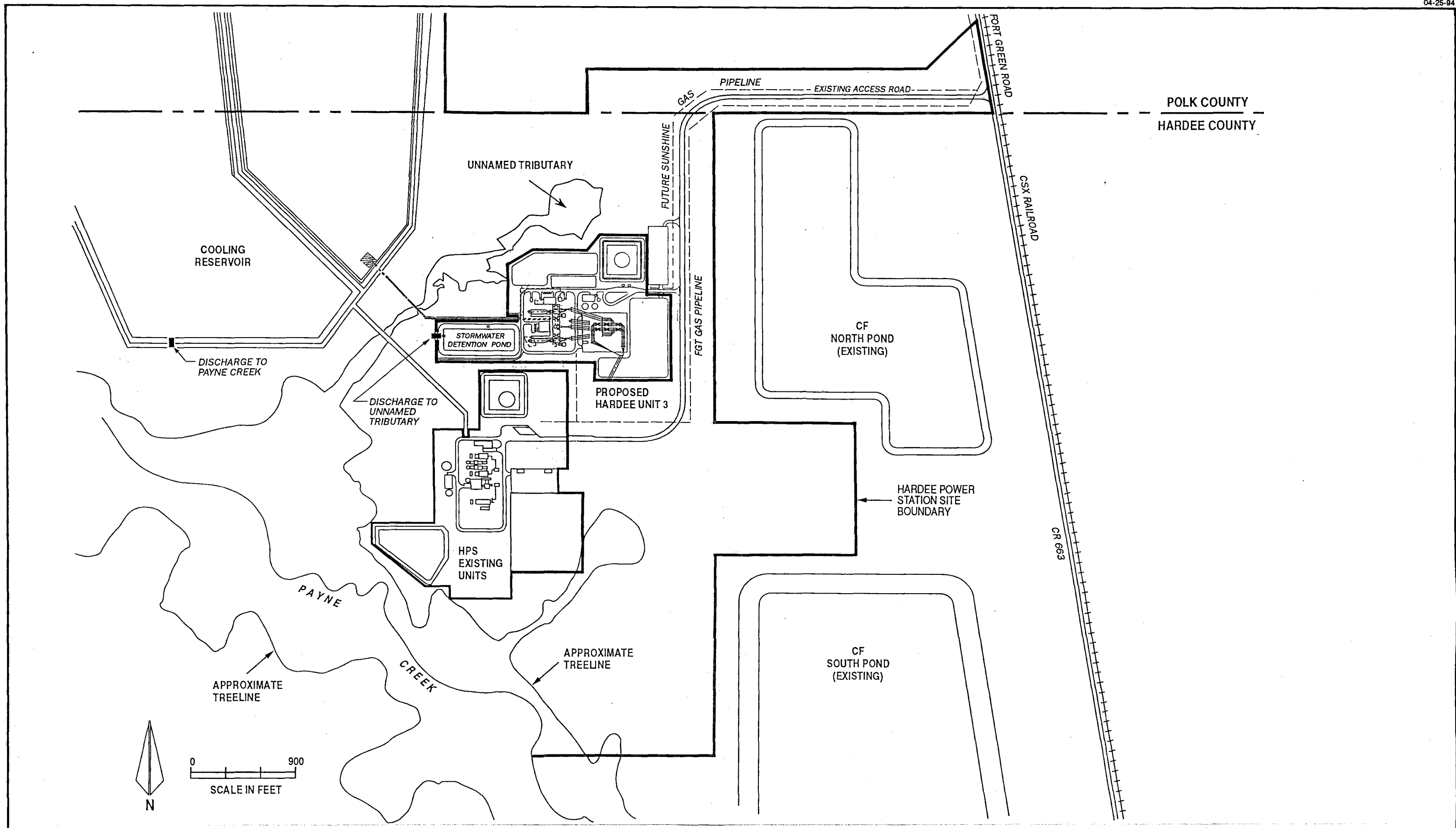


Figure 1.3.2-3
Hardee Unit 3 Proposed Site Layout



NOTE: HPS EXISTING UNITS ON LEFT; PHOTOSIMULATION OF HARDEE UNIT 3 IN CENTER

Figure 1.3.2-4
Photosimulation of Hardee Unit 3 Project

1.3.3 PROJECT DESCRIPTION

The Hardee Unit 3 Project involves an incremental increase to the previously certified HPS ultimate capacity of 660 MW to 880 MW. The project will consist of one highly efficient 440-MW combined cycle unit that will employ the latest pollution abatement technology and will provide optimum efficiency with regard to electric power generation. The site layout for the Hardee Unit 3 Project showing its relation to the HPS existing units is provided in Figure 1.3.2-3.

HPP entered into a contract with SECI and Tampa Electric Company for the operation of the HPS existing units. TPS, SECI, and Tampa Electric Company submitted the original site certification application with a plan for construction of the HPS to be completed in three phases (Phases 1A, 1B, and 2), resulting in the construction of 660 MW of generating capacity. Phase 1A of HPS (existing units) consists of a 295-MW generating facility with a 220-MW combined cycle unit and a 75-MW stand-alone combustion turbine (CT). Phase 1A was placed in commercial operation on January 1, 1993. Phase 1B consists of adding a 75-MW CT to the Phase 1A stand-alone CT, two heat recovery steam generators (HRSGs), and a 70-MW steam turbine to complete a second 220-MW combined cycle unit. Phase 1B will increase the total generating output of HPS to 440 MW with an in-service date no later than January 2003. Phase 2 was planned to consist of a third 220-MW combined cycle unit to be constructed by SECI and had no projected in-service date. The Hardee Unit 3 Project will be an expansion of Phase 2 from 220 MW to 440 MW, thus giving the site an ultimate generating capacity of 880 MW. When Hardee Unit 3 is placed in service in 1999, the station will have a total generating capacity of 735 MW. The ultimate HPS generating capacity of 880 MW will be achieved with the completion of Phase 1B.

The Hardee Unit 3 facility will be constructed through a turnkey contract arrangement with Westinghouse Electric Corporation and Black & Veatch Construction, Inc. This project will consist of two 150-MW Westinghouse Model 501F CTs with dry low NO_x burners totaling 300 MW (net). Each CT will be connected to a HRSG producing steam for a single 140-MW (net) steam turbine. The overall generating capacity of Hardee Unit 3 Project will be 440 MW.

Fuels to be used include natural gas as the primary fuel and fuel oil with a 0.05 percent sulfur content as backup. Fuel oil will be delivered to the site via truck and stored in a new single 16.7-million-liter (4.4-million-gallon) aboveground storage tank.

Hardee Unit 3 will connect to the Florida electric transmission grid within the existing HPS site; no new offsite transmission lines will be constructed. The Hardee Unit 3 facility will connect onsite with either an existing 46-centimeter (cm) (18-inch) natural gas lateral from the existing Florida Gas Transmission Company system already constructed to the HPS site or the proposed SunShine Pipeline Company's natural gas pipeline. Permitting for the natural gas lateral to the HPS site, if developed, will be conducted under a separate permitting process by the SunShine Pipeline Company. No new offsite associated linear facilities are required for the Hardee Unit 3 Project.

As part of the environmental licensing process, a Water Alternatives Study was conducted to:

1. Evaluate the adequacy of the existing cooling reservoir,
2. Evaluate the adequacy of the existing groundwater allocation for the HPS site, and
3. Evaluate potential alternative water sources for the proposed project.

Potential water use options evaluated include the reuse of treated effluent from communities within a 16-km (10-mile) radius of the HPS site, cooling towers, utilization of aquifer source recovery, and other surface water and groundwater sources. The results of the Water Alternatives Study showed that all water use requirements for the Hardee Unit 3 Project could be supplied by the currently existing water allocation established in the original certification for HPS. Therefore, the currently existing groundwater allocation established in the original certification (TPS/SECI, 1989) is adequate to supply the ultimate generating capacity of 880 MW for HPS, including the 440-MW Hardee Unit 3 Project. The Water Alternatives Study also showed that the existing onsite cooling reservoir is capable of accommodating the condenser cooling requirements of the total 880-MW HPS (440-MW Phase 1A and 1B, and 440-MW Hardee Unit 3). The results of the Water Alternatives Study were used in the design of the Hardee Unit 3 Project; results of the study are included in Appendix 10.10.

The Hardee Unit 3 Project will result in an incremental increase in the overall infrastructure and generating capacity of the previously certified HPS with only minimal incremental environmental impacts. Through this incremental expansion of the HPS, SECI will be able to effectively respond to the growing need for electric power to cost effectively serve its cooperative members. By locating the Hardee Unit 3 Project at the HPS site, SECI will take advantage of existing

structures, such as the cooling reservoir and transmission lines, thus minimizing potential impacts associated with construction and operation of a new combined cycle facility.

1.4 BENEFITS OF THE PROJECT

1.4.1 EXTERNAL BENEFITS

The primary benefit of this project to Hardee and Polk counties, the region, and the state of Florida is the provision of a new, clean, and reliable energy source. In addition to providing energy, the Hardee Unit 3 Project will provide employment and tax revenues as well as increased statewide electrical system reliability and increased diversity of fuels usage. The Hardee Unit 3 Project makes beneficial use of mined lands in Hardee and Polk counties and minimizes potential environmental impacts through the use of existing facilities (i.e., cooling reservoir and transmission lines) at the HPS site.

Because of the previously altered environment in the project area and the relatively clean nature of the project, no significant adverse environmental or social impacts will result from the construction or operation of the Hardee Unit 3 Project.

1.4.2 INTERNAL BENEFITS

This project is beneficial to SECI due to its ability to provide economic savings and rate stability for SECI's members as well as satisfying the need to meet projected growth in electric power demand. This new generation source will provide increased SECI system reliability. Also, with its use of natural gas and fuel oil, this project will provide SECI with a diversity of power supply sources and fuel mix.

1.5 REFERENCES

The following references are cited in Chapter 1.0.

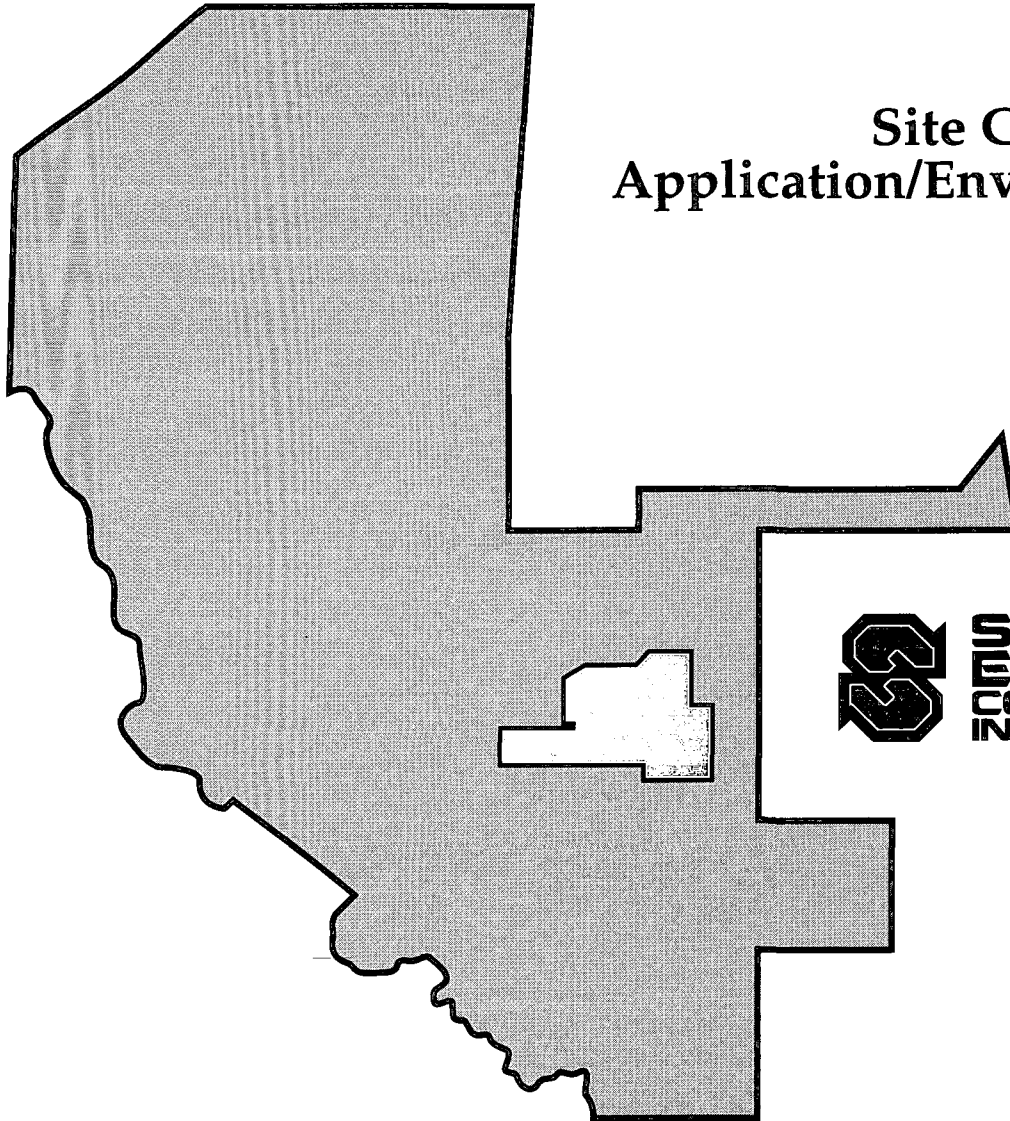
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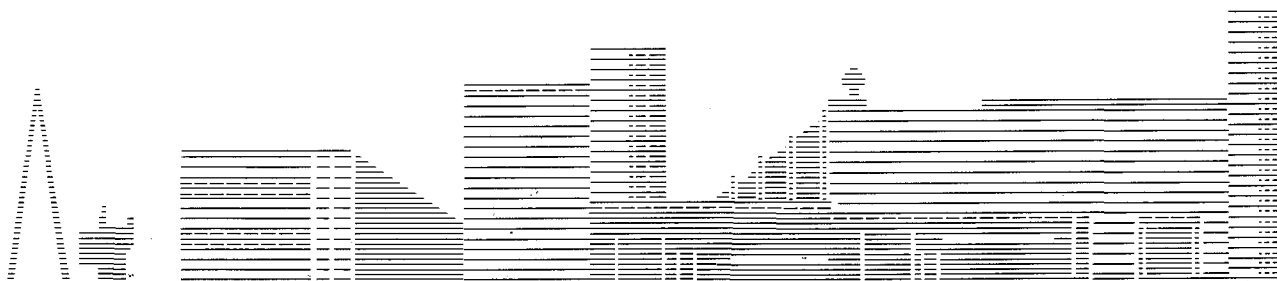
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HARDEE UNIT 3

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2.0 SITE AND VICINITY CHARACTERISTICS

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2.1 SITE AND ASSOCIATED FACILITIES DELINEATION

This section provides information concerning the location of the proposed project site and facilities. This section also provides maps showing the area, communities in the vicinity, adjacent properties, and existing and proposed uses of the site.

The Hardee Unit 3 Project will be located on the 526-hectare (ha) (1,300-acre) Hardee Power Station (HPS) site in Hardee and Polk counties, approximately 14 km (9 miles) northwest of Wauchula, 26 km (16 miles) south-southwest of Bartow, and 64 km (40 miles) east of Tampa Bay (see Figure 2.1.0-1). The HPS site is bordered on the east by Hardee County Road (CR) 663, a CSX Railroad right-of-way, and CF Industries' Hardee Complex. IMC-Agrico properties surround the remaining portions of the site. Payne Creek flows along the southern and western boundary of the HPS site.

The HPS site is located in Section 6 of Township 33S, Range 24E, Section 31 of Township 32S, Range 24E, Sections 1, 2, and 12 of Township 33S, Range 23E, and Sections 35 and 36 of Township 32S, Range 23E. The Hardee Unit 3 facility will occupy approximately 20 ha (50 acres) of the HPS site. The HPS site is currently used for the production of electric power by the 295-MW HPS existing units. With the exception of the HPS existing units and supporting facilities, which include a 230-ha (570-acre) cooling reservoir, the remainder of the HPS site is undeveloped. Portions of the HPS site have been mined for phosphate and reclaimed.

-- The existing facilities associated with the HPS site, the location of the Hardee Unit 3 facilities, and surrounding properties are shown in Figure 2.1.0-2. The 20-ha (50-acre) area identified for the construction of the Hardee Unit 3 facility currently consists of unmined and reclaimed land. Areas of the HPS site immediately adjacent to Payne Creek are in the 100-year floodplain. However, none of the proposed plant structures associated with the Hardee Unit 3 Project will be located in the 100-year floodplain of Payne Creek.

The Hardee Unit 3 Project will require no associated facilities extending beyond the current HPS site boundaries.

Sources: FDOT, 1990; 1992; KBN, 1994.



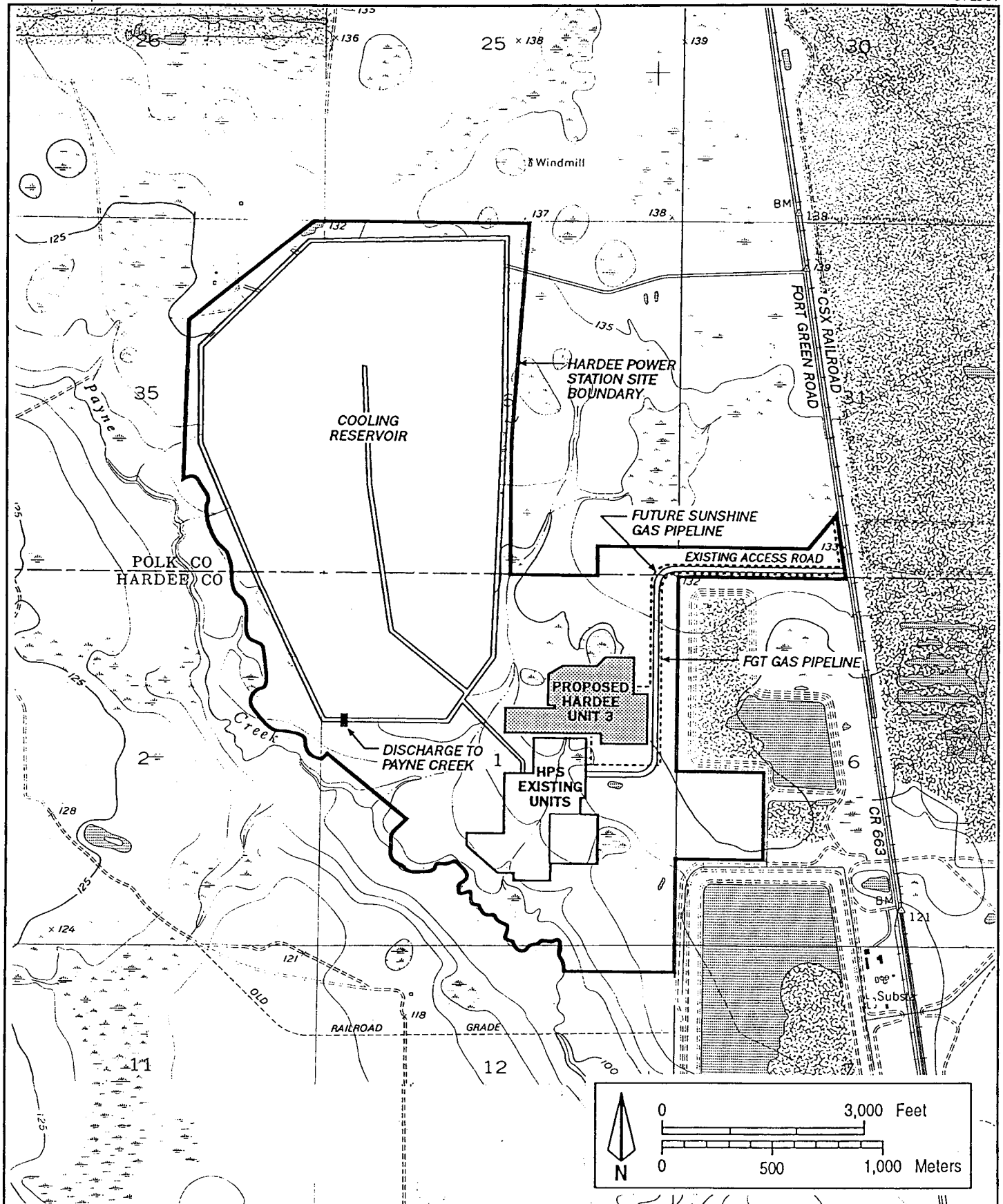


Figure 2.1.0-2
Hardee Unit 3 Site Boundary and Adjacent Properties

Sources: USGS, 1987; KBN, 1994.



2.2 SOCIOPOLITICAL ENVIRONMENT

2.2.1 GOVERNMENT JURISDICTIONS

The proposed Hardee Unit 3 Project facilities will occupy a portion of the existing HPS site in Section 1, Township 33S, Range 22E. The Hardee Unit 3 site is located in unincorporated Hardee County, approximately 12 kilometers (km) (7.5 miles) west of Bowling Green. The existing cooling reservoir to be used by the Hardee Unit 3 facility is located in Sections 1 and 2 of Township 33S, Range 23E in Hardee County and Sections 35 and 36 of Township 32S, Range 23E in Polk County. There are no municipalities or incorporated areas within an 8-km (5-mile) radius of the proposed site. The unincorporated communities of Fort Green and Fort Green Springs are located 4 km (2.5 miles) southeast and 4.8 km (3.0 miles) south of the site, respectively. Figure 2.2.1-1 depicts the HPS site in relation to these communities. Figure 2.2.1-2 is an aerial photograph of the site and vicinity.

None of the following local, regional, or federal areas is located within an 8-km (5-mile) radius of the Hardee Unit 3 Project site.

1. National parks, forests, seashores, wildlife refuges, wilderness areas, memorials, monuments, marine sanctuaries, estuarine sanctuaries, wild and scenic rivers;
2. Roadless area review and evaluation (RARE) areas, critical habitat of endangered species, state parks, forests, game management areas, areas of critical state concern, conservation and recreation lands, save our rivers lands, archaeological landmarks or landmark zones, aquatic preserves, outstanding florida waters and wild and scenic rivers;
3. County parks or special management areas established by law; and
4. Indian reservations and military lands.

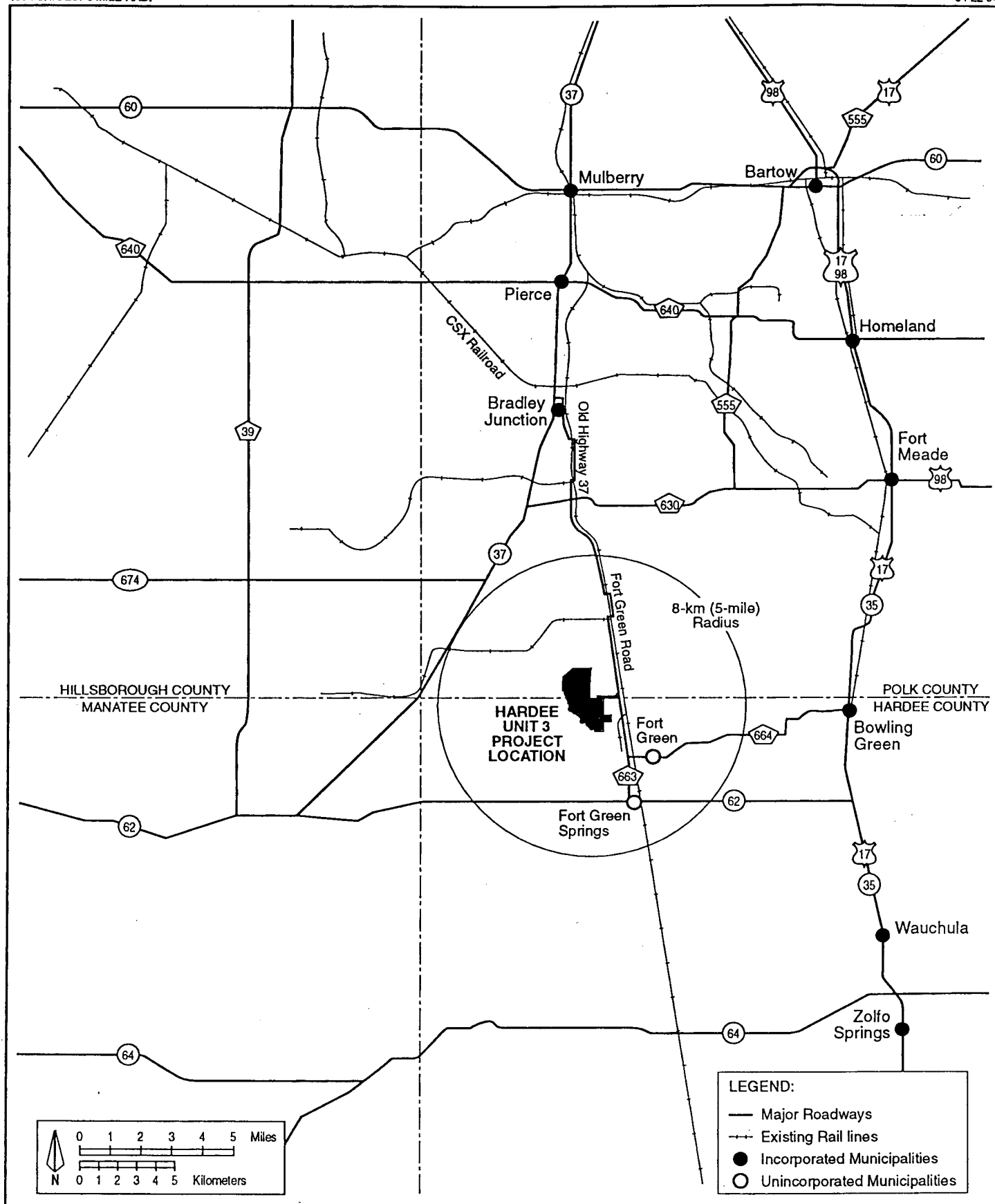


Figure 2.2.1-1
Site Location and Boundaries of Cities and Towns
Within an 8-km (5-mile) Radius

Source: KBN, 1994.



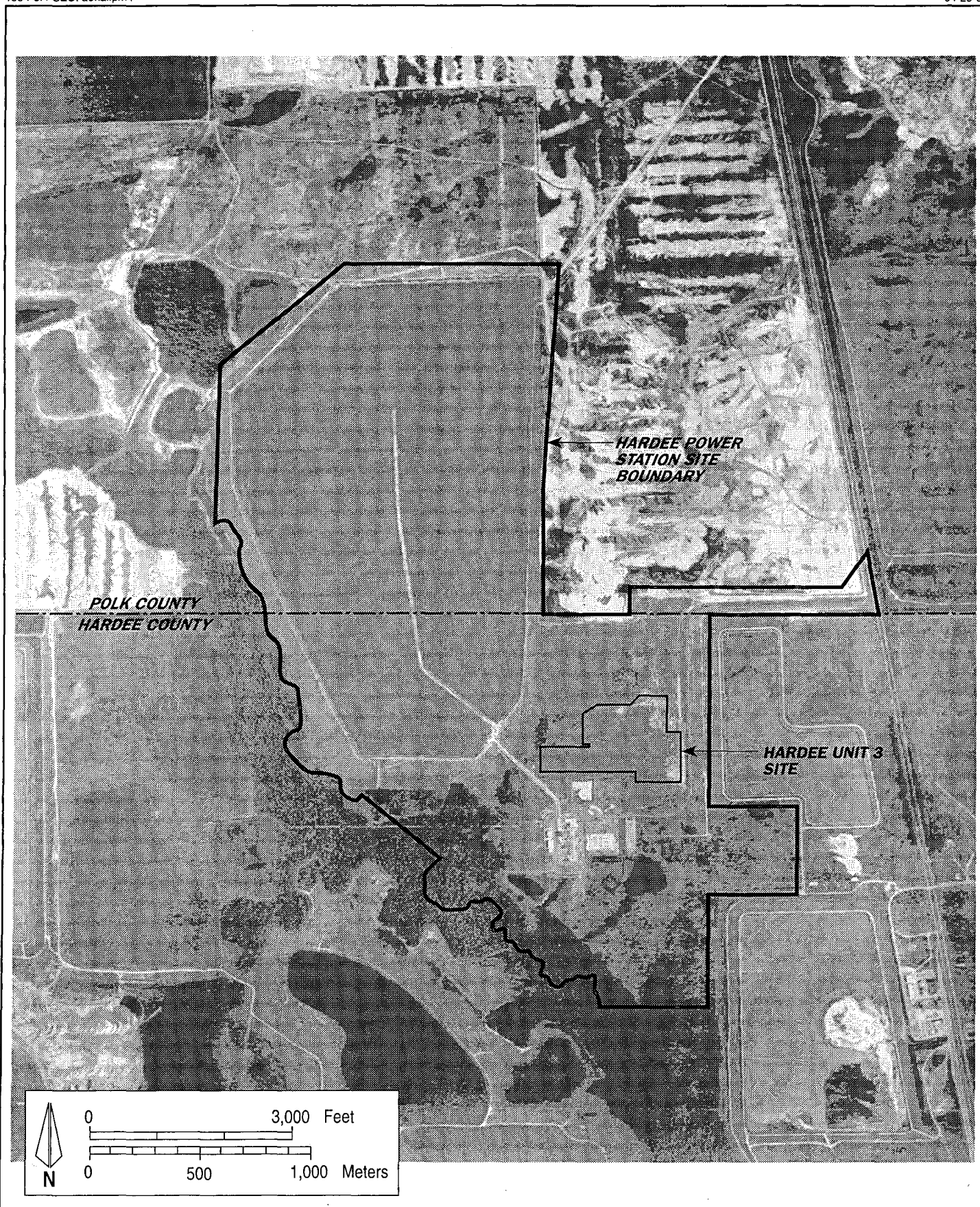


Figure 2.2.1-2
Aerial Photograph of Hardee Unit 3 Site and Surrounding
Vicinity — July, 1993

Source: KBN, 1994.



2.2.2 ZONING AND LAND USE PLANS

The Hardee Unit 3 Project will be constructed entirely within the boundaries identified for the HPS site in the original 1990 certification. All project facilities will be constructed in the portion of the site that is in Hardee County. The existing cooling reservoir (located within the HPS site), which will also be used but unaltered, lies in both Hardee and Polk counties. Local government comprehensive plans applicable to the HPS site include the Hardee County Comprehensive Plan and the Polk County Comprehensive Plan.

Both counties have comprehensive land development regulations that are applicable to the HPS site. On August 14, 1990, the entire HPS site, including the proposed location for Hardee Unit 3, was found by the Siting Board to be consistent and in compliance with the Hardee County and Polk County Land Use Plan and Zoning Regulations (see Appendix 10.4).

In addition to the local comprehensive plans, the Hardee Unit 3 Project will be consistent with the applicable goals and policies of both the State Comprehensive Plan (Ch. 187, FS) and the Central Florida Comprehensive Regional Policy Plan. The Hardee Unit 3 Project will be consistent with the goals and policies within the Natural Systems and Recreational Lands, Air Quality, Land Use, Public Facilities, and Cultural and Historical Resources Elements of the State Comprehensive Plan. The goals and policies within the Central Florida Regional Planning Council's Policy Plan that are relevant to the Hardee Unit 3 Project include: Energy Element, Regional Goal (b), Policy (4) p. II-183; Mining Element, Regional Goal (a), Policy (1) p. II-200; Land Use Element, Regional Goal (a), Policies (1) and (2), pp. II-222 and II-223.

The Hardee Unit 3 Project will be located on the existing HPS site and will represent an incremental increase in the ultimate power-generating capacity of the HPS site from 660 MW to 880 MW. The HPS site was selected as the preferred location for the Hardee Unit 3 Project because this site has been previously reviewed by Hardee and Polk counties and certified for a 660-MW of combined cycle power generation (Certification Number PA89-25) (TPS/SECI, 1989). Furthermore, the HPS site has adequate area to accommodate the proposed expansion from 660 MW to 880 MW. Locating the Hardee Unit 3 Project at the HPS site takes advantage of the existing infrastructure and onsite facilities, and minimizes potential environmental impacts that might otherwise be associated with the construction of a combined cycle power plant at a previously undeveloped site.

HARDEE COUNTY

Zoning--The proposed Hardee Unit 3 project site is located in unincorporated Hardee County. The applicable zoning ordinance is the Hardee County Land Development Code, adopted March 11, 1982, as amended. The applicable local government comprehensive plan is the Hardee County Comprehensive Plan, adopted by the Hardee County Board of County Commissioners on April 11, 1991, and amended August 26, 1992.

The Hardee Unit 3 Project site has been zoned Light Industrial (I-1) by the Hardee County Board of County Commission on May 11, 1989, to allow development of the site for a power plant (see Figure 2.2.2-1). The I-1 zoning district exists for the entire HPS site within Hardee County (a portion of the existing cooling reservoir is located in Polk County). Public and semi-public utility plants and equipment are Principal Uses and Structures within the I-1 zoning district (see Appendix 10.2 for zoning description).

Land Use--According to the Future Land Use Element in the Hardee County Comprehensive Plan (see Appendix 10.3), which was adopted subsequent to the original certification, the proposed project site is located in the Agriculture future land use designation (see Figure 2.2.2-2). All lands adjacent to the Hardee Unit 3 site are also designated Agriculture in Hardee County.

The Comprehensive Plan's Future Land Use Element specifically addresses power plants within the agricultural future land use classification. Policy L.1.6.c states:

...power plants or manufacturing or processing facilities may be permitted, and shall have access to a collector or arterial roadway, shall meet all local regulations, and shall be appropriately buffered from surrounding land uses, including agricultural uses.

Policy L.1.6.e addresses planning controls which will guide development within the Agricultural future land use designation. The policy states:

New development shall: provide buffering to prevent conflicts between agricultural and non-agricultural activities; protect natural resources; allow no ancillary uses detrimental to agriculture; require that post-development conditions for stormwater run-off equal pre-development conditions; and shall require the appropriate contribution from the developer to pay for off-site as well as on-site costs associated with the impacts of the development.

The proposed Hardee Unit 3 Project will be located, constructed, and operated in a manner consistent with the Hardee County Comprehensive Plan Land Use Policies and Land Development Code regulations applicable to the site. The site is consistent with Policy L.1.6.c by being located off of CR 663 (a county-maintained collector roadway) and is surrounded by previously mined lands. The site is located on an existing power plant site and utilizes, to the extent possible, existing infrastructure to limit the impacts to natural resources in the area. No agricultural activities will be displaced as a result of the construction and operation of Hardee Unit 3. In addition, the site will comply with all stormwater regulatory requirements to be consistent with Policy L.1.6.e. A meeting with Hardee County land use and zoning officials confirmed that no additional land use or zoning approvals would be required to construct or operate the Hardee Unit 3 Project (see Appendix 10.3.1).

POLK COUNTY

Zoning--The portions of the HPS site located in Polk County, including a portion of the existing cooling reservoir and the northern section of the existing access road, which may be utilized in the operation of the proposed Hardee Unit 3, are in the Rural Conservation (RC) zoning district (see Figure 2.2.2-1). All property adjacent to the site in Polk County is also zoned RC. According to Polk County Zoning Ordinance Number 83-2, adopted March 1, 1983, power plants are considered a Class III Essential Use. Within the RC zoning district, Class III Essential Uses are allowable as a Conditional Use - Non-Agricultural. Section 5.2.C.5 addresses density and lot size requirements. The section states:

- a. Gross density shall not exceed one (1) dwelling unit per acre.
- b. Minimum lot area shall be forty thousand (40,000) square feet for each dwelling unit exclusive of road right-of-way.

Land Use--According to the Polk County Comprehensive Plan's Future Land Use Element, the portion of the HPS site within Polk County is located in the Phosphate Mining (PM) future land use designation (see Figure 2.2.2-2). All land adjacent to the proposed site in Polk County is designated PM. The Comprehensive Plan Future Land Use Element specifically addresses power plant development in unincorporated Polk County.

Policy 2.114-A3 indicates that "Construction, operation and maintenance of Electric-Power Generation Facilities and ancillary uses and facilities that are required to be certified pursuant to

Sections 403.501 - 403.518, FS (1990)" is a permitted use within the PM future land use designation.

Policy 2.114-C1 indicates that Certified Electric-Power Generating facilities are permitted within the PM future land use designation upon obtaining a conditional-use permit from Polk County

Policy 2.114-C2 of the Future Land Use Element addresses environmental criteria pertaining to the development of Certified Electric-Power Generating facilities in the PM designation. The criteria are:

- Environmentally sensitive areas shall be specifically detailed on the "Conceptual Electric-Power Generating Facility Site Plan" submitted as part of the conditional-use permit process.
- Certified Electric-Power Generating Facilities shall protect environmentally sensitive areas through buffering and/or other mitigating techniques imposed pursuant to Section 403.501 - 403.518, FS.
- The location of all Certified Electric-Power Generating Facilities shall comply with all applicable environmental, federal, state, and local laws, rules, and regulations pertaining to the site, certification, permitting, and operation and maintenance requirements.

The Future Land Use Element also address the development approval criteria for the development of Certified Electric-Power Generating facilities. Policy 2.114-C3(a) states:

...Polk County shall require proposed Certified Electric-Power Generating Facilities to obtain approval as a Conditional Use Permit, or its functional equivalent, prior to the commencement of construction of the facility which approval shall demonstrate compliance with all applicable County ordinances and these policies. Additional review criteria shall include, but not be limited to, the following:

1. that the delivery, and storage of the fuel source will not threaten the safety or health of residents;
2. that height, bulk, and noise factors associated with the facility are compatible with other land uses in the area.

Policy 2.114-C4 addresses set backs to adjacent development. The policy states:

Certified Electric-Power Generating Facilities shall be set back and/or buffered from existing adjacent residential areas.

The existing cooling reservoir is located within a Floodplain-Protection and Wetland-Protection Areas. Policy 2.123-B2.b addresses development within the Floodplain-Protection Area as follows:

Development or redevelopment shall meet the requirements of the Polk County "Flood Protection and Surface Water Management Code" (Ordinance 88-04), as amended, and shall not:

1. enlarge the off-site floodplain;
2. alter the natural function of the floodplain; nor
3. result in post development run-off areas for storm frequencies at least as stringent as those rates established by the applicable water management district pursuant to Section 40C, F.A.C.

Policy 2.123-C2 (b) and (c) address development criteria within wetlands as follows:

- (b) Wetland impacts shall first be avoided. Secondly, where they cannot be avoided, impacts shall be minimized and shall be mitigated by wetland compensation or wetland enhancement.
- (c) Commercial and industrial development shall locate on the non-wetland portion of a development site.

The HPS site was found to be consistent and in compliance with the Polk County Comprehensive Plan and Zoning Regulations in effect prior to construction of the existing facilities. No new construction activities associated with the Hardee Unit 3 Project are scheduled to take place in Polk County except for the potential for on onsite gas lateral to connect to the proposed SunShine natural gas pipeline.

Polk County planning staff and the Board of County Commissioners have determined that a Conditional Use Permit as identified in the comprehensive plan would not be required for the Hardee Unit 3 Project (see Appendix 10.3.2).

The proposed Hardee Unit 3 facilities will be located, constructed, and operated in a manner consistent with the aforementioned Comprehensive Plan Land Use Policies and zoning regulations.

CONCURRENCY MANAGEMENT

At the present time, Hardee County has not adopted a formal concurrency review policy for impacts on public services by new projects located within the county. Discussions with county officials indicated that the information on traffic impacts supplied in the SCA/EA would be sufficient to address the concurrency requirements.

Polk County's Concurrency Management Ordinance 92-10 as amended identifies several public facilities and services that will be available concurrent with the impacts associated with a proposed development activity. These facilities and services include Transportation, Potable Water and Sanitary Sewer, Parks/Open Space, Stormwater Management, Solid Waste, and Mass Transit. Since no new development activities are taking place in Polk County, only impacts associated with operation traffic on Fort Green Road in Polk County (existing plant drive entrance to be utilized by the Hardee Unit 3 Project) will be subject to a concurrency determination. Since the proposed project will generate more than 50 and less than 750 average daily trips during operation (see Section 5.9), a Minor Traffic Review will be required for the concurrency determination. The minor traffic review is included in Appendix 10.14, and a supplement study is presented in Section 5.9.

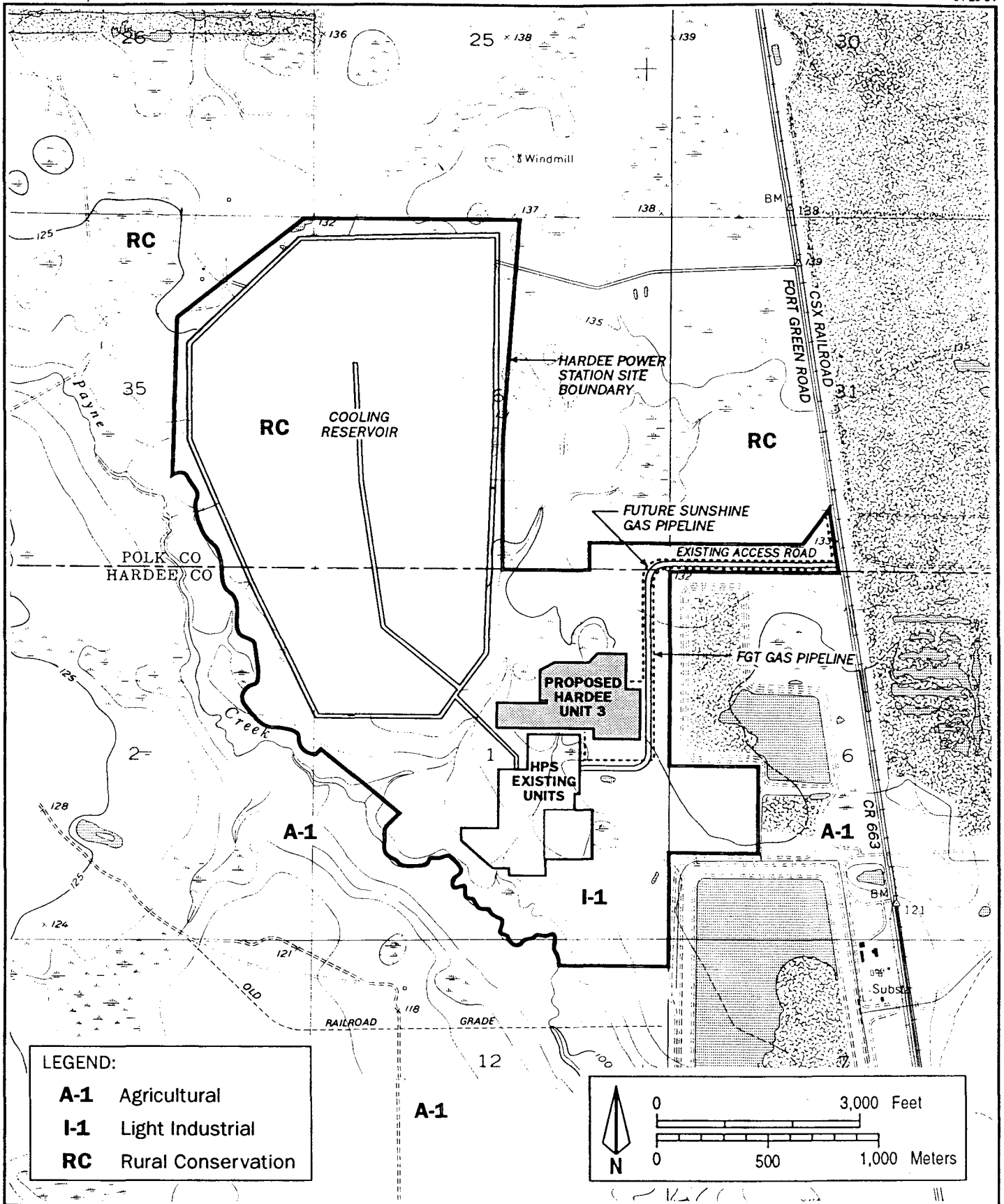


Figure 2.2.2-1
Zoning Map of the Hardee Unit 3 Site and Adjacent Properties

Sources: USGS, 1987; KBN, 1994.



2.2.3 DEMOGRAPHY AND EXISTING LAND USE

2.2.3.1 DEMOGRAPHY

There are no incorporated municipalities within 8 km (5 miles) of the Hardee Unit 3 site. Table 2.2.3-1 lists the nearest communities and their total residential populations for 1980 and 1990. The majority of recent resident population growth has occurred southeast of the site in Wauchula, with a population increase of approximately 8.9 percent in the last decade, whereas Bowling Green and Zolfo Springs experienced decreases in population. Hardee County's unincorporated area population has decreased by 2.8 percent from 13,566 residents in 1980 to 13,191 residents in 1990. Table 2.2.3-2 lists the projected populations for Hardee and Polk counties for the years 1995 and 2000.

The Hardee Unit 3 Project is located in an unincorporated area of Hardee County immediately south of the Hardee/Polk County line, 12 km (7.5 miles) west of Bowling Green. There is no residential population within 1.6 km (1 mile) of the site due to the mining operations and industrial facilities in the area. A low-density residential population exists approximately 4 km (2.5 miles) to the southeast of the site in the unincorporated community of Fort Green Springs.

The cities of Winter Haven and Lakeland are located approximately 40 km (25 miles) north of the site in Polk County. In 1980, the populations for these two cities were 21,119 people and 47,406 people, respectively, or about 21 percent of Polk County's total population. Winter Haven experienced an increase of 17.1 percent, and Lakeland experienced an increase of 48.9 percent between 1980 and 1990 (BEHR, 1991). The cities of Winter Haven and Lakeland are highly urbanized and represent a considerable portion of the population growth in Polk County.

Polk County contained a population of 321,652 people in 1980 and has grown to 405,382 people between 1980 and 1990, an increase of 26 percent (U.S. Bureau of the Census, 1990). In 1980, more than 40 percent of Polk County's population resided in incorporated communities with a majority of that population located in the north-central portion of the county near the cities of Winter Haven and Lakeland.

2.2.3.2 ONGOING LAND USE

Most of the land within an 8-km (5-mile) radius of the site is being actively mined for phosphate or has been reclaimed to pasture or wetlands. Citrus groves are the predominant agricultural activity in the area and occupy several small pockets of land south and southeast of the site.

The only residential community within 8 km (5 miles) is Fort Green Springs which contains about 60 houses (permanent dwellings and mobile homes) and is located about 4 km (2.5 miles) south of the plant site. With the exception of the expansion of the phosphate mining activities to the west and south into Hardee County, no significant changes in land use have occurred in the past 30 years or are likely to occur in the near future based on information obtained by the counties and regional planning councils. Figure 2.2.3-1 shows the existing land use within an approximate 8-km (5-mile) radius of the proposed plant. Data presented in the map are based on U.S. Geological Survey (USGS) 7.5-minute quadrangle maps of the site area, aerial photographs dated 1988 and 1992, local comprehensive plans, and field reconnaissance during November 1993.

Table 2.2.3-1. Historic Populations for Selected Communities and Unincorporated Areas in Hardee and Polk Counties

Community	Population		Percent Change (1980-1990)
	1980	1990	
Unincorporated Hardee County	13,566	13,191	-2.8
Bowling Green	2,310	1,836	-20.5
Wauchula	2,986	3,253	8.9
Zolfo Springs	1,495	1,219	-18.5
Unincorporated Polk County	190,071	242,195	27.4
Bartow	14,780	14,716	-0.4
Fort Meade	5,546	4,976	-11.5
Frostproof	2,995	2,808	-6.7
Lakeland	47,406	70,576	49.9
Winter Haven	21,119	24,725	17.1

Note: The 1990 population counts are subject to adjustment for undercount or overcount by the U.S. Bureau of the Census.

Source: U.S. Bureau of the Census, 1990.

Table 2.2.3-2. Projected Population for Hardee and Polk Counties

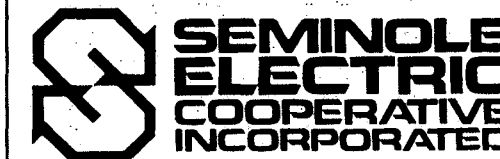
Area	Projected Population	
	1995	2000
Hardee County		
Unincorporated Population	16,144	16,883
Total Population	24,496	25,723
Polk County		
Unincorporated Population	275,814	487,200
Total Population	443,747	477,857

Sources: Polk County Planning Department, 1994.
Hardee County Comprehensive Plan, 1992.



Figure 2.2.3-1 (Page 1 of 2)
Existing Land Use Within 8 km (5 miles) of the Hardee Unit 3 Site

Sources: FLUCFCS, 1985; KBN, 1994.



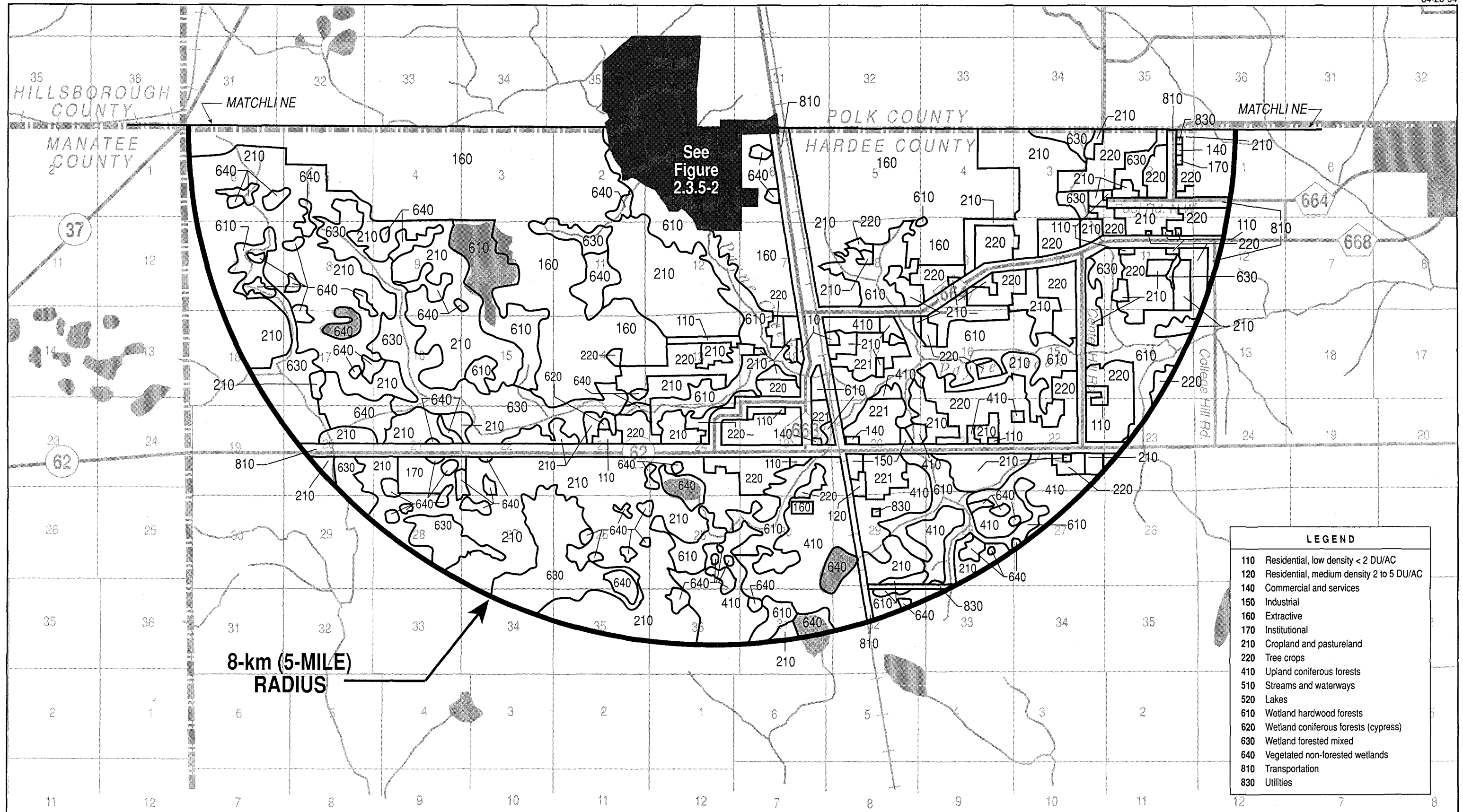


Figure 2.2.3-1 (Page 2 of 2)
Existing Land Use Within 8 km (5 miles) of the Hardee Unit 3 Site

Sources: FLUCFCS, 1985; KBN, 1994.



2.2.4 EASEMENTS, TITLE, AGENCY WORKS

The property on which the Hardee Unit 3 Project is to be constructed is owned by SECI through a subsidiary (Acuera, Inc.). Therefore, no easements, titles, or approvals to use agency works will be required for this project.

2.2.5 REGIONAL SCENIC, CULTURAL AND NATURAL LANDMARKS

There are no federal, state, regional, or local scenic, cultural, or natural landmarks within an 8-km (5-mile) radius of the proposed project.

2.2.6 ARCHAEOLOGICAL AND HISTORIC SITES

There are no known significant archaeological or historical resources on the HPS site. The general area surrounding the HPS site appears to be one with infrequent sites, containing a sparse amount of cultural materials. None of these sites has been considered significant in terms of National Register of Historic Places criteria.

One insignificant prehistoric archaeological site is recorded in the SW1/4 of the NE1/4 of the SW1/4 of Section 1, Township 33 South, Range 23 East. This site is known as 8-Hr-35 in the Florida Master Site File and is located in the Hardee County portion of the HPS site. The prehistoric site was found by Jerald Milanich and Raymond Willis who concluded that the site was not significant in terms of National Register of Historic Places criteria under 36 CFR 63. This recommendation was made to the Florida Division of Historical Resources (DHR) which concurred with the recommendation in 1990.

DHR was contacted prior to submittal of the SCA/EA for the Hardee Unit 3 Project and concluded "that no significant archaeological and historical sites are recorded for or considered likely to be present within the project area...Therefore, it is the opinion of this office that the proposed project will have no effect on any sites listed, or eligible for listing, in the National Register of Historic Places, or otherwise of national, state, or local significance" (see Appendix 10.6).

2.2.7 SOCIOECONOMICS AND PUBLIC SERVICES

2.2.7.1 SOCIAL AND ECONOMIC CHARACTERISTICS

Hardee County's labor force totaled 9,368 in 1991, an increase of 9.7 percent from a 1989 labor force of 8,536. This percentage increase is higher than the statewide labor force increase of 3.8 percent. The 1991 count represents 3.9 percent of the Central Florida Region's total labor force (see Table 2.2.7-1). The Central Florida Region consists of DeSoto, Hardee, Highlands, Polk, and Okeechobee counties. DeSoto County had the lowest annualized unemployment rate in the region (7.8 percent), whereas Hardee County had the highest in the region (10.5 percent) and the sixth highest unemployment rate of the 67 counties in Florida.

The labor force in Polk County experienced an increase of 5.3 percent between 1989 and 1991. This increase also represents a larger percentage increase than the statewide labor force increase of 3.8 percent for the same time period. Three out of every four jobs in the Central Florida Region are located within Polk County.

Average monthly employment statistics for Hardee and Polk counties and the Central Florida Region by major industry group are presented in Table 2.2.7-2. Between 1990 and 1991, employment in Hardee County increased in each employment group with the exception of the manufacturing, wholesale trade, and services industries which experienced decreases. Most employment in Hardee County occurs in the agriculture industry. However, most employment in the Central Florida Region occurs in the services and retail trade industries. The services category employs proportionately fewer people in Hardee County than the region and the state. The transportation, communication, and public utilities industry and the construction industry are also a small component of the county economy compared to regional and state percentages. The agriculture category plays a relatively large role in the Hardee County economy.

Employment in Polk County is focused in the retail trade and service industries (Table 2.2.7-2). In 1991, more than 50 percent of the county labor force was engaged in one of these two industries. Approximately 13 percent of the labor force was employed by the manufacturing industry. While a significant portion of land in Polk County is dedicated to the mining industry, less than 3 percent of the county's workforce is employed in mining.

Personal income data for 1989 and 1990 are presented in Table 2.2.7-3 and Table 2.2.7-4, respectively. Additional income characteristics for Polk and Hardee counties are presented in Table 2.2.7-5. The majority of employment groups in private, nonfarm industries in Hardee and Polk counties experienced an increase in personal income between 1989 and 1990. The largest increase came from the manufacturing industry in Hardee County and the transportation, communication, and public utilities industry in Polk County. With the exception of the construction industry, all major employment groups experienced increases in personal incomes within the Central Florida Region and the state. Finance, insurance, and real estate showed the slowest personal income growth from 1989 to 1990, posting only a 1.4 percent increase in Hardee County. The slowest growth in Polk County came from the wholesale trade industry, posting only 0.9 percent increase. This pattern is also consistent with regional and state trends that depict slow manufacturing income growth for the same period. The largest industry in Hardee and Polk counties is the service sector, which generated 35.9 and 31.7 percent, respectively, of the total personal income in 1990. The service sector is also the largest industry in the Central Florida Region and the state.

In addition to the private, nonfarm industries depicted in Tables 2.2.7-3 and 2.2.7-4, farm and government industries contribute to personal income. In the farm industry, Hardee County posted a 19.5 percent decrease in total personal income from 1989 to 1990. This decrease which occurred in the farm industry was a significant portion of the 24.5 percent total decrease in personal income experienced in the Central Florida Region.

The government industry produced personal income increases in Hardee County, the Central Florida Region, and the state between 1989 and 1990. The large personal income increases came from the Central Florida Region, primarily due to Polk County government industries, which generated 72.5 percent of the region's personal income in the government sector.

Hardee County contained 5,213 households in 1990 at an average size of 2.87 people per household. This represents a 4.5 percent increase in the number of households from those counted in the 1980 federal census, but a 4.1 percent decrease in household size during the same time period. The average household size is somewhat above the average for the state of 2.45 people per household in 1991 and 2.45 in 1980. The number of households is anticipated to continue to increase and was estimated at approximately 5,750 and 6,180 households in 1995 and

2000, respectively, with an average size of 2.78 and 2.70 people in 1995 and 2000, respectively. Polk County was estimated to contain approximately 160,535 households in 1991 at an average household size of 2.52 people (University of Florida, 1992).

Housing in Hardee County is primarily owner-occupied and single-family structures, a majority of which have been constructed since 1960. In 1989, 46 building permits were issued for new single-family homes, one of which was to be located in the Bowling Green area. Forty-seven new single-family structures were authorized in 1990, and no new permits were issued in Bowling Green (Hardee County Building and Zoning Department, 1991).

Polk County experienced a much higher demand for new housing and authorized 1,828 single-family homes and 50 multi-family structures in 1992 and 2,116 single-family and 23 multi-family structures in 1993. A majority of the new units authorized in Polk County are located in the Lakeland/Winter Haven areas (Polk County Building Department, 1994).

In 1990, the median value of an owner-occupied home was \$40,300 in Hardee County and \$61,000 in Polk County. Both counties fell below the median for the state of \$77,100 (U.S. Bureau of the Census, 1990 Census of Population and Housing). In 1990, the median contract rent for Hardee and Polk counties was \$257/month and \$300/month, respectively.

2.2.7.2 TRANSPORTATION

Access in and around the area surrounding the HPS site is almost exclusively by private vehicle. There are no public transit facilities serving the local area and communities. Figure 2.2.7-1 shows the major rail and road routes to and surrounding the Hardee Unit 3 site. The following paragraphs describe the routes that the construction and operation workforces are expected to travel.

State Road (SR) 37 is the primary north-south state highway in southwest Polk County. This is a 2-lane facility south of SR 60 in Mulberry and is expected to serve as the primary access route [to its intersection with County Road (CR) 630] for construction and operation workers returning to the Lakeland area and smaller communities such as Mulberry and Bradley Junction north of the plant site. It is expected that workers from these areas would exit the site heading north on Fort Green Road. At the intersection of Fort Green Road and CR 630, construction workers would

head west on CR 630, then turn north on SR 37. The 1993 p.m. peak-hour traffic count for the section of SR 37 south of SR 60 was 1,160 vehicles (total two-way), about 5 percent of this traffic being trucks [Florida Department of Transportation (FDOT, 1993)]. There are four at-grade railroad crossings on this section of roadway.

The section of SR 37 south of CR 630, down to SR 674 is also likely to be used by workers residing west of Polk County on SR 674. From CR 630, workers would travel south on SR 37 and west on CR 674. The section of SR 37 between SR 674 and CR 630 had a 1993 p.m. peak-hour traffic count of 132. Approximately 14 percent of this volume was truck traffic. There are no rail crossings on this section of the road.

Access to the site to the Polk County communities of Winter Haven and Bartow, northeast of the site, and Fort Meade to the east is provided over US 17/SR 35. This is a 4-lane divided highway from US 98 in Fort Meade to its intersection with SR 60 in Bartow. While this highway follows a somewhat northwesterly direction (away from the site) between Fort Meade and Bartow, its high-speed/high-capacity design and the absence of rail crossings would likely induce workers residing in northern communities to take Fort Green Road to CR 630, where they would head east to US 17/SR 35. The 1993 p.m. peak-hour traffic count for this portion of US 17/SR 35 was 993 north of the intersection with CR 630/US 98.

While US 17/SR 35 carries a p.m. peak hour volume of 858 south to Bowling Green in Hardee County, it is not likely that site workers would follow that route to the site (via CR 663 and SR 62 or CR 664) since it is a longer route to the site than the one through Polk County (via Fort Green Road and CR 630). The only portion of US 17/SR 35 in Hardee County that is likely to be used by workers is the portion south of the intersection with SR 62. This segment would provide access for workers residing in Wauchula and Zolfo Springs in Hardee County and in Arcadia in DeSoto County. These workers would turn east onto SR 62 from CR 663 when leaving the site. The 1993 p.m. peak-hour volume on the portion of US 17/SR 35 just south of SR 62 was 858, approximately 6 percent of this being truck traffic. There are no at-grade rail crossings along this route.

CR 555 was constructed by the state and is currently maintained by Polk County and provides access from the site to the northeast by connecting CR 630 west of Fort Meade to SR 60 in

Bartow. This road provides a direct, low-volume alternative to US 17/SR 35 for workers returning to the Winter Haven-Bartow area. The 1993 p.m. peak-hour volume for this portion of CR 555 was 552 south of SR 60. Workers living in the Winter Haven-Bartow area would exit the site on Fort Green Road heading north to CR 630. They would then head east on CR 630 to its intersection with CR 555 where they would turn north toward the Winter Haven-Bartow area. This segment has a low traffic volume and has three at-grade railroad crossings.

CR 630 provides a direct east-west connection between SR 37 and US 17/SR 35. This 2-lane Polk County highway was also originally a state highway. Workers would exit the site onto Fort Green Road using CR 630 westbound to SR 37 and eastbound to either US 17/SR 35 or CR 555 to Fort Green Road. The 1993 p.m. peak-hour volume for CR 630 east of SR 37 was 110. There is a high level of truck traffic on this road as well as four at-grade rail crossings.

Access from the site to western coastal communities and the population centers of Hillsborough County is provided over SR 674. Workers would travel west on CR 630 and then south on SR 37 to SR 674. At that point, workers would travel west on SR 674 toward the western coastal communities. The 1993 p.m. peak-hour volume for SR 674 just west of SR 37 was 57.

Fort Green Road is a 2-lane, county-maintained highway extending from Bradley Junction to south of the site entrance. Fort Green Road will provide the principal access for workers exiting the site in both north and south directions. The surface condition of the road is generally good, and the road had a p.m. peak-hour volume of 78 in 1993. The Polk County portion has some alignment changes and four rail crossings. Traveling north toward CR 630, Fort Green Road makes four 90-degree turns as it crosses first to the east and then back to the west of the CSX rail line. The CSX trains average 8 to 12 movements a day through this area, with a possibility of at least 1 or 2 trains during the morning and afternoon shift changes.

Within Hardee County, SR 62 is a 2-lane state highway that runs east-west and will provide workers with access to points west and southeast (via US 17/SR 35). Worker traffic would exit the site on CR 663 and turn either west or east on SR 62. The 1993 p.m. peak-hour volume on the section of SR 62 just west of US 17/SR 35 was 181. There is moderate truck traffic on this road. South of SR 62, CR 663 is an unpaved road and is not a viable alternative to other local roads.

CR 664 is a 2-lane county highway that proceeds southwest from Bowling Green (and its intersection with US 17/SR 35) to an intersection with CR 663 south of the site. Workers using this highway would probably exit east toward Bowling Green. Correspondence with Hardee County staff indicated that no traffic counts are available for this portion of CR 664. There is one rail crossing on CR 664 just east of CR 663.

The CSX Transportation branchline (Brewster Subdivision - Tampa Division) provides north/south rail service to the area. The railroad is located about 0.8 km (0.5 mile) east of the center of the site, extends south from Edison (between Keyville and Bradley Junction), and interchanges with the Seminole Gulf Railway, a Class III short-line, at Arcadia. Numerous spurs off of this line to the north provide private access to phosphate companies.

No public licensed airports or airfields are located within an 8-km (5-mile) radius of the proposed site.

2.2.7.3 MEDICAL FACILITIES

Hardee County contains one general hospital with 50 beds, and Polk County contains eight hospitals with a total capacity of 1,811 beds. The nearest facility to the project site is Hardee Memorial Hospital located approximately 22.5 km (14 miles) southeast of the site in Wauchula. Both counties contain nursing homes and nursing and personal care facilities.

Emergency medical services are located in both Hardee and Polk counties. Within Hardee County, one ambulance and an emergency medical team are located in Wauchula. In Polk County, within an approximate 16-km (10-mile) radius of the facility, Fort Meade and Mulberry each contain one ambulance and medical team. Bartow, located farther north, also contains two ambulances and two emergency medical teams.

2.2.7.4 FIREFIGHTING FACILITIES

Emergency fire response in the site vicinity is provided by the Hardee County Fire Department and the Polk County Fire Department. The primary responder is Station 1, which is located in Wauchula, approximately 21 km (13 miles) southeast of the site. Station 1 is equipped with a pumper, tanker, and rescue equipment and is staffed with a 20-person crew. The response time

from this facility is expected to be approximately 15 to 20 minutes. Backing up Station 1, if necessary, is the Bowling Green Station, located on Highway 17 in Bowling Green.

The primary responder in Polk County is the Bradley Station. The Bradley Station is equipped with a 750-gallon-per-minute (gpm) pumper, tanker, and rescue equipment and is staffed with two people during the day and volunteers at night. The response time from the Bradley Station is approximately 10 minutes. Backup support would be provided by the Fort Meade Station or the Bowling Green Station in Hardee County. Table 2.2.7-6 lists the firefighting equipment for communities within 16 km (10 miles) of the site.

Firefighting equipment is available throughout the area. Within Hardee County, the fire departments in Bowling Green and Zolfo Springs are voluntary; the Wauchula Fire Department has a full-time force of 20 (Choate, 1994).

In Polk County, Fort Meade's force of 27 is entirely voluntary; however, the fire department in Bartow contains 14 full-time firefighters, 17 part-time firefighters, and 40 voluntary members (Monroe, 1994). Bradley Junction has 2 full-time and 10 volunteer members (Gunter, 1994).

2.2.7.5 POLICE PROTECTION

Police protection in the vicinity of the proposed project site is currently provided by the Hardee County Sheriff's Department. The proposed project site is located in the north (police service) zone. Each zone in Hardee County is patrolled by two deputies. Deputies from adjacent zones are available to provide backup if necessary. The response time is approximately 15 to 20 minutes, depending on the location and workload of the deputy on duty in the zone and the type of assistance requested.

The Hardee County Sheriff Department maintains a force of 57 officers with 32 vehicles, and 1 air patrol, and is responsible for police protection in the unincorporated portions of the county (Harris, 1994). Bowling Green, Wauchula, and Zolfo Springs have police departments which serve those communities. The police force in Bowling Green consists of four full-time employees, six part-time employees, and six vehicles (Brown, 1994). Wauchula's police department consists of 11 full-time and 6 part-time employees plus 17 vehicles (Brock, 1994). Zolfo Springs' police department consists of four employees and four vehicles (Brock, 1994). In

addition to county and local police, the area is also served by the Florida Highway Patrol (FHP), with one officer stationed in Hardee County (Clerk of FHP, 1994).

As of February 4, 1994, Polk County has 360 full-time certified law enforcement employees and 3 part-time certified law enforcement employees. Within the unincorporated portion of the county are four primary patrol zones. Each patrol zone is normally staffed by one uniformed deputy sheriff per shift, 24 hours a day. The proposed project site is located in Zone 66. Zone 66 is patrolled by one deputy; however, additional deputies are available if necessary. The response time is approximately 10 to 15 minutes. In addition, Bartow, Mulberry, and Fort Meade each have police departments which service these communities (Polk County Sheriff Department, 1994).

2.2.7.6 RECREATION FACILITIES

There are no federal, state, or local recreation facilities within an 8-km (5-mile) radius of the project site. The nearest local facility is the Little Cypress Golf and Country Club, which is located about 16 km (10 miles) away, just west of Wauchula.

Two state parks, Highlands Hammock and Payne Creek, and one state recreation trail, Peace River, are located within Hardee County. Payne Creek State Park and the Peace River Recreational Trail are located about 13.7 km (8.5 miles) east of the site. Highlands Hammock State Park is located in the southeastern edge of the county, more than 32 km (20 miles) southeast of the site.

Polk County contains two state parks (Lake Kissimmee and Lake Arbuckle), one special water area, and several state-owned fish management areas. None of these facilities is located within 8 km (5 miles) of the proposed site.

2.2.7.7 ELECTRIC AND GAS

Electricity is supplied to the area by the Peace River Electric Cooperative, Florida Power & Light Company (FPL), and Tampa Electric Company (Polk County only). Hardee County contains no natural gas transmission pipelines except for the line that is currently serving the existing HPS. The Florida Gas Transmission Company distributes gas to Fort Meade in Polk County and to the HPS site by a gas lateral constructed as part of the original site certification.

2.2.7.8 WATER SUPPLY FACILITIES

Hardee County has no county-owned water facilities; all are municipal or private. The rural unincorporated areas of the county receive water from private wells. Municipal service is provided in Wauchula, Bowling Green, and Zolfo Springs.

Polk County provides water to certain communities within the county; however, Bartow, Fort Meade, and Mulberry each contain municipal treatment and distribution systems.

2.2.7.9 SEWAGE TREATMENT FACILITIES

Sewage treatment facilities in Polk and Hardee counties are located only in the more urbanized areas; the unincorporated areas use private septic systems.

Sewage treatment systems serve Wauchula, Bowling Green, and Zolfo Springs in Hardee County and Fort Meade, Bartow, Lakeland, and Winter Haven in Polk County. Table 2.2.7-7 lists current treatment volumes and capacities for each system.

2.2.7.10 SOLID WASTE DISPOSAL

One solid waste disposal area is located near Wauchula in Hardee County. The landfill has an expected capacity of 10.25 years remaining and receives an average of 21,350 tons per year (TPY) (Williamson, 1994).

Polk County contains three county landfills: North Central at Lakeland, Southeast at Lake Wales, and Northeast at Lake Hamilton. The area in Polk County surrounding the proposed site would use the North Central landfill which receives an average of about 300,000 TPY of solid waste with an anticipated design capacity of 20 years (Mahler, 1994).

Table 2.2.7-1. 1991 Labor Force, Employment, and Unemployment for Hardee County, Polk County, the Central Florida Region, and Florida

Area	Labor Force	Employment	Unemployment	Unemployment Rate (%)
Hardee County	9,368	8,381	987	10.5
Polk County	180,659	162,390	18,269	10.1
Central Florida Region	238,446	214,947	23,499	9.42
Florida	6,431,205	5,960,694	470,525	7.3

Sources: State of Florida, Department of Labor and Employment Security, unpublished data.
U.S. Department of Labor, Bureau of Labor Statistics.
University of Florida, 1992.

Table 2.2.7-2. 1991 Average Monthly Employment by Major Industry Group for Hardee County, Polk County, the Central Florida Region, and Florida

Industry	Hardee County	Polk County	Central Florida Region	Florida
Agriculture, Forestry, and Fishing	2,387	10,433	19,274	149,784
Mining	ND	3,820	3,820	8,147
Construction	181	8,019	9,931	283,999
Manufacturing	312	20,653	22,688	491,919
Transportation, Communication, and Public Utilities	169	8,152	9,615	315,448
Wholesale Trade	296	7,504	8,839	287,354
Retail Trade	1,094	33,612	42,806	1,120,022
Finance, Insurance, Real Estate	209	7,433	8,965	359,575
Services	1,603	44,588	58,791	1,904,943
Government	670	10,480	13,963	371,986
Other	ND	189	189	13,022
TOTAL	6,921	154,883	196,181	5,306,199

ND = Not disclosed.

Source: State of Florida, Department of Labor and Employment Security, Bureau of Labor Market Information, "Employment, Wages, and Contributions Report" (ES-202), unpublished data.

Table 2.2.7-3. 1989 Personal Income for the Major Private, Nonfarm Industries in Hardee County, Polk County, the Central Florida Region, and Florida

Private Nonfarm Industries	Income (\$1,000)			
	Hardee County	Polk County	Central Florida Region	Florida
Manufacturing	5,483	604,975	652,734	14,974,128
Mining	ND	139,609	142,021	570,501
Contract Construction	ND	255,086	310,735	10,100,898
Wholesale Trade	6,291	222,992	249,555	9,046,497
Retail Trade	13,836	542,981	664,727	17,225,299
Finance, Insurance, and Real Estate	4,093	190,015	222,784	10,679,489
Transportation, Communication, and Public Utilities	6,684	215,262	253,584	8,917,942
Services	27,205	1,000,555	1,198,169	42,719,679
Other	11,439	78,138	117,811	1,365,900
Total	74,986	3,249,613	3,812,120	115,600,333

Note: ND = Not disclosed.

Source: U.S. Department of Commerce, Bureau of Economic Analysis, unpublished data.

Table 2.2.7-4. 1990 Personal Income for the Major, Private, Nonfarm Industries in Hardee County, Polk County, the Central Florida Region, and Florida

Private, Nonfarm Industries	Income (\$1,000)			
	Hardee County	Polk County	Central Florida Region	Florida
Manufacturing	6,408	620,354	668,044	15,425,169
Mining	ND	142,663	145,113	556,068
Contract Construction	ND	246,588	301,495	9,976,541
Wholesale Trade	5,545	225,044	253,505	9,478,339
Retail Trade	14,324	561,726	688,088	18,006,791
Finance, Insurance, and Real Estate	4,151	202,703	238,627	11,250,991
Transportation, Communication, and Public Utilities	6,616	236,972	277,692	9,655,678
Services	28,151	1,075,966	1,295,691	47,264,771
Other	13,193	78,914	126,137	1,464,546
Total	78,388	3,390,930	126,137	123,078,894

Note: ND = Not disclosed.

Source: U.S. Department of Commerce, Bureau of Economic Analysis, unpublished data.

Table 2.2.7-5. 1989 Income Characteristics for Hardee and Polk Counties

Income Characteristic	Hardee County (\$)	Polk County (\$)
Per Capita Income (1989)	9,411	12,392
Median Income--Family	24,327	28,965
Median Income--Household	22,065	25,216

Source: U.S. Department of Commerce, Bureau of the Census, 1990 Census of Population and Housing: Summary Tape File 3.

Table 2.2.7-6. Firefighting Equipment for Communities Within Approximately 16 km
(10 miles) of Hardee Unit 3

Community	Equipment	
	Pumpers	Tankers
Hardee County		
Bowling Green	2	1
Wauchula	3	1
Zolfo Springs	1	1
Polk County		
Fort Meade	3	2 ^a
Bartow	3	2 ^b
Bradley Junction	1	1 ^a

^a Plus one rescue vehicle.

^b Plus one aerial truck.

Sources: M. Choate, Hardee Fire and EMS Department, 1994.
W. Gunter, Bradley and Fort Meade Fire Departments, 1994.
Monroe, Bartow Fire Department, 1994.

Table 2.2.7-7. 1989 Municipal Sewage Systems Usage and Capacity for Selected Communities in Hardee and Polk Counties

Community	Volume (mgd)	
	Current Use	Capacity
Hardee County		
Bowling Green	0.220	0.320
Wauchula	0.86	1.0
Zolfo Springs	0.125	0.2
Polk County		
Fort Meade	0.5	1.0
Bartow	2.75	2.75

Sources: D. Elbertson, Bowling Green Municipal Offices, 1994.
Polk County Water and Sewer Department, 1994.
R. McClellan, Zolfo Springs Municipal Offices, 1994.
G. Heine, Wauchula Municipal Offices, 1994.
D. Allen, Bartow Water Department, 1994.

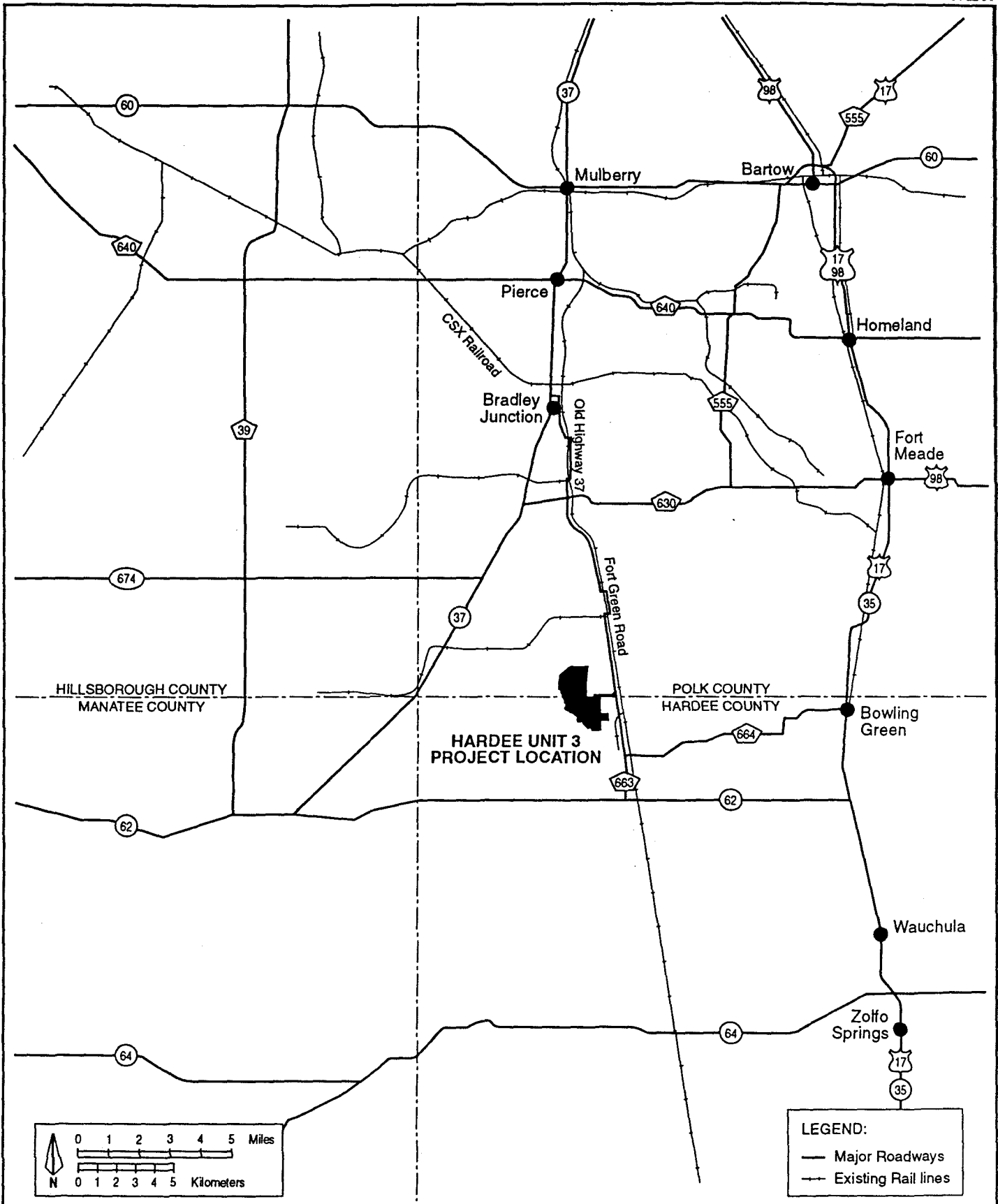


Figure 2.2.7-1
Major Transportation Routes Surrounding the
Hardee Unit 3 Project

Source: KBN, 1994.



2.3 BIOPHYSICAL ENVIRONMENT

2.3.1 GEOHYDROLOGY

Characterization of the geohydrology of the overall HPS site was included in the SCA/EA document prepared for the original HPS (TPS/SECI, 1989). Site-specific data were collected to describe lithology and hydrogeologic units and allow comparison with regional trends. The data collected for the HPS site are considered to be representative of the Hardee Unit 3 Project area and provide the basis for the description of the current project area in this section.

2.3.1.1 GEOLOGIC DESCRIPTION OF THE SITE-AREA

2.3.1.1.1 Regional Stratigraphy

The HPS site lies within Polk and Hardee counties and is underlain by sediments and rock primarily of Tertiary age (Stewart, 1966; Wilson, 1977). Portions of the HPS site have been mined to recover phosphate ore and reclaimed. Mining activities are restricted to the upper 9 to 12 m (30 or 40 ft) of substrate. After mining, reclamation activities result in a mixture of upper-sand layers. Unmined or deeper soils will conform to the following description.

A generalized stratigraphic section for the two-county area near the site is shown in Figure 2.3.1-1. The deepest described formation is the Cedar Keys which overlies rocks deeper than 610 m (2,000 ft). Above this formation is the Oldsmar Limestone which underlies all of the Florida peninsula. The Avon Park Limestone, which thickens to more than 305 m (1,000 ft) and is found above the Oldsmar, is the primary aquifer across Florida (refer to Section 2.3.2). Overlying the Avon Park is the Ocala Group which consists of (in ascending order) the Inglis, Williston, and Crystal River Formations. The Ocala crops out in the Green Swamp area of northern Polk County and increases in thickness from 90 to 180 m (300 to 600 ft).

The Suwannee Limestone Formation ranges in thickness from 25 to 75 m (80 to 250 ft), crops out in northeastern Hillsborough County, and pinches out in Polk County. Overlying the Suwannee are the Hawthorn Group strata. Current practice is to subdivide the lower part into the Tampa member, which consists of a lowermost "sand and clay" unit, and an upper limestone unit. The overlying Hawthorn Formations rest upon a weathered contact and are subdivided into a lower calcareous formation, an interbedded middle member, and an upper clastic member. Total

thickness of the Hawthorn Group varies from very thin to as much as 90 m (300 ft) in Polk and Hardee counties.

The Tamiami Formation and the overlying Caloosahatchee Marl generally occur south of the site but are discontinuous near the site area where the Bone Valley member predominates. The Bone Valley ranges in thickness from 6 to 18 m (20 to 60 ft) and is exposed in stream cuts and on high plateaus in Polk County.

The most recent deposits are the unnamed terrace deposits which range from 0 to 21 m (0 to 70 ft) thick. These deposits are described more fully in Section 2.3.1.3.

2.3.1.1.2 Lithology

Generalized descriptions (from Wilson, 1977, except as noted) of the formations in the site area are summarized here in ascending order.

Oldsmar (Lake City) Formation--Limestones and dolomites with evaporites, soft to hard, chalky zones, occasional fine honeycomb, abundant nodules and nests of nodules of gypsum altered from anhydrite, some selenite cemented fractures (Stewart, 1966).

Avon Park Formation--Limestone, chalky, nodular, oolitic, fragmental, intergranular anhydrite and gypsum, very fossiliferous, cream, white, and buff; commonly thin dolomite in middle part, dense to finely crystalline or sucrosic, yellow to grayish brown. Lower dolomite unit massive, dense to finely crystalline or sucrosic, some coarsely crystalline, pale-yellow and brown to dark-brown and gray, mottled.

Ocala Group--Limestone, chalky, nodular, granular, fragmental, some oolitic, generally very fossiliferous, cream, white, some buff; occasional dolomite in lower part, sucrosic to dense and cherty, yellowish brown to dark-brown and gray.

Suwannee Formation--Limestone, nodular, granular, chalky, some fragmental, some oolitic, usually very fossiliferous, cream to white, occasionally some clear quartz grains.

Sand and Clay Unit of Tampa Limestone--Sand, fine-coarse grained, clean to silty, limey, grayish green; and clay, silty, sandy, marly, gray to pale green, and hard, waxy, dark green to black, marly; minor limestone.

Tampa Limestone Unit--Limestone, massive or thick-bedded, hard, dense, cherty, fossiliferous, phosphatic, white to gray and brown; minor thin bedded sand and clay. Where underlying sand and clay unit is absent, equivalent beds are limestone, predominantly sandy, fossiliferous, gray, cherty; in places marly, soft, pebbly.

Hawthorn Group--Predominantly marl, dolomite and limestone; soft, chalky, fine-grained to sandy or pebbly; abundant brown or black phosphorite grains or pebbles; minor thin-bedded sand and clay. Generally the uppermost limestone in the section, less clastic than the underlying sand and clay unit, phosphatic throughout.

Bone Valley Member--Clayey sand and sandy clay, fine-grained, calcareous to noncalcareous; abundant phosphorite nodules up to pebble size, white to gray in upper part, amber or black in lower part; includes beds of clean phosphatic sand, and sand and gravel.

Unnamed Sand Unit--Sand, clayey, very fine to medium grained, predominantly fine-grained; white to brown; trace of phosphate in lower part, minor thin beds of limestone, and bluish gray clayey sand and clay.

2.3.1.1.3 Site-Area Stratigraphy

The results of four deep borings were used to prepare the general stratigraphic description for the site. These borings are the Southwest Florida Water Management District (SWFWMD) Regional Observation Monitoring Program (ROMP) No. 40 Well near Duette, the United States Steel Agri-Chemicals (USSAC) South Rockland Well in Section 1 of Township 33 S, Range 24 E, about 3.2 km (2 miles) west of Bowling Green (Dames & Moore, 1979), and the CFI production test well and deep Floridan test well, both in Section 26 of Township 34 S, Range 23 E, about 3.2 km (2 miles) southwest of Fort Green Springs. The terrace sands range in thickness from 9 to 12 m (30 to 40 ft), and the Hawthorn lies from 9 to 113 m (30 to 370 ft) deep. The Tampa Formation lies at depths of from 67 to 146 m (220 to 480 ft); the top 18 to 29 m (60 to 95 ft) is limestone, and the bottom 9 to 14 m (30 to 45 ft) is sand and clay. The Suwannee Limestone lies at depths

of 108 to 204 m (355 to 670 ft), and the Ocala Group ranges from 146 to 283 m (480 to 930 ft) deep. Two of the deep wells reached the Avon Park Limestone at depths of 223 and 482 m (730 and 1,580 ft). The deep Floridan test well reached the Oldsmar (Lake City) Formation at a total depth of 550 m (1,800 ft).

2.3.1.1.4 Site-Area Structure

The major geologic structure is the Peninsular Arch, which forms the backbone of the Florida peninsula striking S 35°E. Subparallel to this and to the north of the site is the Ocala Uplift which is a faulted elliptical area in Levy County where this structure is 370 km (230 miles) long and 113 km (70 miles) wide. The nearest structure to the site is the Kissimmee flexure, which strikes east of northeast through the central part of southern Polk County. To the south of the site is the South Florida Basin which is a gentle structure trending S 45°W. Faulting has not been identified within the immediate site vicinity to date.

2.3.1.1.5 Site-Area Physiography

The area falls into the geomorphic province known as the Polk Upland (White, 1970), occurring above the Wicomico Shoreline which is a Pleistocene terrace landform occurring at elevation +30 m (+100 ft) several miles south of the site. South of the site is the geomorphic terrain mapped as the DeSoto Plain. The Polk Upland is flat and covered with a blanket of permeable sand; seepage is rapid and little dissected by streams, resulting in a subdued topography. Only remnants of the ancient shoreline, i.e., bars, spits, and terrace scarps, mark the landform as it gently slopes toward the south.

2.3.1.2 DETAILED SITE LITHOLOGIC DESCRIPTION

The presence of pebble-sized phosphate grains in localized areas or very thin zones within the Bone Valley strata dominates the detailed site geohydrology. Parts of the site containing economic deposits of pebble-phosphate have been strip mined. Mining activity typically removed the unnamed surficial sands (overburden) and placed them in the adjacent pit bottom at a lower elevation. Mixing with clayey sand overburden is inevitable so that the entire zone, typically less than 9 m (30 ft), has been altered where mining activity was conducted. Strip mining and reclamation activities have been completed within the HPS site, resulting in land surface configurations that restore drainage basins to pre-mining conditions. Other parts of the HPS site have not been mined and remain undisturbed.

An exploratory program was conducted to characterize the hydrogeologic units occurring at the HPS site. The subsurface investigations consisted of:

1. Ten Standard Penetration Test (SPT) borings. These borings, identified as B-1 through B-10, were drilled to depths varying from 12 m (40 ft) to greater than 61 m (200 ft).
2. Six shallow aquifer observation wells completed to approximate depths of 6.1 m (20 ft). These observation wells were identified as B-1, B-2, B-3, B-10, B-11, and B-12. These borings were advanced with casing and water to approximately 9 m (30 ft). Copies of the boring logs are included in the HPS SCA/EA (TPS/SECI, 1989).
3. Three deep intermediate aquifer observation wells completed to depths greater than 61 m (200 ft). These observation wells were identified as B-3A, B-10A, and B-12A. These borings were advanced with casing and water to approximately 25 m (80 ft), and then were drilled with open hole using native fluids to boring termination. Copies of the boring logs are included in HPS SCA/EA (TPS/SECI, 1989).

Split spoon samples, Shelby tube samples, and wash samples were obtained during drilling activities conducted during the exploratory program. The laboratory testing program consisted primarily of moisture content, dry density, organic content, Atterberg limits, sieve analyses, and permeability testing, with some shear strength testing (see Section 2.3.1.4) for foundation design. A total of 86 grain-size analyses were conducted, 16 of which included a hydrometer test on the silt and clay fraction. Soil classification tests according to the Unified Method (ASTM D2487) were prepared for the samples. The group symbols ranged from SP to SM to ML for the clastic units and from CH and CL to SC for the cohesive soil units. The definitions of these symbols are provided in Figure 2.3.1-2. Results of geotechnical testing program are included in the HPS SCA/EA (TPS/SECI, 1989).

Cross sections for the HPS site have been developed with the data collected from the three deep borings (see Figure 2.3.1-3). A north-south cross section is presented in Figure 2.3.1-4, and a west-east cross section is presented in Figure 2.3.1-5.

The Upper Sand Unit is a gray, fine-grained sand that becomes browner and siltier with depth. In areas where mining has occurred, this overburden material was removed and reworked or

replaced with tailing sands. The natural water content of these soils averaged 12 percent, and the fines ranged from 18 to 34 percent in eight tests. Thickness of this unit is typically 1.5 to 3 m (5 to 10 ft), except in mined areas where it can be up to 8 m (25 ft) thick.

The Upper Confining Bed underlies the Upper Sand Unit and consists of sandy clay, clayey sand, and cemented sand layers. The unit is typically a light gray to tan clayey sand underlain by light gray to light brown sandy clay which may interfinger toward the base. Water contents range from 25 to 60 percent in 37 tests on these materials. Liquid limits averaging 90 percent and plastic limits averaging 30 percent were found in 27 tests. Dry densities from tube samples were extremely variable from 18 tests yielding total porosities of 30 to 70 percent. From 30 grain size tests, the fines ranged from 18 to 62 percent. Kaolinite, palygorskite, and montmorillonite clay minerals are present according to the literature, and the presence of montmorillonite is confirmed by the very high liquid limits of 185 percent found in some samples. Cation exchange capacities are expected to be as high as 100 milliequivalents per 100 grams (meq/100 g) for the clays that are predominant near the base of the upper confining bed. Near the top of the bed, where the clays are kaolinitic, the cation exchange capacity is expected to be only 5 to 15 meq/100 g. Three laboratory permeability tests ranged from a low of 7.4×10^{-9} cm/sec to a high of 6.7×10^{-6} cm/sec. Thickness ranged from 6 to 15 m (20 to 50 ft) at the site, although silty sand and even gravelly sand seams (the phosphate deposit) may be found as inclusions within this unit. Where mining has taken place, this unit may be as thin as 3 to 5 m (10 to 15 ft). Typically a "hardpan" or "pit bottom" of limestone or calcareous cement zone is found at depths of from 8 to 16 m (25 to 50 ft). These are materials of the Bone Valley Formation.

The Intermediate Sand Unit is found directly underlying the Upper Confining Bed and consists of gray phosphatic sands and silts of the upper Hawthorn Formation. The water content ranged from 28 to 50 percent, the liquid limit was 74 percent (average), and the plastic limit was 37 percent (average) based on results of tests conducted on the clayey interbeds. This suggests that the cation exchange capacity of this layer is similar to that of the overlying clays; montmorillonite is present in the clay interbeds. Tests conducted on undisturbed tube samples gave total porosity values of 52 and 64 percent, and percent fines ranged from 15 to 45 percent. This unit contains numerous beds which are similar to the layers above, but layers of gray to black fine-grained sands with sandy silt are abundant enough to form an interconnected porous media which is 12 to

21 m (40 to 70 ft) thick on the site. Thin cemented layers and silty clay interbeds are characteristic inclusions.

The Lower Confining Bed that underlies the Intermediate Sand Unit consists of clayey sands and silts of the lower Hawthorn Formation. Tests performed on samples collected from this layer show water content ranging from 41 to 53 percent, an average liquid limit of 60 percent, plastic limit of 38 percent, and fines ranging from 35 to 60 percent. These beds include silty clay, phosphatic clayey sand, clay, sandy clays, sand and clay, and sand with brown clay near the base. Very thin carbonate beds and calcareous cemented interbeds are found throughout this unit. Based on boring data, this unit appears to be 24 to 30 m (80 to 100 ft) thick at the site.

The Carbonate Unit underlies the Lower Confining Bed and consists of dolomite and limestone of the lowermost Hawthorn and Tampa Formations. This unit occurs where the carbonate layers became relatively massive or where 50 percent of the section is dominated by carbonate beds. This can be a white limestone to a gray dolomite with occasional chert. In boring P-12A, this unit was as thin as 3.3 m (11 ft).

2.3.1.3 GEOLOGIC MAPS

Soils have been mapped in both Polk County and Hardee County by the U.S. Department of Agriculture in cooperation with the county soil conservation services (USDA, 1984; and Polk County SCS, unpublished, 1988). The site occurs predominantly within the Smyrna-Myakka-Ona general soil grouping, which consists of nearly level, poorly drained soils that are sandy throughout and that have a dark colored subsoil at a depth of less than 76 cm (30 inches). Individual soil mapping units include Smyrna sand, Myakka fine sand, Ona fine sand, Basinger fine sand, Fort Green fine sand on 2 to 5 percent slopes, Immokalee fine sand, Wabasso fine sand, Placid fine sand (depressional, in sinkholes), Samsula muck, and Bradenton-Fleda-Chobee association (frequently flooded, in wetlands). In Polk County, areas of mined land are described as:

#11 - Arents - Water complex consists of overburden material (material removed to get to the "matrix" material or phosphate-bearing strata) piled into mounds of narrow ridges with very steep sides separated by narrow pits that may or may not contain water. The water table of this complex is variable but primarily the arents part has a water table more than 2 m (80 inches) from the surface.

This statement described the topography and soils at the mined portions of the HPS site prior to subsequent reclamation and construction. The area designated for Hardee Unit 3 includes mined soils that have been reclaimed and unmined soils.

The lowest point on the HPS site is at elevation +30 m (+100 ft) where Payne Creek flows southeastward from the extreme southern end of the site. The floodplain of Payne Creek forms the southwestern boundary of the site, and the elevations raise up somewhat steeply to elevation +35 m (+115 ft). The land slopes gently upward toward the north and northeast at a fairly uniform grade to a maximum elevation of +42 m (+137 ft) at the extreme northeastern corner of the site. Several circular depressions are shown on aerial photographs and topographic maps which predate the mining activity. These features are discussed in Section 2.3.2.2.

Polk County has been geologically mapped in detail (Campbell, 1986) whereas Hardee County has not. Significant geologic units in the site area (Brooks, 1981) include mainly the Pliocene Bone Valley (Pbv) Formation which is mapped in the site area. To the east along the Peace River, the Miocene Hawthorn (Mh2) Formation is mapped, and to the south of the site deposits are mapped as Miocene Hawthorn of the Statenville Type (Mh3).

Differentiation of the uppermost Unnamed Sand unit from the Bone Valley member is based on a noticeable change in clay content. Typically, the top of the Bone Valley is represented by a clayey sand often yellowish gray and poorly indurated. Since this clayey sand is only 1.5 m (5 ft) thick and occasionally underlain by a white to light gray fine grain sand, it cannot be relied upon as a confining bed. Presence of ditch drains (see Section 4.1.4) and deeper mine pits onsite provide an interconnection between the recent sand deposits and the sand units contained within the Bone Valley member. For these reasons, the most significant geologic horizon is the "hardpan" or "pit bottom" strata where calcareous cementation marks the first Hawthorn Group carbonate.

Figure 2.3.1-3 shows the boring location plan for the HPS site. It also includes locations of cross sections and piezometers. Figure 2.3.1-6 shows the elevation of geologic "hardpan" layer which separates the water table aquifer from the intermediate confined aquifer.

2.3.1.4 BEARING STRENGTH

A preliminary geotechnical and foundation engineering study was conducted to characterize subsurface conditions at the Hardee Unit 3 site (AT&E, 1993; see Appendix 10.7). The study included performing laboratory and field testing on collected soil samples, evaluating conditions encountered with respect to proposed construction, and preparing preliminary recommendations for foundation design. Fourteen soil borings (see Figure 2.3.1-7) were conducted in general compliance with ASTM procedures for standard field penetration tests (D-1586). The penetration resistance (N-value) recorded by driving split-spoon samplers was the measurement used to determine bearing strength of site soils.

The soils in the west-central portion of the Hardee Unit 3 site were described as typically clean to slightly silty or slightly clayey fine sand extending from ground surface to depths of 0.6 to 4 m (2 to 13 ft). The sands were generally underlain by clayey sands which graded to sandy clays and clays to boring termination depths of 9 to 27 m (30 to 90 ft) below existing ground surface. Soils in the upper 9 m (30 ft) typically had N-values ranging from 8 to 40 blows per foot. Below a depth of approximately 9 m (30 ft), the soils generally increased in relative density with N-values frequently above 30 blows per foot. The soils encountered in these standard penetration test boring locations are generally consistent with the findings of the exploratory drilling program previously conducted for the HPS site as summarized in Section 2.3.1.2. Soils encountered in the west-central portion of the Hardee Unit 3 site are comparable to the soils of the Upper Sand Unit and Upper Confining Bed, as depicted in Figures 2.3.1-4 and 2.3.1-5.

Exceptions to this trend were noted at two borings located in the eastern portion of the Hardee Unit 3 site, along the entrance road alignment. Soils encountered in this part of the site included clean and slightly clayey fine sand to 8.5 m (28 ft) underlain by sandy clay to a boring termination depth of 14 m (45 ft) at one location; at the second boring location, clean sand at the surface was underlain by 10 m (34 ft) of loose to very loose sand and soft clay, which in turn was underlain by stiff to very hard clayey sand to boring termination depth of 20 m (65 ft). These borings appeared to be located within an area that had been previously mined because the soils within the upper 9 to 12 m (30 to 40 ft) had much looser relative densities than noted for the balance of the Hardee Unit 3 site. The N-values recorded at these two locations for soils in the upper 9 m (30 ft) were less than 10 blows per foot, with N-values for deeper soils generally greater than 10 blows per foot.

The subsurface soil conditions were concluded to be generally suitable for support of the proposed power block facilities on mat foundation systems. Major heavily loaded equipment foundations, such as stack foundations subjected to high overturning loads, will be founded on deep foundations such as auger cast pilings. It was indicated that high contact pressures might preclude the use of spread footings, while deep foundation systems were considered suitable for use if the arrangement of structures resulted in the potential for excessive differential settlement. Special pavement design was recommended for construction of the access roadway across mined areas in the eastern portion of the site.

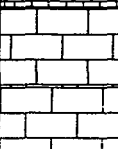
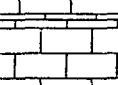
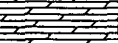
TERTIARY	RECENT		UNNAMED SANDS		SAND, CLAYEY, VERY FINE TO MEDIUM MOSTLY FINE GRAINED; WHITE TO BROWN; TRACE PHOSPHATE IN LOWER PART. MINOR THIN BEDS OF LIMESTONE AND BLUE GRAY CLAYEY SAND AND CLAY.	SURFICIAL AQUIFER
	PLEISTOCENE					
	PLIOCENE					
	MIOCENE	HAWTHORN GROUP	BONE VALLEY		CLAYEY SAND AND SANDY CLAY. FINE-GRAINED, CALCAREOUS TO NON-CALCAREOUS; ABUNDANT PHOSPHORITE NODULES TO PEBBLE SIZE, WHITE TO GRAY IN UPPER PART, AMBER & BLACK IN LOWER PART; BEDS OF CLEAN PHOSPHATE.	INTERMEDIATE AQUIFER
			PEACE RIVER		PREDOMINANTLY A CLASTIC UNIT BROWN TO BLACK; FINE GRAINED TO SANDY OR PEBBLY; W/OCCASIONAL CARBONATE BEDS; CLAYEY, DOLOMITIC, PHOSPHATIC	
			ARCADIA		VERY CALCAREOUS OR DOLOMITIC QUARTZ SAND TO VERY SANDY CARBONATE, W/SANDY CALCAREOUS TO DOLOMITIC CLAYS; 15-20% PHOSPHATE.	
			TAMPA		DOLOMITIC LIMESTONE NEAR TOP WITH CLAYEY INTERBEDS, BECOME GREENISH SAND + CLAY AT BASE.	
	OLIGOCENE		SUWANNEE		LIMESTONE, NODULAR, GRANULAR, CHALKY, FOSSILS, CREAM TO WHITE IN COLOR.	FLORIDAN AQUIFER
	EOCENE	OCALA	CRYSTAL RIVER		LIMESTONE, CHALKY, NODULAR, GRANULAR, FRAGMENTAL, SOME OOLITIC, FOSSILIFEROUS; CREAM WHITE, SOME BUFF; W/OCC DOLOMITE IN LOWER PART; SUCROSIC TO DENSE AND CHERTY, YELLOWISH BROWN TO DARK BROWN AND GRAY.	
			WILLISTON			
			INGLIS			
	PALEOCENE		AVON PARK		LIMESTONE, CHALKY, NODULAR, FRAGMENTAL, W/ANHYDRITE AND GYPSUM; CREAM WHITE TO BUFF.	
			OLDSMAR		LIMESTONE, AS ABOVE, WITH RUBBLE ZONES.	
			CEDAR KEYS		ANHYDRITE AND DOLOMITE BEDS WITH GYPSUM NODULES.	

Figure 2.3.1-1
Generalized Stratigraphic Column of the HPS Site Vicinity

Sources: Ad Hoc Committee on Florida, Hydrostratigraphic Unit Definition, 1986; Wilson, 1977; Stewart, 1966; KBN, 1994.



SOIL CLASSIFICATION CHART ASTM D 2487

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS more than 50% retained on no. 200 sieve	SANDS more than 50% of coarse fraction passes no. 4 sieve	CLEAN SANDS	SP	Poorly graded sands and gravelly sands, little or no fines
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS 50% or more passes no. 200 sieve	SILTS AND CLAYS liquid limit 50% or less		ML	Inorganic silts, very fine sands, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	SILTS AND CLAYS liquid limit greater than 50%		CH	Inorganic clays of high plasticity, fat clays

Figure 2.3.1-2
Definition of Soil Types Underlying the HPS Site

Sources: ASTM Book of Standards, Volume 4.08, 1994; KBN, 1994.



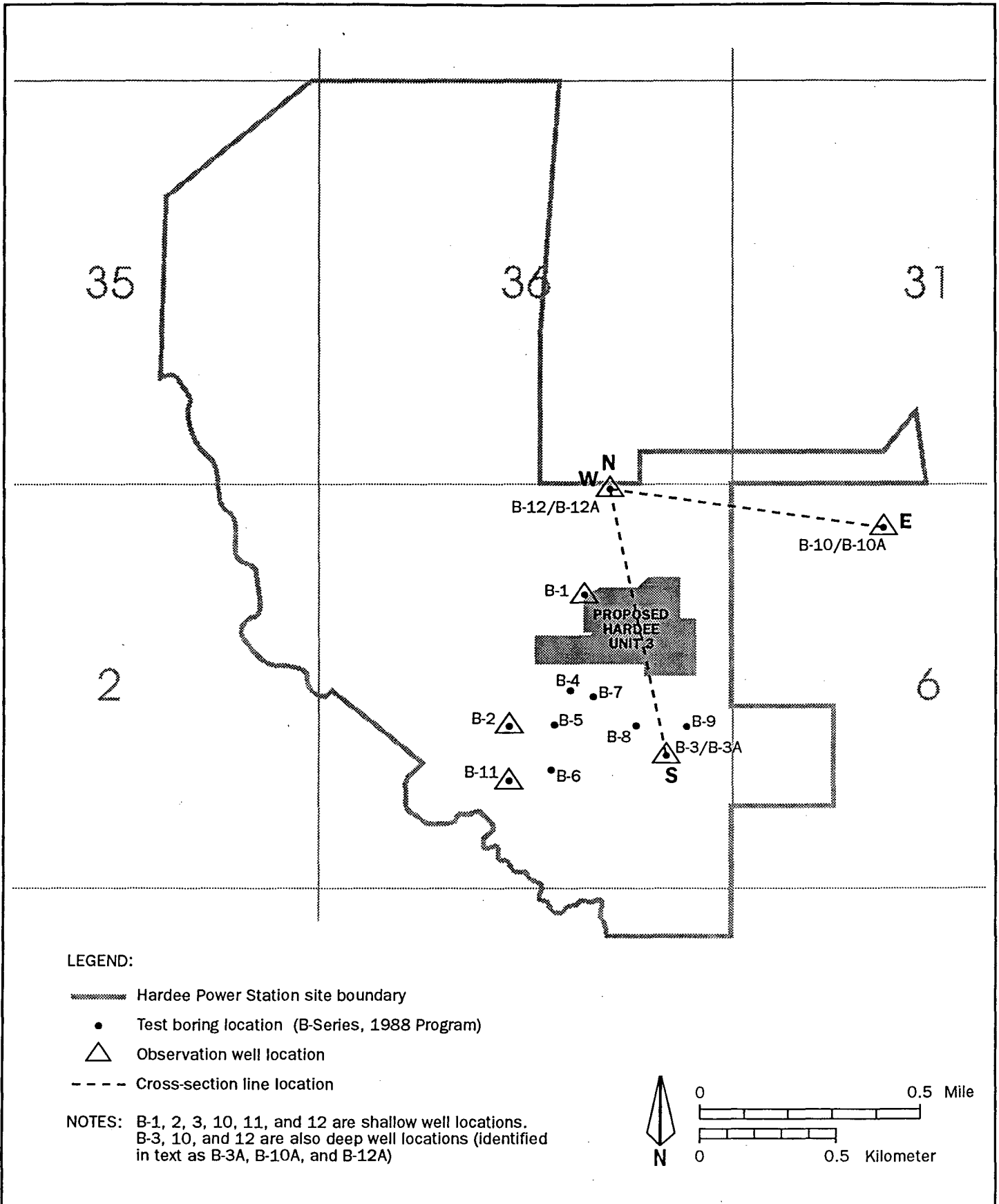


Figure 2.3.1-3
 Boring Location Plan With Cross-Section Lines

Sources: TPS/SECI, 1989; KBN, 1994.



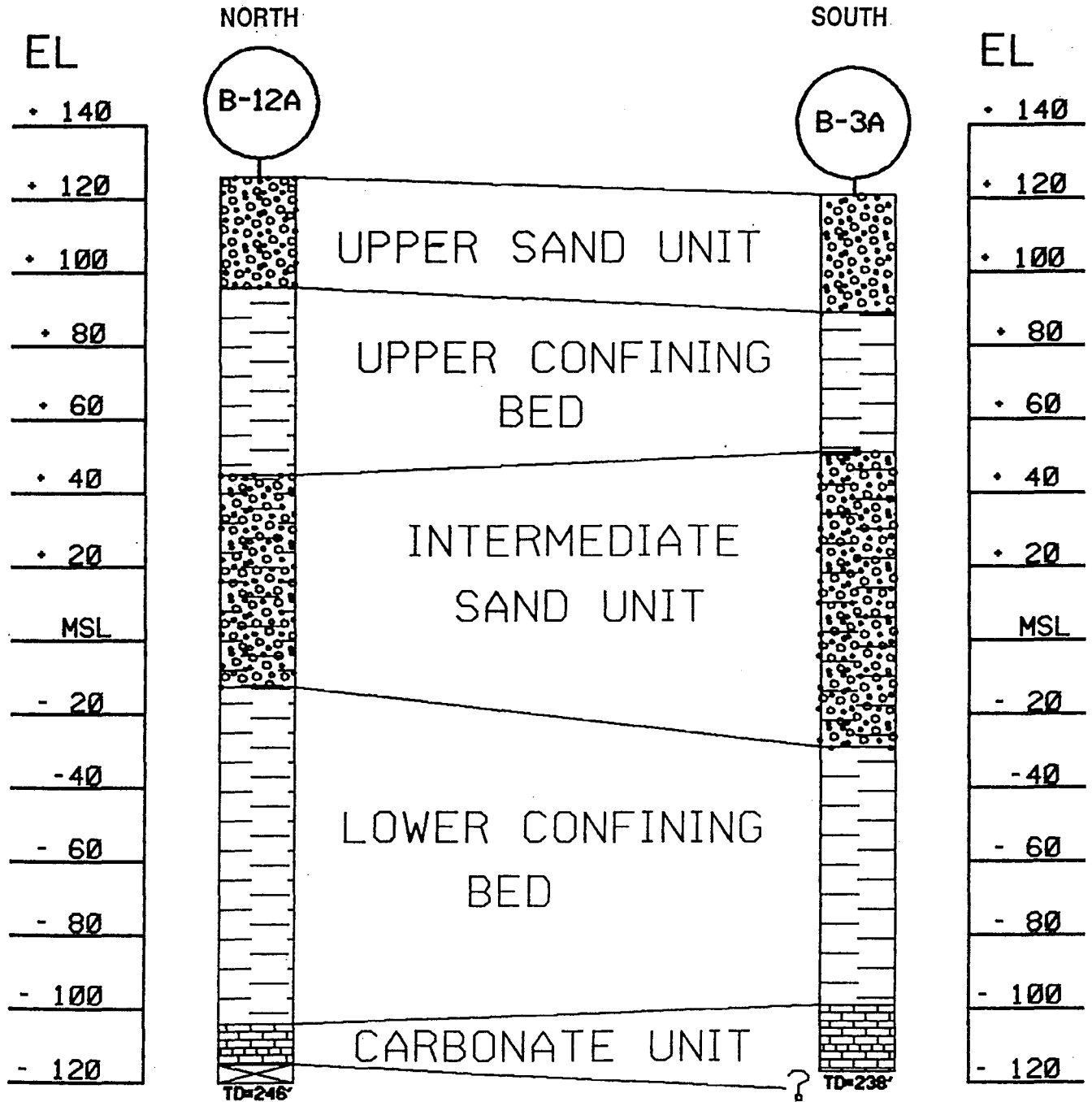


Figure 2.3.1-4
Generalized North-South Stratigraphic Cross Section of the
HPS Site

Source: TPS/SECI, 1989.



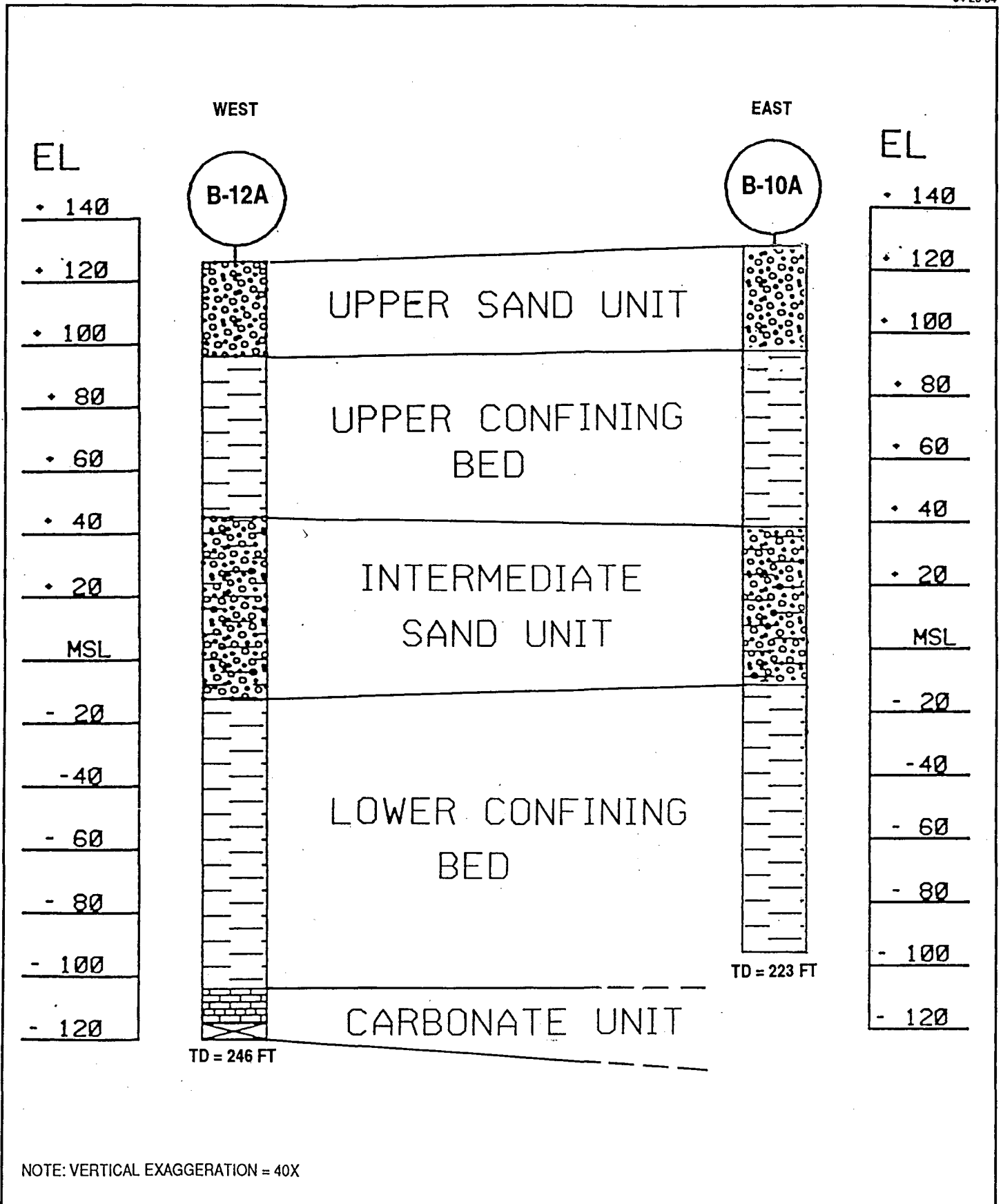


Figure 2.3.1-5
Generalized West-East Stratigraphic Cross Section of the
HPS Site

Source: TPS/SECI, 1989; KBN, 1994.



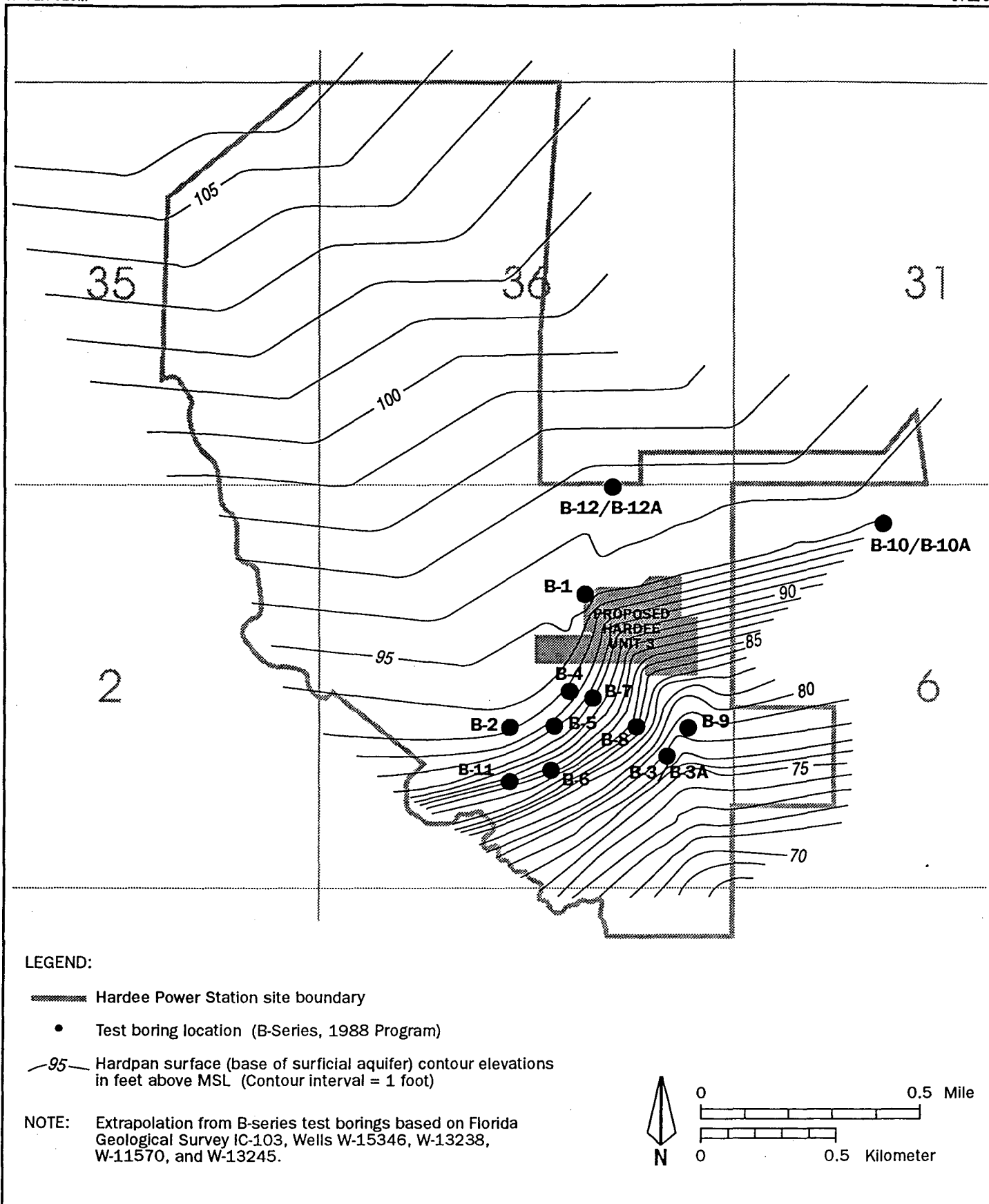


Figure 2.3.1-6
Geologic Map of Hardpan (Upper Surface of Confining Layer)

Sources: TPS/SECI, 1989; KBN, 1994.



2.3.1-17

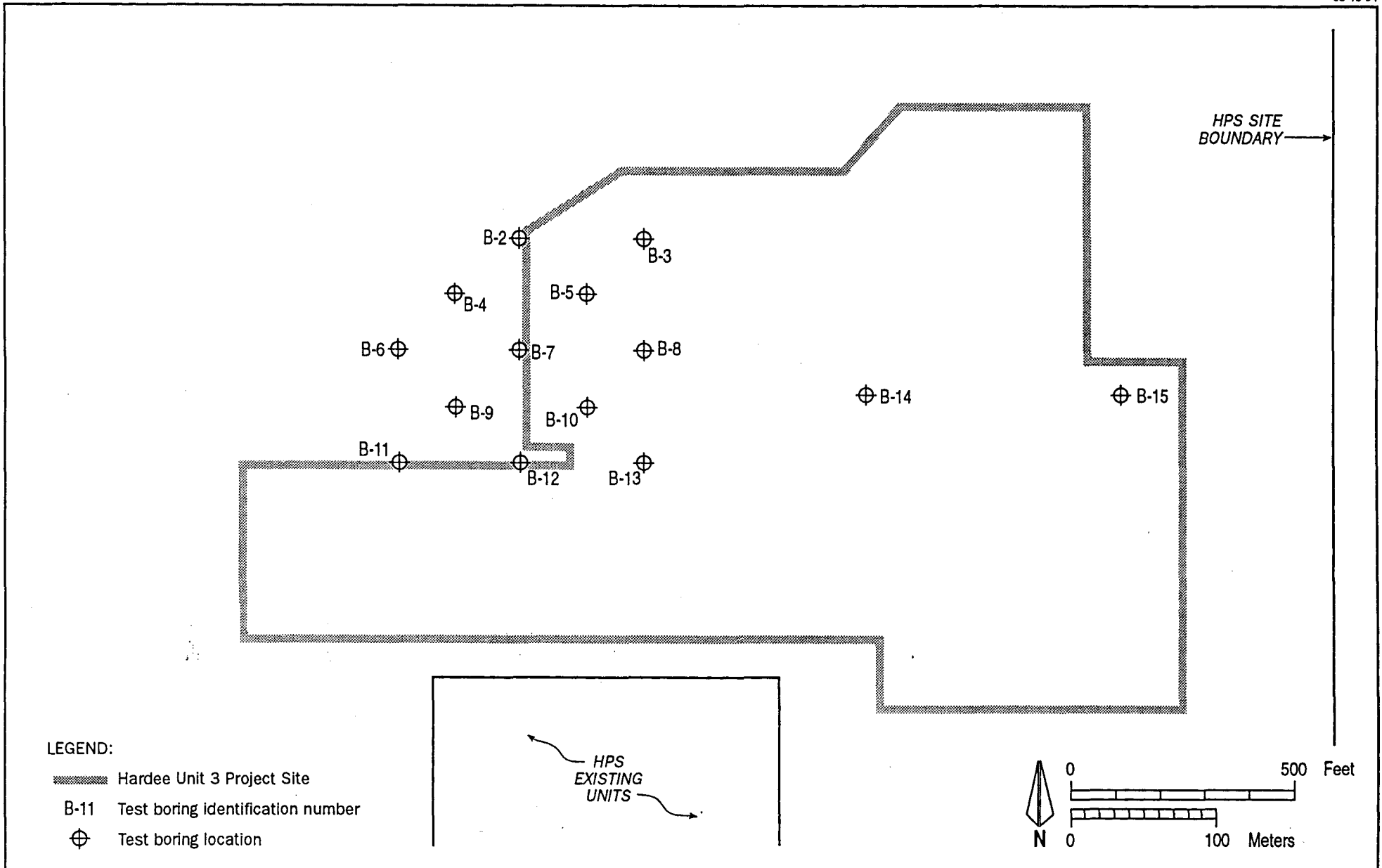


Figure 2.3.1-7
Location of Test Borings at the Hardee Unit 3 Site — April 1993

Sources: AT&E, 1993; KBN, 1994.



2.3.2 SUBSURFACE HYDROLOGY

The SCA/EA document prepared for HPS (TPS/SECI, 1989) included a detailed characterization of subsurface hydrology for the site. The occurrence and movement of groundwater in the surficial, intermediate, and Floridan aquifers were described based upon a site-specific data collection program that is considered representative of the HPS site, including the specific area identified for Hardee Unit 3. Supplemental data collected at the HPS site are provided herein to characterize groundwater quality trends and the potential for karst activity.

2.3.2.1 SUBSURFACE HYDROLOGIC DATA FOR THE SITE

2.3.2.1.1 Shallow Aquifer

Groundwater in this aquifer is classified as G-II. The shallow aquifer at the HPS site was initially characterized at six locations (see Figure 2.3.1-3) using 5.1-cm (2-inch) diameter PVC observation wells. These wells were constructed with 1.5-m (5-ft) screens installed at depth intervals of 4.5 to 6 m (15 to 20 ft) below ground (TPS/SECI, 1989).

Falling head borehole permeability testing was conducted in these observation wells on December 11, 1988, and results are shown in Table 2.3.2-1. The objective of these tests was to estimate the permeability and hydrologic characteristics of the shallow aquifer at areas that had not been mined and areas that had been mined. These characteristics are representative of mined and reclaimed portions of the HPS site and are therefore considered applicable to the Hardee Unit 3 Project.

Water-level data were collected at the Hardee Unit 3 site during the preliminary geotechnical and foundation engineering study (AT&E, 1993; see Appendix 10.7). Groundwater levels in the shallow aquifer were measured at the completion of drilling during the period from April 13 to 29, 1993. The water table surface was encountered at land surface to a maximum depth of 0.8 m (2.7 ft). The April 1993 water levels were used to construct a water table surface contour map as presented in Figure 2.3.2-1. Groundwater flow is predominantly westward with some variation of the water table surface near the west-central portion of the Hardee Unit 3 site. The direction of groundwater flow in this portion of the site may be influenced by localized topography or the interface between native and reclaimed soils.

Saturated flows closely parallel the top of the clayey sand which is considered to be the top of the Bone Valley formation. Continuous monitoring of the shallow aquifer at SWFWMD shallow Well No. 40 near Duette, Florida, indicated water levels fluctuated approximately 3.5 m (11 ft) during a 9-year period of record from 1981 to 1990.

Data from a total of 13 pump tests within a 24-km (15-mile) radius of the site were presented by SWFWMD (SWFWMD, 1988, Table 4). The average values reported for these tests suggest that for the shallow aquifer, the coefficient of transmissivity (T) equals 1,650 square feet per day (ft^2/day) and that the specific yield (Sy) equals 0.11 or 11 percent by volume. The ratio of horizontal to vertical hydraulic conductivity is on the order of 200.

Water quality in the shallow aquifer is highly dependent on the surface activities and the chemical makeup of the rainfall. Based on the SWFWMD ambient groundwater quality monitoring program (SWFWMD, 1988, Figure 20), the following regional trends are considered as background levels: total dissolved solids (TDS) concentration is expected to be less than 250 milligrams per liter (mg/L), total hardness (TH) less than 180 mg/L, chlorides (Cl) less than 25 mg/L, and sulfates (SO_4) less than 25 mg/L.

Site-specific water quality parameters were characterized during the preconstruction period at HPS in February and March 1989, with results listed in Table 2.3.2-2. Pertinent parameters tested met primary and secondary drinking water standards.

Supplemental groundwater quality characterization of the shallow aquifer has been conducted since October 1991 at six monitor well locations at the HPS site as a condition of certification. These locations, designated Wells HPS-1 through HPS-6, are distinct from the observation wells installed prior to site certification, as described above. These wells are part of the monitoring plan implemented for the HPS existing units to characterize groundwater quality trends in the vicinity of the cooling reservoir and the detention pond, and are described as follow:

- HPS-1 Shallow well, upgradient from the cooling reservoir
- HPS-2 Shallow well, downgradient from the cooling reservoir
- HPS-3 Deep well, downgradient from the cooling reservoir
- HPS-4 Shallow well, downgradient from the cooling reservoir

- HPS-5 Shallow well, upgradient from the detention pond
- HPS-6 Shallow well, downgradient from the detention pond

Monitor well locations are presented in Figure 2.3.2-2, and analytical data are summarized in Table 2.3.2-3.

2.3.2.1.2 Intermediate Aquifer

The intermediate aquifer at the HPS site was initially characterized at three locations (B-3A, B-10A, and B-12A) using 2-inch-diameter PVC observation wells. These wells were screened between depths of 30 and 60 m (100 and 200 ft) below ground. Intermediate aquifer monitor well construction details are presented in the HPS SCA/EA (TPS/SECI, 1989).

Falling head borehole permeability testing was conducted in these observation wells on December 11, 1988, to determine the permeability and hydrologic characteristics of the intermediate aquifer. Results are shown in Table 2.3.2-4.

Water-level data recorded for the three observation wells completed in the intermediate aquifer during the preconstruction period (December 1988) at HPS indicated the water surface occurred between 3 and 8.5 m (10.2 and 28 ft) below land surface. Regional data reported by USGS (1993a) indicate the HPS site is located in the vicinity of a potentiometric surface high for the intermediate aquifer. The contours of the potentiometric surface of the intermediate aquifer reported for September 1992 are presented in Figure 2.3.2-3. The direction of groundwater flow in the intermediate aquifer is toward the south-southeast in the vicinity of the HPS site.

Continuous monitoring of the intermediate aquifer at SWFWMD Hawthorn Well No. 40 near Duette, Florida, indicated water levels fluctuated approximately 4.3 m (14 ft) during a 10-year period of record from 1981 to 1990.

A total of nine pump tests within a 24-km (15-mile) radius of the site were presented by SWFWMD (SWFWMD, 1988, Table 4). The average values reported for these tests suggest that for the intermediate aquifer, T equals 1,450 ft²/day; storativity (S) equals 0.0002; and leakance coefficient (L) equals 0.0002 cubic foot per day per square foot (ft³/day/ft²). The ratio of horizontal to vertical hydraulic conductivity is on the order of 2,000.

Based on the SWFWMD (1988, Figure 27) ambient groundwater quality monitoring program, the following regional trends are considered as background levels: TDS is expected to be less than 250 mg/L, TH less than 120 mg/L, Cl less than 25 mg/L, and SO_4 between 25 and 250 mg/L. Site-specific water quality results are listed in Table 2.3.2-5. The sampled parameters generally meet state drinking water quality standards.

2.3.2.1.3 Floridan Aquifer

The Floridan aquifer was not initially characterized with site-specific data collected at the HPS site, but was described on a regional basis. The contours of the regional potentiometric surface of the Floridan aquifer reported by USGS (1993b) for September 1992 are presented in Figure 2.3.2-4. Direction of groundwater flow in the Floridan aquifer is toward the southwest in the vicinity of the HPS site. Continuous monitoring of a well completed in the Avon Park Formation of the Floridan aquifer at SWFWMD ROMP No. 40 deep well near Duette, Florida, indicated water levels fluctuated approximately 15.2 m (50 ft) during a 10-year period of record from 1981 to 1990.

Data from a total of 11 pump tests within a 24-km (15-mile) radius of the site were presented by SWFWMD (SWFWMD, 1988, Table 4). The average values reported for these tests indicate that for the Floridan aquifer, T equals 250,000 ft^2/day , S equals 0.0011, and L equals 0.00021 $\text{ft}^3/\text{day}/\text{ft}^2$. The ratio of horizontal to vertical hydraulic conductivity is on the order of 2. Based upon the hydrologic data that characterized the Floridan aquifer in the vicinity of the HPS site, a water use authorization was issued as part of the original site certification for HPS (TPS/SECI, 1989) for groundwater withdrawals of 3.8 mgd annual average and 8.64 mgd maximum daily average.

Water quality in the Floridan aquifer is dependent on the recharge from the overlying aquifers. Based on the SWFWMD ambient groundwater quality monitoring program (SWFWMD, 1988, Figure 36), the following regional trends are considered as background levels: TDS is expected to be less than 350 mg/L, TH between 120 and 180 mg/L, Cl less than 25 mg/L, and SO_4 between 25 and 250 mg/L. Additional water quality characteristics are provided in Table 2.3.2-6, based on available data collected offsite.

Supplemental analysis of groundwater samples collected from production Well No. 1 installed at the HPS existing facilities has been conducted. Analyses of chloride, sulfate, and TDS conducted on samples collected during 1993 are summarized in Table 2.3.2-7. The sampled parameters generally meet state groundwater quality standards.

2.3.2.1.4 Characteristic Confining Units

The Upper Confining Bed as described in Section 2.3.1.2 separates the shallow aquifer above from the intermediate aquifer below. Recharge to the intermediate aquifer through the upper confining bed is classified as none to very low, perhaps ranging from 0 to 5 cm (0 to 2 inches) per year (SWFWMD, 1988).

The Lower Confining Bed as described in Section 2.3.1.2 separates the intermediate aquifer above from the Floridan aquifer below. Recharge to the Floridan aquifer through the lower confining bed is classified as very low, less than 5 cm (2 inches) per year (Stewart, 1980).

2.3.2.2 KARST HYDROGEOLOGY

The HPS site falls into the area of Central Florida Karst where cover collapse sinkholes dominate (Sinclair *et al.*, 1985). This area consists of cohesive sediments interlayered with discontinuous carbonate beds. A major tenet of karst development theory is that active solution enlargement of voids in carbonate rock occurs above the water table. When the site area was subjected to significant sea level changes during the Pleistocene epoch, karst activity was possible. Sea level stands at elevation (El) +45 m (+150 ft) (Okefenokee Shoreline), El +30 m (+100 ft) (Wicomico Shoreline), El + 9 m (+30 ft) (Pamlico Shoreline), and El +2 m (+8 ft) (Silver Bluff Shoreline) would presumably affect the deposits above those elevations. From the deep borings on the site, these elevations are represented by the calcareous layers in the Hawthorn Formation. The lower carbonate unit at El-30 m (-100 ft) is well below the water table surface and subject to a reduced threat of current karstic activity.

Apparent surface depression features identified in the vicinity of the HPS existing units were ground-truthed. Most of the surface depressions identified were shallow and located outside the main plant area, although some were within the cooling reservoir area (TPS/SECI, 1989). Initial subsurface explorations conducted at the HPS site did not reveal significant solutioning of the surfaces of the Hawthorn and surficial soils in these surface depressions.

An assessment of potential sinkhole development was conducted by Jammal & Associates, Inc. (1990), prior to construction of the HPS existing units. The site-specific assessment included review of black and white and infrared aerial photographs, review of soil boring logs conducted by others, review of published data for the site vicinity, field reconnaissance of surface depressions, and installation of two additional soil borings in areas adjacent to selected surface depressions. On the basis of qualitative and quantitative analyses, it was concluded that the potential for sinkhole development at the HPS existing units and at the HPS site overall was very low to none. It was also concluded that alternate foundation designs for plant buildings would not impact sinkhole potential during or after installation.

Topographic depressions noted in areas surrounding the HPS site typically appear to be 2 to 4 ha (5 to 10 acres) in size and are roughly circular. These depressions appear to be on an east-northeast orientation that may be associated with a fracture and related to sinkhole activity in the past.

The findings of the preliminary geotechnical and foundation engineering study conducted at the Hardee Unit 3 site (AT&E, 1993; see Appendix 10.7) were reviewed for evidence of potential karst activity. The lithologic logs prepared for the 14 soil borings did not indicate the occurrence of loss circulation zones, voids, or cavities to depths up to 27 m (90 ft) below existing ground surface. Clayey soils consistent with the upper confining bed were encountered at the 14 boring locations in areas of native and reclaimed soils.

Table 2.3.2-1. Results of Permeability Testing of Shallow Water Table Observation Wells at the HPS Site (December 1988)

Piezometer No.	Ground Surface Elevation (ft-msl)	Groundwater Elevation (ft-msl)	Permeability (cm/sec)
P-1	122.3	118.8	2.0×10^{-4}
P-2	114.2	109.4	2.0×10^{-4}
P-3	121.7	114.3	4.9×10^{-4}
P-10	127.4	123.9	1.3×10^{-4}
P-11	113.1	109.8	1.7×10^{-4}
P-12	126.3	121.7	3.2×10^{-4}

Note: cm/sec x 0.04 = inch/sec.
ft-msl x 0.3 = m-msl.

Source: TPS/SECI, 1989.

Table 2.3.2-2. Water Quality Characteristic of the Shallow Aquifer at the HPS Site
(February/March 1989)

Parameters	Concentration	
	Well P3 ^a	Well P12 ^a
Total Alkalinity, mg/L as CaCO ₃	6.0	12.0
Chloride, mg/L	15.5	24.2
Nitrate + Nitrite as Nitrogen, mg/L	<0.005	0.009
Ortho-Phosphorus, mg/L	0.980	1.70
Silica, Total, mg/L	16.8	21.2
Silica, Dissolved, mg/L	5.21	9.83
Total Dissolved Solids, mg/L	78.7	111
Total Suspended Solids, mg/L	93.3	694
Specific Conductance, μ mho/cm	120	222
Sulfate, mg/L	4.1	3.2
Total Calcium, mg/L	10.8	26.3
Total Iron, mg/L	7.9	10.3
Total Magnesium, mg/L	3.0	6.7
Total Manganese, μ g/L	14	12
Total Potassium, mg/L	0.96	1.77
Total Sodium, mg/L	7.5	16.6
Dissolved Iron, mg/L	0.67	2.37
Dissolved Manganese, μ g/L	4.0	6.0

^a These wells are 9.1 m (30 ft) below present existing grade.

Source: TPS/SECI, 1989.

Table 2.3.2-3. Results of Groundwater Monitoring Conducted at the HPS Site During 1993 (Page 1 of 6)

Parameter	Sampling Date	Units	Concentration in Monitor Well					
			HPS-1	HPS-2	HPS-3	HPS-4	HPS-5	HPS-6
Total Metals								
Aluminum	1/26/93	mg/L	<0.5	<0.5	0.95	<0.5	7.1	<0.5
	7/22/93	mg/L	<0.2	<0.2	0.9	<0.2	6.6	<0.2
	Max. Value	mg/L	120	8.8	8.6	1.1	75	77
	Min. Value	mg/L	<0.2	<0.2	0.9	<0.2	3.4	<0.2
Arsenic	1/26/93	µg/L	15	<10	<10	<10	<10	<10
	7/22/93	µg/L	15	<10	<10	<10	<10	<10
	Max. Value	µg/L	20	<10	18	<10	<10	<10
	Min. Value	µg/L	<10	<10	<10	<10	<10	<10
Beryllium	1/26/93	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
	7/22/93	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
	Max. Value	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
	Min. Value	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Cadmium	1/26/93	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	7/22/93	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	Max. Value	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Min. Value	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Table 2.3.2-3. Results of Groundwater Monitoring Conducted at the HPS Site During 1993 (Page 2 of 6)

Parameter	Sampling Date	Units	Concentration in Monitor Well					
			HPS-1	HPS-2	HPS-3	HPS-4	HPS-5	HPS-6
Total Metals (continued)								
Chromium	1/26/93	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	7/22/93	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Max. Value	mg/L	0.42	<0.05	0.007 ^a	<0.05	0.23	0.20
	Min. Value	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Copper	1/26/93	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	7/22/93	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Max. Value	mg/L	0.007 ^a	<0.05	<0.05	<0.05	<0.05	<0.05
	Min. Value	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Iron	1/26/93	mg/L	48	2.9	23	21	2.2	11
	7/22/93	mg/L	41	4.7	21	25	1.9	13
	Max. Value	mg/L	48	4.7	46	25	12	41
	Min. Value	mg/L	10	1.2	21	1.3	1.9	9.3
Lead	1/26/93	µg/L	<5	<5	<5	<5	8	<5
	7/22/93	µg/L	<5	<5	<5	<5	<5	<5
	Max. Value	µg/L	36	10	<5	<5	90	51
	Min. Value	µg/L	<5	<5	<5	<5	<5	<5

Table 2.3.2-3. Results of Groundwater Monitoring Conducted at the HPS Site During 1993 (Page 3 of 6)

Parameter	Sampling Date	Units	Concentration in Monitor Well					
			HPS-1	HPS-2	HPS-3	HPS-4	HPS-5	HPS-6
Total Metals (continued)								
Mercury	1/26/93	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	7/22/93	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Max. Value	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Min. Value	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nickel	1/26/93	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	7/22/93	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max. Value	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Min. Value	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Selenium	1/26/93	µg/L	<10	<10	<10	<10	<10	<10
	7/22/93	µg/L	<10	<10	<10	<10	<10	<10
	Max. Value	µg/L	<10	<10	<10	<10	<10	<10
	Min. Value	µg/L	<10	<10	<10	<10	<10	<10
Zinc	1/26/93	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	7/22/93	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	Max. Value	mg/L	0.06	0.06	0.15	0.07	0.07	0.066
	Min. Value	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Table 2.3.2-3. Results of Groundwater Monitoring Conducted at the HPS Site During 1993 (Page 4 of 6)

Parameter	Sampling Date	Units	Concentration in Monitor Well					
			HPS-1	HPS-2	HPS-3	HPS-4	HPS-5	HPS-6
Radionuclides								
Gross alpha (total)	1/26/93	pCi/L	12.±2.4	2.8±1.5	3.0±1.2	2.0±1.0	32.7±4.4	3.9±1.2
	7/22/93	pCi/L	12.8±2.5	5.0±2.0	8.7±2.4	3.8±1.4	14.1±2.4	13.2±2.3
	Max. Value	pCi/L	884.±53	108.±12.4	26.2±7.6	12.6±3.1	1528.±102	424.±46
	Min. Value	pCi/L	12.±2.4	2.1±1.4	3.0±1.2	2.0±1.0	14.1±2.4	6.6±1.7
Gross alpha (dissolved)	1/26/93	pCi/L	4.0±1.4	2.1±1.3	4.1±1.7	1.9±0.9	4.5±1.4	3.7±1.2
	7/22/93	pCi/L	11.4±2.4	4.5±1.8	3.2±1.3	3.0±1.3	8.5±1.8	6.3±1.6
	Max. Value	pCi/L	15.4±3.1	4.5±1.8	5.9±2.0	4.4±1.5	81.±5.3	10.9±2.6
	Min. Value	pCi/L	3.5±1.2	1.4±0.8	3.0±1.2	1.5±1.2	4.5±1.4	6.1±1.6
Radium 226 (total)	1/26/93	pCi/L	3.6±0.3	2.0±0.3	1.1±0.2	0.3±0.1	3.2±0.3	0.4±0.2
	7/22/93	pCi/L	2.3±0.3	2.4±0.3	1.1±0.2	0.6±0.1	1.8±0.2	0.6±0.1
	Max. Value	pCi/L	125.±2.7	9.9±0.6	3.3±0.3	1.4±0.2	193.±4.7	42.1±1.9
	Min. Value	pCi/L	1.8±0.2	0.2±0.1	0.2±0.2	0.1±0.1	1.8±0.2	0.0±0.1
Radium 226 (dissolved)	1/26/93	pCi/L	2.5±0.3	1.4±0.2	0.5±0.2	0.2±0.1	1.6±0.2	0.3±0.1
	7/22/93	pCi/L	2.0±0.2	2.4±0.3	0.5±0.1	0.5±0.2	1.2±0.2	0.4±0.1
	Max. Value	pCi/L	5.3±0.5	2.4±0.3	0.7±0.2	0.5±0.2	2.4±0.4	0.6±0.1
	Min. Value	pCi/L	0.7±0.1	0.1±0.1	0.1±0.1	0.0±0.1	0.9±0.2	0.0±0.1

Table 2.3.2-3. Results of Groundwater Monitoring Conducted at the HPS Site During 1993 (Page 5 of 6)

Parameter	Sampling Date	Units	Concentration in Monitor Well					
			HPS-1	HPS-2	HPS-3	HPS-4	HPS-5	HPS-6
Chloride	1/26/93	mg/L	14	8.5	49	17	6.1	21
	7/22/93	mg/L	13	12	57	18	9	17
	Max. Value	mg/L	17	12	83	22	11	34
	Min. Value	mg/L	8.5	5.0	49	10	5.3	17
Color (apparent)	1/26/93	PCU	750	70	750	450	880	50
	7/22/93	PCU	350	65	600	300	1000	35
	Max. Value	PCU	1000	500	1500	900	4000	1000
	Min. Value	PCU	25	35	600	45	650	20
Color (true)	1/26/93	PCU	700	20	630	350	810	40
	7/22/93	PCU	300	25	500	300	800	35
	Max. Value	PCU	700	40	1300	750	3000	250
	Min. Value	PCU	40	20	500	20	600	25
Oxidation-Reduction Potential	1/26/93	Eh	29	53	130	75	230	32
	7/22/93	Eh	4.1	7.4	63.7	45.6	157.8	27.2
	Max. Value	Eh	280	240	303	260	320	290
	Min. Value	Eh	4.1	7.4	72	36.2	98	27.2

2.3.2-13

Table 2.3.2-3. Results of Groundwater Monitoring Conducted at the HPS Site During 1993 (Page 6 of 6)

Parameter	Sampling Date	Units	Concentration in Monitor Well					
			HPS-1	HPS-2	HPS-3	HPS-4	HPS-5	HPS-6
Sulfite (field)	1/26/93	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	7/22/93	mg/L	<2.0	<2.0	6.0	<2.0	<2.0	<2.0
	Max. Value	mg/L	0.4	1.2	6.0	0.4	5.0	1.2
	Min. Value	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sulfate	1/26/93	mg/L	<5	<5	<5	<5	7	13
	7/22/93	mg/L	<5	10	<5	<5	<5	12
	Max. Value	mg/L	2.3	10	<5	<5	21	72
	Min. Value	mg/L	<5	<5	<5	<5	<5	12
Total Dissolved Solids	1/26/93	mg/L	200	370	370	270	250	120
	7/22/93	mg/L	150	470	440	330	230	130
	Max. Value	mg/L	330	470	460	360	930	140
	Min. Value	mg/L	91	260	250	200	160	120

Note: Groundwater samples collected by Pace Incorporated personnel on the dates indicated.
Groundwater sample analysis excluding radionuclides conducted by Pace Incorporated; analysis for radionuclide parameters conducted by Thornton Laboratories, Inc.

mg/L = milligram per liter
 μ g/L = microgram per liter
 pCi/L = picoCurie per liter
 Eh = redox potential
 PCU = platinum cobalt units

^a Reporting limit indicated by Pace Incorporated for samples collected June 30, 1992, was an order of magnitude different than for other sampling events; maximum value reported for this one sampling event was at a lower concentration than the reporting limit for the other events.

Source: Hardee Power Partners, Inc., 1991 - 1993.

Table 2.3.2-4. Results of Permeability Testing of Intermediate Aquifer Observation Wells at the HPS Site (December 1988)

Piezometer No.	Ground Surface Elevation (ft-msl)	Groundwater Elevation (ft-msl)	Permeability (cm/sec)
B-3A	121.7	93.7 ^a	4.4×10^{-5}
B-10A	127.4	117.2	1.7×10^{-5}
B-12A	126.3	114.8	9.3×10^{-6}

Note: cm/sec x 0.4 = inch/sec.
ft-msl x 0.3 = m-msl.

^a Depth to water dropped to 54.7 ft-msl on 2/16/89 suggesting that this is a Floridan aquifer observation well.

Source: TPS/SECI, 1989.

Table 2.3.2-5. Water Characteristics (Inorganics) at the HPS Site for Intermediate Aquifer--Well P12A (February/March 1989) (Page 1 of 2)

Parameter	Concentration
Total Alkalinity, mg/L as CaCO ₃	216
Chloride, mg/L	27.9
Nitrate + Nitrite as Nitrogen, mg/L	0.072
Ortho-phosphorus, mg/L	0.034
Silica, Total, mg/L	58.1
Cyanide, mg/L	<0.004
Total Dissolved Solids, mg/L	327
Total Suspended Solids, mg/L	23
Specific Conductance, μ mho/cm	458
Sulfate, mg/L	21
Fluoride, mg/L	1.80
MBAS, mg/L	0.14
Ammonia Nitrogen, mg/L	0.33
TKN, mg/L	0.79
Oil and Grease, mg/L	<5
BOD, mg/L	5.4
COD, mg/L	<10
Turbidity, NTU	6.8
Aluminum, μ g/L	67
Antimony, μ g/L	<10
Arsenic, μ g/L	2.0
Beryllium, μ g/L	<2
Cadmium, μ g/L	0.5
Calcium, mg/L	43.0
Chromium, μ g/L	<11
Copper, μ g/L	<7
Iron, μ g/L	198
Lead, μ g/L	<3
Magnesium, mg/L	19.8
Manganese, μ g/L	<6
Mercury, μ g/L	<0.2
Nickel, μ g/L	<26
Potassium, mg/L	4.4
Selenium, μ g/L	<2
Silver, μ g/L	<0.05
Sodium, mg/L	35.6
Zinc, μ g/L	18.0
Phenols, μ g/L	<5
Aldrin, μ g/L	<0.003
Dieldrin, μ g/L	<0.0003
Chlordane, μ g/L	<0.01
4,4'DDT, μ g/L	<0.001
Demeton, μ g/L	<0.1

Table 2.3.2-5. Water Characteristics (Inorganics) at the HPS Site for Intermediate Aquifer--Well P12A (February/March 1989) (Page 2 of 2)

Parameter	Concentration
Endosulfan, $\mu\text{g/L}$	< 0.003
Endrin, $\mu\text{g/L}$	< 0.004
Guthion, $\mu\text{g/L}$	< 0.01
Heptachlor, $\mu\text{g/L}$	< 0.001
Lindane, $\mu\text{g/L}$	< 0.01
Malathion, $\mu\text{g/L}$	< 0.1
Methoxychlor, $\mu\text{g/L}$	< 0.03
Myrex, $\mu\text{g/L}$	< 0.001
Parathion, $\mu\text{g/L}$	< 0.04
2,4-D, $\mu\text{g/L}$	< 10
Silvex, $\mu\text{g/L}$	< 20
Toxaphene, $\mu\text{g/L}$	< 0.005
PCB-1016, $\mu\text{g/L}$	< 0.001
PCB-1221, $\mu\text{g/L}$	< 0.001
PCB-1232, $\mu\text{g/L}$	< 0.001
PCB-1242, $\mu\text{g/L}$	< 0.001
PCB-1248, $\mu\text{g/L}$	< 0.001
PCB-1260, $\mu\text{g/L}$	< 0.001
Chlorinated Hydrocarbons	
2-Chloronaphthalene, $\mu\text{g/L}$	< 10
1,2-Dichlorobenzene, $\mu\text{g/L}$	< 10
1,3-Dichlorobenzene, $\mu\text{g/L}$	< 10
1,4-Dichlorobenzene, $\mu\text{g/L}$	< 10
Hexachlorobenzene, $\mu\text{g/L}$	< 10
Hexachlorobutadiene, $\mu\text{g/L}$	< 10
Hexachlorocyclopentadiene, $\mu\text{g/L}$	< 10
Hexachloroethane, $\mu\text{g/L}$	< 10
1,2,4-Trichlorobenzene, $\mu\text{g/L}$	< 10
Gross Alpha, pCi/L	2.2 ± 2.3
Gross Beta, pCi/L	5.7 ± 4.2
Radium 226, pCi/L	4.1 ± 0.1
Radium 228, pCi/L	0.0 ± 1.0
Strontium 90, pCi/L	< 0.5

Source: TPS/SECI, 1989.

Table 2.3.2-6. Water Quality Characteristics for the Lower Floridan Aquifer (Page 1 of 2)

Parameter	Value
Calcium, mg/L as CaCO ₃	113
Magnesium, mg/L as CaCO ₃	49
Sodium, mg/L as CaCO ₃	37
Potassium, mg/L as CaCO ₃	8
Total Hardness, mg/L as CaCO ₃	162
Alkalinity, mg/L as CaCO ₃	160
Sulfate, mg/L as CaCO ₃	26
Chloride, mg/L	21
Silica, mg/L	27
Fluoride, mg/L	2.0
Cyanide, mg/L	<0.005
MBAS, mg/L	<0.180
Oil and Grease, mg/L	<5
Turbidity, NTU	14
pH, units	7.5
Total Dissolved Solids, mg/L	342
Specific Conductivity, μ mho/cm	320
Total Kjeldahl Nitrogen, mg/L	0.39
Ammonia Nitrogen, mg/L	0.20
Organic Nitrogen, mg/L	0.19
Nitrate+Nitrite-Nitrogen, mg/L	0.031
	0.421
Total Nitrogen, mg/L	
Orthophosphorus, mg/L	0.20
Total Phosphorus, mg/L	0.20
Arsenic, μ g/L	<10
Barium, μ g/L	75
Beryllium, μ g/L	<0.1
Cadmium, μ g/L	<0.7
Chromium, μ g/L	13
Copper, μ g/L	7

Table 2.3.2-6. Water Quality Characteristics for the Lower Floridan Aquifer (Page 2 of 2)

Parameter	Value
Calcium, mg/L as CaCO ₃	113
Iron, µg/L	420
Lead, µg/L	1
Manganese, µg/L	28
Mercury, µg/L	<0.2
Nickel, µg/L	23
Selenium, µg/L	16
Silver, µg/L	<0.07
Strontium, µg/L	300
Zinc, µg/L	143
Alpha, Gross (pC/L)	8.4
Radium 226 (pC/L)	3.0

Sources: TPS/SECI, 1989.
KBN, 1994.

Table 2.3.2-7. Results of Groundwater Analyses Conducted at HPS Production
Well No. 1

Parameter	Sampling Date	Concentration (mg/L)
Chloride	4/6/93	8.4
	7/7/93	16.2
Sulfate	4/6/93	86.7
	7/7/93	179
Total Dissolved Solids	4/6/93	281
	7/7/93	285

Note: mg/L = milligrams per liter.

Groundwater samples collected by HPS personnel on the dates indicated.
Groundwater sample analysis conducted by Tampa Electric Company, Central Testing Laboratory.

Source: Hardee Power Partners, Inc., 1993.

2.3.2-21

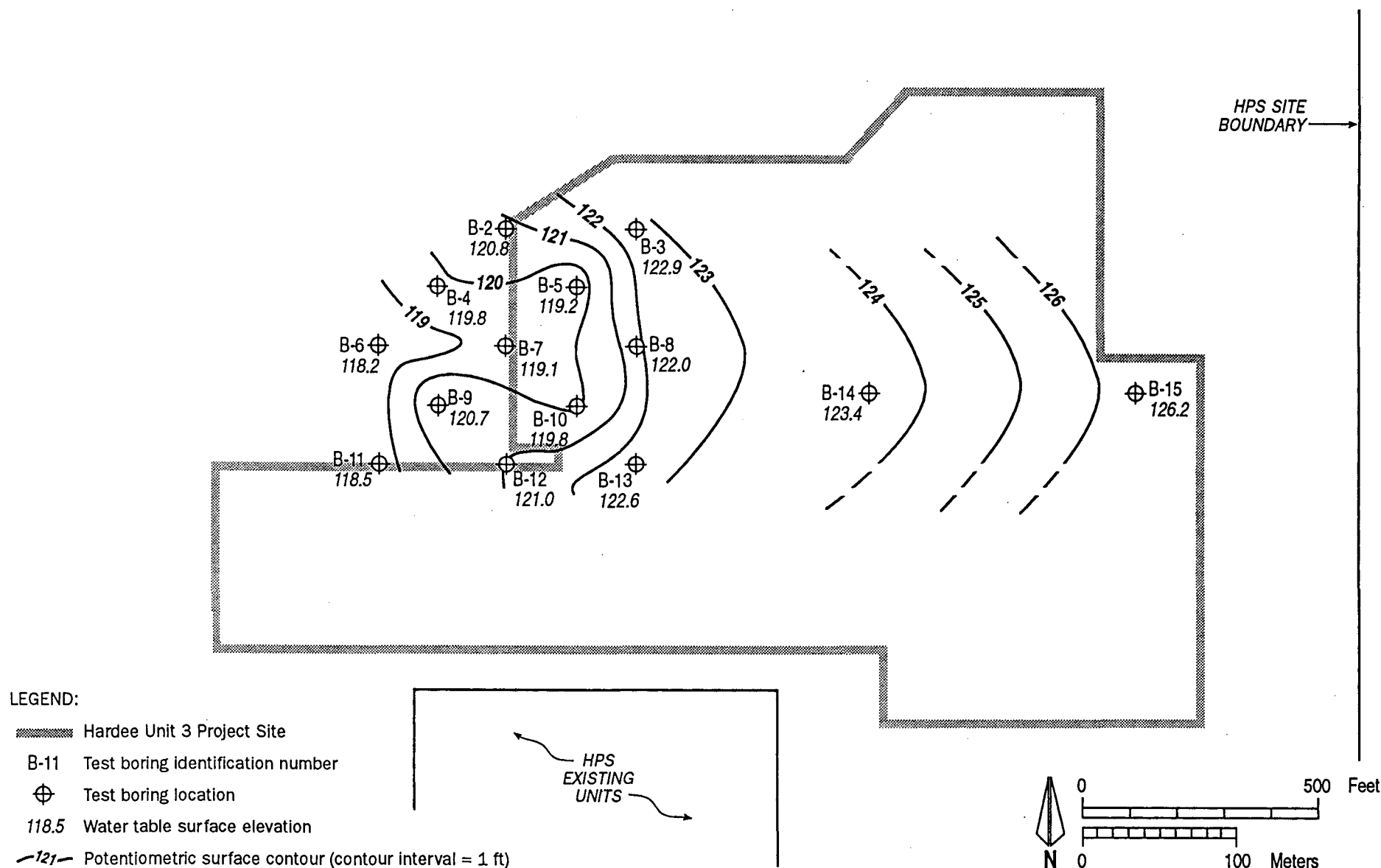


Figure 2.3.2-1
Potentiometric Surface of the Water Table Aquifer
at the Hardee Unit 3 Site — April 1993

Sources: AT&E, 1993; KBN, 1994.



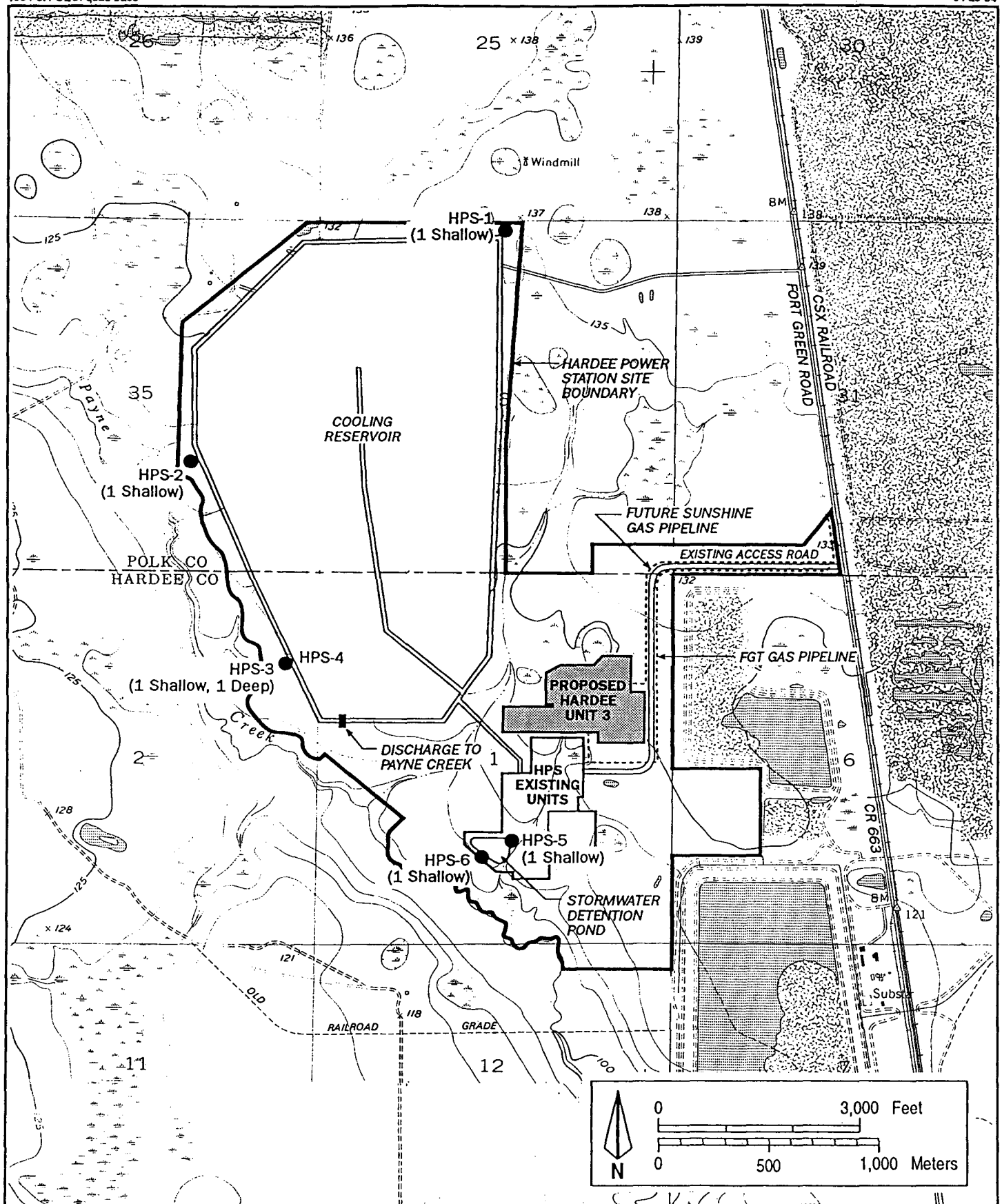


Figure 2.3.2-2
HPS Existing Groundwater Monitoring Well Locations

Sources: USGS, 1987; KBN, 1994.



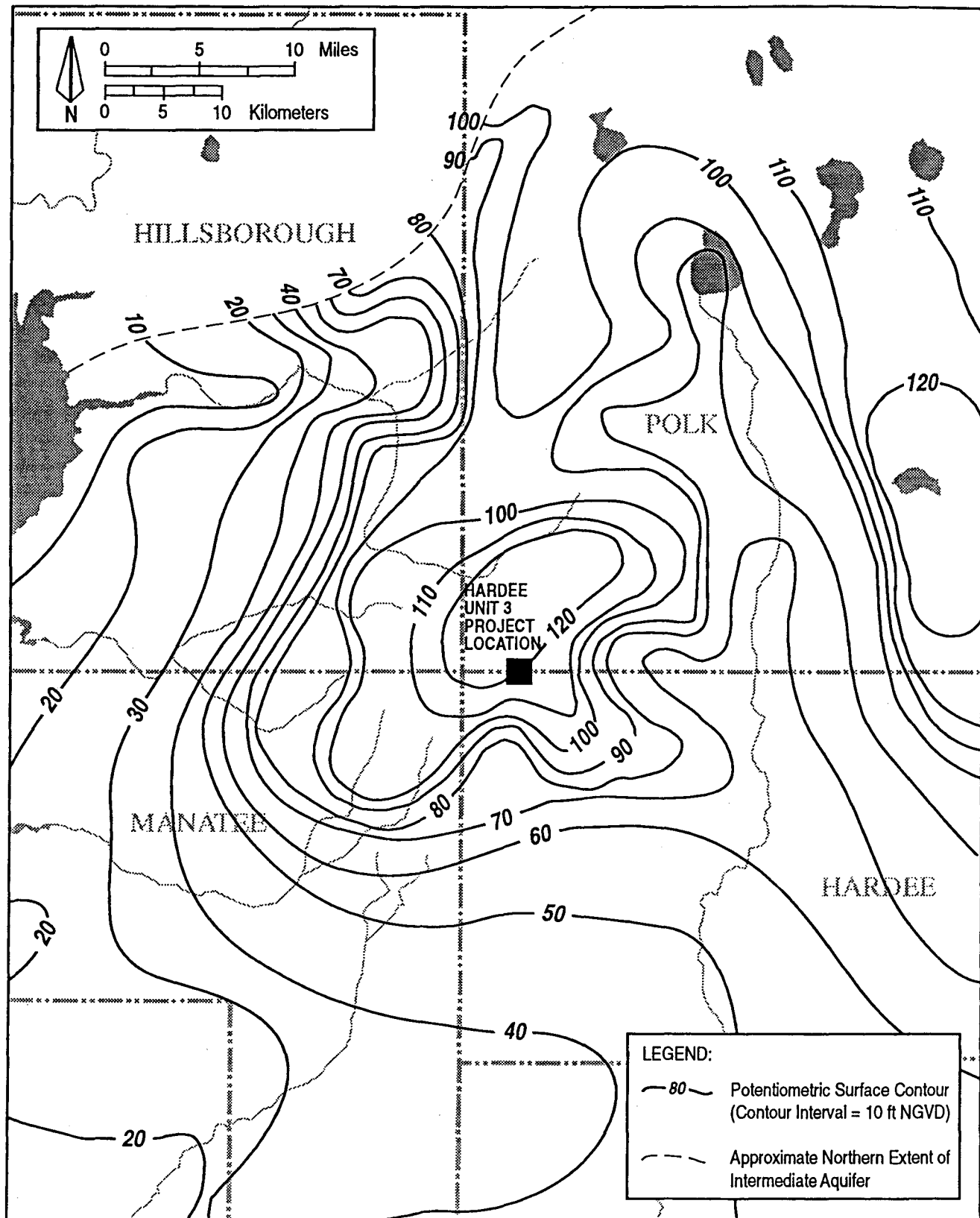


Figure 2.3.2-3
Potentiometric Surface of the Intermediate Aquifer in the Vicinity
of the Hardee Unit 3 Site — September 1992

Sources: USGS, 1993a; KBN, 1994.



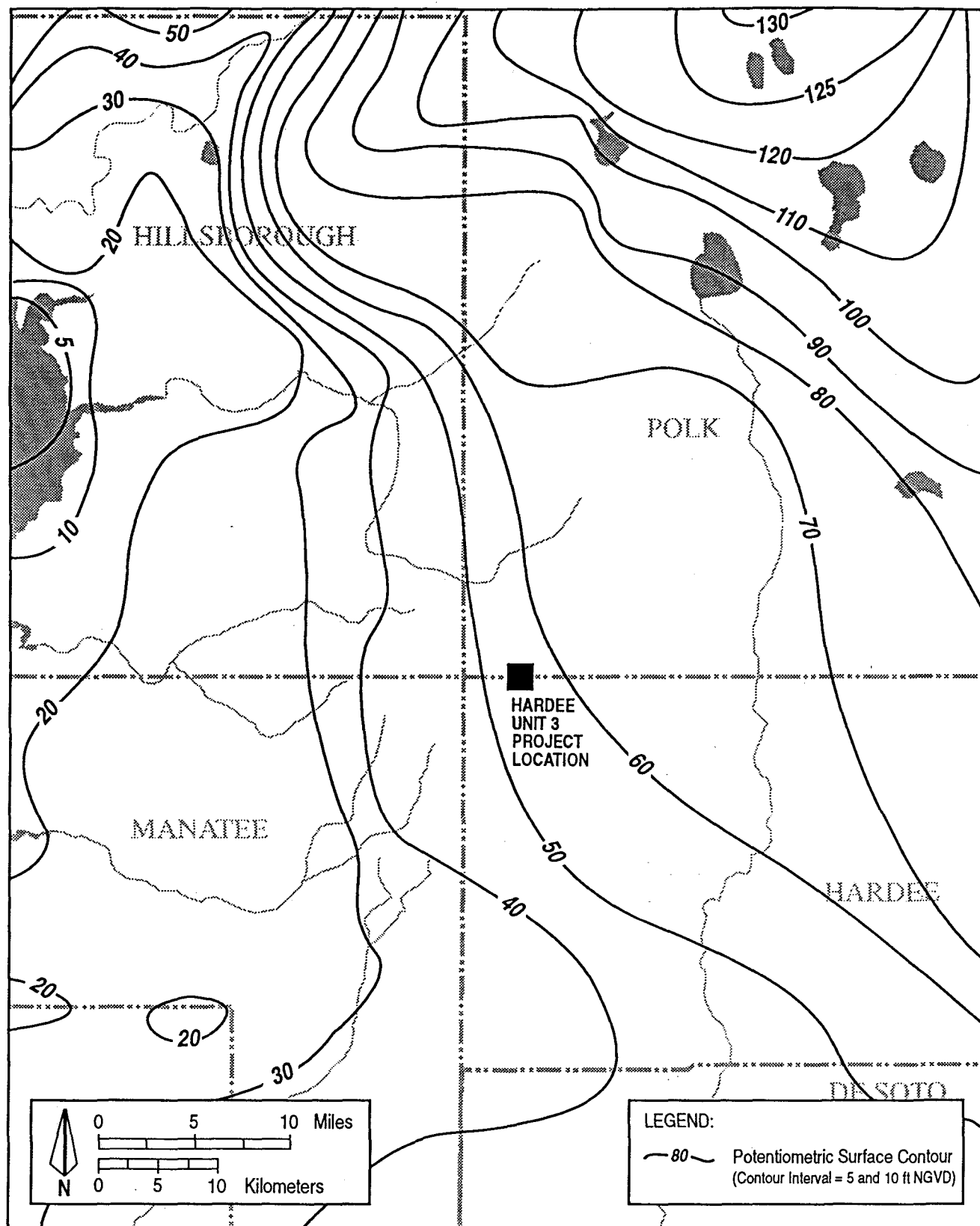


Figure 2.3.2-4
Potentiometric Surface of the Upper Floridan Aquifer in the Vicinity
of the Hardee Unit 3 Site — September 1992

Sources: USGS, 1993b; KBN, 1994.



2.3.3 SITE WATER BUDGET AND AREA USERS

2.3.3.1 SITE WATER BUDGET

Components of the existing HPS site water budget include precipitation, evaporation and evapotranspiration, runoff, and groundwater recharge. The nearest long-term climatological data collection station is located at Wauchula, Florida, approximately 14 km (9 miles) from the site.

Long-term monthly precipitation data at Wauchula for the period 1933 through 1988 were obtained from the SWFWMD and the National Oceanic and Atmospheric Administration (NOAA). Data on long-term monthly averages, maximums, and minimums are summarized in Table 2.3.3-1. The annual precipitation averages 135 cm (53.33 inches) per year with the highest precipitation in the summer months (June, July, August, and September) and the lowest in late fall/winter (November and December); however, the entire period from October to May is subject to periods of extended and significant drought.

The estimated monthly evapotranspiration rates for the HPS site are given in Table 2.3.3-2. Evapotranspiration estimates were prepared using published potential evapotranspiration rates for Tampa, Florida (Institute of Food and Agricultural Sciences, 1983) and an average annual plant coefficient of 70 percent. The estimated monthly evapotranspiration rates range from 4.6 cm (1.8 inches) per month in December to 11.2 cm (4.4 inches) per month in May. Monthly temperature normals were also available at Wauchula for the period 1941 to 1970, and are presented in Table 2.3.3-2. Highest temperature normals occur in July and August of 27.4 and 27.6°C (81.3 and 81.6°F) and lowest in January of 16.6°C (61.8°F). The additional climatic parameters of dewpoint temperature, relative humidity, evapotranspiration, and wind speed were also determined for the site area and are summarized in Table 2.3.3-2.

2.3.3.2 AREA USERS

There are no major municipal water users within 8 km (5 miles) of the HPS site. The Bowling Green municipal waterworks is the closest major wellfield to the site. This wellfield is permitted for an average pumpage of less than 18.9 million liters (5 million gallons) per day. The Bowling Green wellfield is 9.7 to 11.3 km (6 to 7 miles) east of the HPS site.

Review of current water use permits issued by SWFWMD (1994a) for the area within 8 km (5 miles) of the HPS site identified industrial, agricultural and residential water users. Permitted

industrial water users within this area include Agrico Chemical Company, CF Industries, Inc., Cargill Fertilizer, Inc., IMC-Agrico Company, and U.S. Agri-Chemicals Corporation. Water use descriptions identified for these industrial facilities include: phosphate ore processing, phosphate pit dewatering, phosphate water table dewatering, personal sanitary use, ornamental container grown nurseries, and other (unmetered). Numerous water use permits identified within this same area include the following descriptions: cattle (pastured), citrus, cucumbers (spring and fall), grains (small), sod, strawberries, sweet corn, tomatoes (spring), and vegetables (spring and fall).

The sole water use permit within 8 km (5 miles) of the HPS site that included a residential use description was for the Florida Department of Corrections facility (Hardee Correctional Institute) located in Section 21, Township 33 south, Range 23 east. This facility is about 6 km (4 miles) southwest of the HPS site. Two 25-centimeter (cm) (10-inch) diameter production wells were installed to depths of 274 and 290 m (900 and 950 ft). The water use permit issued for the site includes average daily withdrawal of 1,078,840 liters per day (Lpd) [285,000 gallons per day (gpd)] and maximum daily withdrawal of 2,157,680 Lpd (570,000 gpd).

Three production wells were installed to provide raw water for the HPS existing units. The three 41-cm (16-inch) diameter wells are open to the Floridan aquifer and are authorized under the original certification for average daily withdrawal of 14.4 million Lpd (3.8 mgd) and maximum daily withdrawal of 32.7 million Lpd (8.64 mgd).

Review of current well construction permits issued by SWFWMD identified 101 wells with 8 different use codes within one mile of the HPS site. Well use codes identified for this area, presented in decreasing order, include: plugged or abandoned (31), sealing water wells (25), observation or monitor (22), test or piezometer (10), industrial (5), domestic (4), public supply (3), and irrigation (1). The three existing production wells at the HPS site are identified with a public supply use code. Selected information from the well construction permit list (SWFWMD, 1994b) that describes permit number, locations, well use code, well depth, and well diameter is presented in Table 2.3.3-3.

Table 2.3.3-1. Monthly and Annual Precipitation Averages and Extremes at Wauchula, Florida, 1933-1988

Month	Precipitation (inches)		
	Average	Maximum	Minimum
January	2.15	7.84	0.03
February	2.85	8.92	0.19
March	3.12	9.22	0.08
April	2.48	8.26	0.00
May	4.30	11.32	0.01
June	8.88	18.42	2.40
July	8.69	15.54	2.21
August	7.24	15.53	2.66
September	7.29	18.06	1.19
October	2.81	10.36	0.00
November	1.74	11.18	0.02
December	1.76	5.51	0.00
Annual	53.33	83.48	36.66

Note: inches x 2.54 = centimeters (cm).

Sources: SWFWMD, 1988.
TPS/SECI, 1989.

Table 2.3.3-2. Estimated Climatic Conditions at the HPS Site

Parameter	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Average
Monthly Temperature Normals ^a	°F	61.8	63.1	67.1	72.1	76.6	80.2	81.3	81.6	80.2	74.7	67.4	62.7	--	72.4
Average Dewpoint Temperature	°F	53	54	57	60	67	72	73	73	72	66	58	54	--	63.3
Relative Humidity	%	73	72	70	66	72	76	76	75	76	74	72	73	--	73
Daily Average Wind Speed	mph	7	8	9	8	7	6	6	6	6	7	7	8	--	7
Evapotranspiration															
Potential	inches/month	2.70	3.27	4.48	5.56	6.29	5.87	5.68	5.32	4.80	4.32	3.18	2.61	54.08	--
Estimated Actual ^b	inches/month	1.9	2.3	3.1	3.9	4.4	4.1	4.0	3.7	3.4	3.0	2.2	1.8	37.9	--

Note: miles per hour (mph) x 1.6 = kilometers per hour (km/hr).
inches per month x 2.54 = centimeters (cm) per month.
degrees Fahrenheit (°F) - 32 x 5/9 = degrees Celsius (°C).

^a Temperature normals based on 1941-70 data from Wauchula station.

^b Actual evapotranspiration based on an average annual crop coefficient of 0.7.

Sources: IFAS, 1979.
IFAS, 1983.
TPS/SECI, 1989.

Table 2.3.3-3. Well Construction Permits Within 1 Mile of the HPS Site (Page 1 of 5)

Permit Number	Township	Range	Section	Well Use Code ^a	Well Depth (feet)	Well Diameter (inches)
362163.01	T32S	R23E	25	SWW	380	6
362164.01	T32S	R23E	25	SWW	600	6
412278.01	T32S	R23E	25	Y	600	6
432016.01	T32S	R23E	25	SWW	600	6
432017.01	T32S	R23E	25	SWW	600	6
432019.01	T32S	R23E	25	SWW	600	6
432020.01	T32S	R23E	25	Y	380	6
500346.01	T32S	R23E	25	Y	600	6
528924.01	T32S	R23E	25	Y	600	6
534906.01	T32S	R23E	25	Y	600	6
534907.01	T32S	R23E	25	Y	600	6
433278.01	T32S	R23E	26	SWW	600	6
528345.01	T32S	R23E	26	Y	600	6
382585.01	T32S	R23E	34	O	27	6
382586.01	T32S	R23E	34	O	37	6
444612.01	T32S	R23E	34	SWW	600	6
444613.01	T32S	R23E	34	SWW	600	6
538016.01	T32S	R23E	34	Y	600	6
544095.01	T32S	R23E	34	Y	575	6
511344.01	T32S	R23E	35	O	24	4
444609.01	T32S	R23E	36	SWW	600	6
477945.01	T32S	R23E	36	SWW	600	6
517562.01	T32S	R23E	36	O	42	2

Table 2.3.3-3. Well Construction Permits Within 1 Mile of the HPS Site (Page 2 of 5)

Permit Number	Township	Range	Section	Well Use Code ^a	Well Depth (feet)	Well Diameter (inches)
517562.02	T32S	R23E	36	O	42	2
517562.03	T32S	R23E	36	O	42	2
388591.01	T32S	R24E	30	SWW	600	6
409378.01	T32S	R24E	30	SWW	600	6
409379.01	T32S	R24E	30	SWW	600	6
332018.01	T32S	R24E	30	SWW	600	6
435385.01	T32S	R24E	30	SWW	600	6
435892.01	T32S	R24E	30	Y	600	6
477946.01	T32S	R24E	30	SWW	600	6
521344.01	T32S	R24E	30	I	320	4
523966.01	T32S	R24E	30	Y	320	4
526097.01	T32S	R24E	30	Y	600	6
528922.01	T32S	R24E	30	Y	600	6
528923.01	T32S	R24E	30	Y	600	6
530332.01	T32S	R24E	30	Y	600	6
530333.01	T32S	R24E	30	Y	600	6
409380.01	T32S	R24E	31	SWW	600	6
425462.01	T32S	R24E	31	SWW	600	6
440299.01	T32S	R24E	31	Y	600	6
440300.01	T32S	R24E	31	Y	520	6
485532.01	T32S	R24E	31	Y	600	6
331684.01	T33S	R23E	1	I	125	4

Table 2.3.3-3. Well Construction Permits Within 1 Mile of the HPS Site (Page 3 of 5)

Permit Number	Township	Range	Section	Well Use Code ^a	Well Depth (feet)	Well Diameter (inches)
471411.01	T33S	R23E	1	O	21	2
471412.01	T33S	R23E	1	O	21	2
471413.01	T33S	R23E	1	O	21	2
471414.01	T33S	R23E	1	O	21	2
471415.01	T33S	R23E	1	O	21	2
472078.01	T33S	R23E	1	O	238	2
472080.01	T33S	R23E	1	O	246	2
473508.01	T33S	R23E	1	Y	150	2
473679.01	T33S	R23E	1	Y	500	6
480184.01	T33S	R23E	1	Y	200	2
480185.01	T33S	R23E	1	Y	21	2
514464.01	T33S	R23E	1	P	1,200	16
514465.01	T33S	R23E	1	P	1,200	16
514466.01	T33S	R23E	1	P	1,200	16
517561.01	T33S	R23E	1	O	28	2
517561.02	T33S	R23E	1	O	28	2
517561.03	T33S	R23E	1	O	28	2
444614.01	T33S	R23E	2	SWW	600	6
444615.01	T33S	R23E	2	SWW	600	6
496358.01	T33S	R23E	2	Y	600	6
543639.01	T33S	R23E	2	T	15	2
543639.02	T33S	R23E	2	T	20	2
543639.03	T33S	R23E	2	T	27	2

Table 2.3.3-3. Well Construction Permits Within 1 Mile of the HPS Site (Page 4 of 5)

Permit Number	Township	Range	Section	Well Use Code ^a	Well Depth (feet)	Well Diameter (inches)
543639.04	T33S	R23E	2	T	25	2
543639.05	T33S	R23E	2	T	25	2
543639.06	T33S	R23E	2	T	25	2
543639.07	T33S	R23E	2	T	25	2
543640.01	T33S	R23E	2	T	15	4
543640.02	T33S	R23E	2	T	25	4
331682.01	T33S	R23E	3	I	125	4
378572.01	T33S	R23E	3	Y	915	10
522372.01	T33S	R23E	3	SWW	600	6
523688.01	T33S	R23E	3	SWW	600	6
545933.01	T33S	R23E	3	SWW	510	6
324042.01	T33S	R23E	11	D	260	4
324043.01	T33S	R23E	11	D	260	4
511921.01	T33S	R23E	11	SWW	600	6
511992.01	T33S	R23E	11	SWW	600	6
520395.01	T33S	R23E	11	Y	600	6
530482.01	T33S	R23E	11	Y	600	6
384602.01	T33S	R24E	6	I	275	4
423405.01	T33S	R24E	6	Y	125	4
471408.01	T33S	R24E	6	O	21	2
472077.01	T33S	R24E	6	O	223	2
544204.01	T33S	R24E	6	Y	245	4

Table 2.3.3-3. Well Construction Permits Within 1 Mile of the HPS Site (Page 5 of 5)

Permit Number	Township	Range	Section	Well Use Code ^a	Well Depth (feet)	Well Diameter (inches)
544204.02	T33S	R24E	6	Y	200	4
544205.01	T33S	R24E	6	Y	300	6
328764.01	T33S	R24E	7	T	31	6
329524.01	T33S	R24E	7	D	310	4
335749.01	T33S	R24E	7	I	1,205	24
355801.01	T33S	R24E	7	D	310	4
473418.01	T33S	R24E	7	O	18	2
473419.01	T33S	R24E	7	O	18	2
473420.01	T33S	R24E	7	O	18	2
473421.01	T33S	R24E	7	O	18	2
476859.01	T33S	R24E	7	IRR	41	4

Note: feet (ft) x 0.3 = meters (m).
inches x 2.54 = centimeters (cm).

^a Well Use Code:

- D = domestic.
- I = industrial.
- O = observation or monitor.
- IRR = irrigation.
- SWW = sealing water well.
- P = public supply.
- T = test well/piezometer.
- Y = plugged or abandoned.

Source: SWFWMD, 1994b.

2.3.4 SURFICIAL HYDROLOGY

This section is based primarily on the data collection and analyses performed in conjunction with the HPS EA/SCA (TPS/SECI, 1989). Additional data collection efforts center on water quality sampling and analyses tasks and are identified as *1993 sampling*.

2.3.4.1 HYDROLOGIC CHARACTERIZATION

2.3.4.1.1 Physical Characteristics

The HPS site is in the Polk Upland physiographic region with land surface elevations ranging from 30 to 40 m (100 to 130 ft) above sea level (SWFWMD, 1988). The site is near the headwaters of Payne Creek, approximately 16 km (10 miles) from the confluence of the creek with the Peace River. This confluence is approximately 129 km (80 miles) from the mouth of the Peace River at Charlotte Harbor on the Gulf of Mexico. Prominent site features are the existing HPS units [covering approximately 20 ha (50 acres)] and the 230-ha (570-acre) cooling reservoir.

Existing Cooling Reservoir

The existing 230-ha (570-acre) cooling reservoir was designed and constructed to satisfy at a minimum the engineering design and operational criteria (e.g., sufficient water supply and heat rejection capabilities) for the 660-MW HPS.

The existing cooling reservoir was designed conservatively to meet the following engineering criteria:

1. The cooling reservoir shall be capable of rejecting a minimum of 1.95×10^9 Btu/hr continuously.
2. The cooling reservoir shall be capable of supplying a daily average water temperature of 95°F (35°C) or cooler to the condenser at all times under design ambient conditions and 100 percent load. Additionally, the condenser back pressure shall not exceed 4.5 inches Hg (114.3 mm Hg).
3. The cooling reservoir water quality shall be maintained at satisfactory quality to allow continuous condenser cooling operation.

The cooling reservoir was constructed on reclaimed phosphate land as part of reclamation efforts by Agrico for its approved and ongoing mining operations (Figures 2.3.4-1, 2.3.4-2, and 2.3.4-3). The northeastern portion of the reservoir is below grade (i.e., the reservoir water

surface is below the adjacent reclaimed ground surface). The south and western edges of the reservoir are above grade (i.e., the reservoir water surface is above the adjacent reclaimed and/or undisturbed ground surface). In these areas, the reservoir has been created and maintained by the construction of a wide berm. The outside slope is 20:1, and the inside slope is 4:1. This very flat, outside slope was selected to create a stable structure with low maintenance and seepage control requirements. Based on Agrico's previous reclamation and reservoir construction experience in the area, this very flat slope provides ideal, stable and low maintenance conditions for the creation of ponds and reservoirs. The minimum cooling reservoir water depth is approximately 10 ft.

Analytical results from a water quality sample obtained from the cooling reservoir in October 1993 are presented in Table 2.3.4-1. In general, water quality in the cooling reservoir was found to be good.

In addition to providing the condenser cooling water supply for the HPS existing units, the cooling reservoir also functions as the fundamental component of the heat dissipation/rejection system. In the circulating water system, cooling water from the cooling reservoir is pumped through the condenser to condense the turbine exhaust steam for the HPS existing units. This heated water is discharged back to the reservoir, where it is cooled through evaporative, radiant, and other natural cooling mechanisms as it flows through the reservoir. After cooling, the water is reused for additional condenser cooling. The existing cooling reservoir will be utilized for similar purposes for the Hardee Unit 3 facility.

Unnamed Tributary

The unnamed tributary to Payne Creek is located immediately to the west of the Hardee Unit 3 project site and receives runoff from the immediate surrounding area. Water levels in the tributary are a function of rainfall events and antecedent moisture conditions in the surrounding soils. Standing water is present year-round in the center portion of the tributary which was mined and reclaimed as an open water body. From the open water system, the tributary grades into a more meandering path through a small forested segment which was not mined. The hydrologic flow in the forested segment is more pronounced than in the open water portion of the tributary. From the project site, the tributary follows in a generally southern direction, eventually entering Payne Creek along the southwestern boundary of the HPS site.

Payne Creek

Payne Creek, in the site vicinity, is a meandering stream with a well-defined channel under average flow conditions. Stream dimensions vary from 3 to 6 m (10 to 20 ft) wide with a maximum channel depth of approximately 1.5 m (5 ft). Beyond the channel, the creek flows within a broad floodplain, as shown in Figure 2.3.4-4. Data in this figure were developed by combining onsite vertical survey information in the immediate vicinity of the creek with data from 1:24,000 USGS topographic maps.

Payne Creek and the Peace River to Charlotte Harbor are classified as Class III surface waters (Chapter 17-302, F.A.C.). Charlotte Harbor is classified as a Class II surface water (Chapter 17-302, F.A.C.).

The Hardee Unit 3 site consists of gently sloping terrain with gradients from 0 to 6 percent in the direction of Payne Creek (see Figure 2.3.4-5). Several wetland areas exist on or adjacent to the site with individual drainageways to Payne Creek. Portions of the HPS site and adjacent lands (on both sides of Payne Creek) have been mined for phosphate. After mining was completed, these areas were reclaimed in accordance with approved reclamation plans.

2.3.4.1.2 Hydrologic Characteristics

USGS has maintained a stream gauging station on Payne Creek near Bowling Green for 14 years (1964-1968 and 1980-present). The station (No. 02295420) is located on the U.S. 17 bridge over the creek approximately 2.4 km (1.5 miles) from the creek mouth at Peace River and is about 19 km (12 miles) southeast of the Hardee Unit 3 site. This station was used to estimate the mean, maximum, and minimum average daily streamflow in Payne Creek near the HPS site (see Table 2.3.4-2). The USGS station flows were multiplied by the ratio of drainage areas for the two locations to determine the flows in Payne Creek at the discharge location near the HPS site. These calculations yield an average annual Payne Creek flow near the HPS site of 0.62 cubic meter per second (m^3/s) [22 cubic feet per second (cfs)], or approximately 0.9 cfs per square mile.

The low flows in Payne Creek near the HPS site were estimated using low-flow frequency analyses of the low flows at the Payne Creek-Bowling Green USGS station (USGS, 1984), corrected to the HPS site location using the ratio of drainage areas. The low flows for durations

from 1 to 183 days and recurrence intervals from 2 to 20 years are shown in Table 2.3.4-3. Seven-day low flows of $0.03 \text{ m}^3/\text{s}$ (1.0 cfs) or less can be expected to occur with a recurrence interval of 2 years. Thirty-day low flows of $0.06 \text{ m}^3/\text{s}$ (2.0 cfs) or less can be expected also to occur with a recurrence interval of 2 years. Given the relatively small drainage area of Payne Creek at the HPS site, regular periods of low flow routinely occur.

Flood flows in Payne Creek near the site were estimated from a technique described in USGS publication WRI 82-4012 (1982). USGS developed a series of regression equations from long-term discharge stations using the independent parameters drainage area, slope, and lake area in the basin. The regression equation applicable to the site area, the regression constants and exponents, and the resulting flows are given in Table 2.3.4-4 for recurrence intervals from 2 to 500 years. The peak 10-year flow at the HPS site is estimated to be $50.7 \text{ m}^3/\text{s}$ (1,810 cfs); the peak 25-year flow is estimated to be $70.8 \text{ m}^3/\text{s}$ (2,530 cfs).

Streamflow and stage measurements were taken on Payne Creek as part of the monitoring program developed in support of the TPS/SECI (1989) application (see Section 2.3.4.2). The discharge hydrograph for the monitoring period on Payne Creek near the HPS site is shown in Figure 2.3.4-6.

During the period of site-specific stream gauging (October 11, 1988, through April 13, 1989), the Payne Creek discharge varied substantially. The highest Payne Creek discharge ($1.05 \text{ m}^3/\text{s}$; 37.6 cfs) was observed on January 25, 1989; the lowest Payne Creek discharge ($0.04 \text{ m}^3/\text{s}$; 1.6 cfs) was observed on April 11-13, 1989. The Payne Creek discharge hydrograph is presented in Figure 2.3.4-6.

Based on this streamflow hydrograph, there was a slow and steady decrease in the baseflow (i.e., non-storm event runoff) from October to April, with occasional short-term rises due to area rainfall. The creek network drains the watershed relatively rapidly; frequent or sustained rain, such as the summer months' rainfall, is required to increase this baseflow.

Streamflow measurements were taken once a month near the HPS site from October 1988 through April 1989 (PC-2) and downstream of the site near Bowling Green from December 1988 through April 1989 (PC-4, USGS Station No. 02295420). The locations of these two stations are

presented in Figure 2.3.4-7. Table 2.3.4-5 gives a summary of the recorded stages and streamflows at Station PC-2, near the HPS site.

2.3.4.1.3 Chemical Characteristics

Prior studies of surface water quality in the site vicinity have been performed by phosphate mining companies as part of permit approval or monitoring programs for Development of Regional Impacts (DRIs), National Pollutant Discharge Elimination System (NPDES) permit approval programs, mining and reclamation plans, and related environmental permits. Two different water quality studies were conducted in Payne Creek near the site, by Agrico and by CFI (conducted by Dames and Moore). The Agrico study consists of four annual reports for the period 1983-1986. The CFI (Dames and Moore) study encompassed the period from July 1975 through January 1976. Water quality samples collected during these two studies represent data collected from four different station locations (Stations 1, 2, 3, and 4). Data from the two studies are combined and summarized in Table 2.3.4-6. These four station locations are shown in Figure 2.3.4-8. The complete data set for the period was provided in the original SCA (TPS/SECI, 1989).

For this previous data, the mean values (at any station) for 5 of the 46 parameters tested exceeded Chapter 17-3, F.A.C., Class III water quality standards. These parameters included: dissolved oxygen, chromium, iron, lead, and zinc. The mean dissolved oxygen concentration failed to meet Class III water quality criteria at three stations. The remaining parameters (i.e., chromium, iron, lead, and zinc) exceeded Class III water quality criteria at two stations and were based on a relatively few number of observations. Table 2.3.4-7 presents the *in situ* data.

In 1993, SECI collected two sets of water quality samples at three of the former water quality stations used in support of the TPS/SECI (1989) application (i.e., Stations PC-1, PC-2, and PC-3; see Figure 2.3.4-9). The results of the 1993 analyses are shown in Tables 2.3.4-8, 2.3.4-9, and 2.3.4-10 for Stations PC-1, PC-2, and PC-3, respectively. These tables include the previous monitoring data for comparison purposes.

In general, water quality monitored in Payne Creek as part of the 1993 monitoring program is very good. Only four exceedances of the Class III mercury standard were observed, and one exceedance of the Class III zinc standard was observed.

As seen in Tables 2.3.4-8, 2.3.4-9, and 2.3.4-10, water quality in Payne Creek is essentially unchanged over the past 4 years. Exceedances of Class III water quality standards were observed in both data sets for ammonia nitrogen and in the 1993 data for silver at Station PC-3 and radium 226 at Stations PC-1 and PC-3. Based on these analyses, it can still be concluded that the water quality in Payne Creek is very good, and exceedances of Class III water quality standards are random in both a spatial and temporal sense.

2.3.4.2 MEASUREMENT PROGRAMS

The following surface water hydrology and water quality field studies were conducted to supply the information needed for impact assessments.

Continuous Water Level Recording (Conducted in 1988 and 1989 only)--A continuous water level recording station location was installed on Payne Creek adjacent to the HPS site; this station (PC-2) was operated as part of the original study for a period of 8 months during 1988 through 1989. This gauging station location is shown in Figure 2.3.4-9. The station consisted of a Leupold and Stevens Type A Continuous Water-Level Recorders and vertically mounted PVC stilling wells. The recorders show changes in water level and water flow. The water level recorder was serviced and the charts removed each month with 100 percent data recovery. The charts were digitized and the data stored in computer files. The original charts were cataloged and filed as a permanent record.

In addition, the USGS maintains a gauging station on Payne Creek below the proposed site, near Bowling Green (USGS No. 02295420). The drainage area to this gauge is approximately 313 square kilometers (km²) [121 square miles (mi²)] and includes the HPS site. The current data from this station (i.e., for the study period) were obtained.

Cross-Section Survey (Conducted in 1988 and 1989 only)--A cross-section was conducted at a representative site near the additional water level gauging stations on Payne Creek to determine river/creek morphology in the vicinity of probable points of discharge. The data were as collected using a sounding rod and surveyor's level. Since no disturbance of the creek bed has occurred, the results of this survey should closely approximate existing conditions.

Water Quality Sampling--The baseline water quality monitoring program used in support of the original application (TPS/SECI, 1989) was structured to provide the necessary database on existing water quality at the site for evaluation of impacts and mitigative measures. The locations of the water quality sampling stations are shown in Figure 2.3.4-9. Samples were collected from four stations on Payne Creek; one located upstream of the proposed HPS site, one located adjacent to the proposed site; and two stations located downstream of the proposed HPS site. All samples were surface grab samples.

Water quality sampling for most water quality parameters (including Chapter 17-3, F.A.C. Class III water quality parameters, except organics, and other classical water quality parameters) was conducted monthly for 6 months at four stations. Chapter 17-3, F.A.C. Class III organics (e.g., pesticides) were sampled twice (November 1988 and February 1989). All analyses (except total dissolved solids) were done on a total or unfiltered basis.

For the 1993 sampling in support of the Hardee Unit 3 application, confirmatory water quality samples were obtained from three stations in a manner consistent as described above. Any changes in FDEP sampling and analysis protocols were included in the 1993 sampling efforts. When evaluating the 1993 sampling results, the most recent FDEP water quality standards were used.

Synoptic Streamflow Studies (Conducted in 1988 and 1989 only)--Streamflow was measured at the HPS site and USGS gauging stations once every month for the monitoring period of 8 months. The two gauging stations are shown in Figure 2.3.4-9. The discharge measurements were made using either Teledyne-Gurley pygmy and Price flow meters or Marsh-McBerney flow meters in accordance with standard USGS stream gauging techniques. The measurements were coordinated with the water quality sampling efforts and completed within 2 days to ensure consistency among stations.

Table 2.3.4-1. Summary of Water Quality Conditions in the HPS Cooling Reservoir at the Intake--
1993 (Page 1 of 6)

Parameter	Class III Standard	September 1993 Data
Water Quality Data		
Alkalinity (Bicarbonate), mg CaCO ₃ /L	> 20	96
Alkalinity (Carbonate), mg CaCO ₃ /L		
Cyanide, mg/L	≤ 0.0052	< 0.005
Fluoride, mg/L	≤ 10	1.81
Hardness, mg/L as CaCO ₃		101
Methylene Blue Active Substances, mg/L		
Total Kjeldahl Nitrogen, mg/L		1.57
Ammonia Nitrogen, mg/L		0.046
Organic Nitrogen, mg/L		
Unionized Ammonia, mg/L	≤ 0.02	< 0.005
Nitrate+Nitrite-Nitrogen, mg/L		0.009
Total Nitrogen, mg/L		1.58
Oil and Grease, mg/L	< 5	< 5
Carbonaceous Biochemical Oxygen Demand, (5-day) mg/L		4.0
Chemical Oxygen Demand, mg/L		44
Orthophosphorus, mg/L		0.347
Total Phosphorus, mg/L		0.816
Sulfate, mg/L		35.3
Turbidity, NTU	< 29 ^a	10
Aluminum, µg/L		
Antimony, µg/L	≤ 4,300	< 5
Arsenic, µg/L	≤ 50	< 5
Beryllium, µg/L	≤ 0.13 ^b	< 0.1
Cadmium, µg/L	0.82 ^c	< 5
Calcium, mg/L		20.4
Chromium, µg/L	148 ^c	< 5
Chromium + 6, µg/L	≤ 11	< 10
Copper, µg/L	8.3 ^c	< 10
Iron, µg/L	≤ 1,000	162
Lead, µg/L	1.9 ^c	< 5
Magnesium, mg/L		12.2
Manganese, µg/L		< 5
Mercury, µg/L	≤ 0.012	< 0.2
Nickel, µg/L	111.5 ^c	< 30

Table 2.3.4-1. Summary of Water Quality Conditions in the HPS Cooling Reservoir at the Intake--
1993 (Page 2 of 6)

Parameter	Class III Standard	September 1993 Data
<u>Water Quality Data (Continued)</u>		
Potassium, mg/L		0.6
Selenium, mg/L	≤ 0.005	<5
Silver, $\mu\text{g/L}$	≤ 0.07	<0.07
Sodium, mg/L		24.8
Strontium, Total, $\mu\text{g/L}$		88
Thallium, $\mu\text{g/L}$	≤ 48	<5
Zinc, $\mu\text{g/L}$	74.9 ^c ($\leq 1,000$)	73
Total Coliforms, colonies/100 mL	$\leq 1,000^d$, $\leq 2,400$ max	3,700
Fecal Coliforms, colonies/100 mL	200 ^d , 800 max	<1
Chloride, mg/L		17.8
Total Suspended Solids mg/L		16
Total Dissolved Solids, mg/L		185
Silica, dissolved reactive, mg/L		<1
<u>Radiation Data</u>		
Alpha, Gross (pCi/L) (gross alpha + Radium 226)	≤ 15	12.5
Beta, Gross (pCi/L)		
Radium 226 (pCi/L) (Radium 226+Radium 228)	≤ 5	1.0
Radium 228 (pCi/L) (Radium 226+Radium 228)	≤ 5	<1.0
<u>Volatile Organics (all units $\mu\text{g/L}$, all compound were analyzed for, but none detected at the specified value)</u>		
Chloromethane	$\leq 470.8^b$	<1
Bromomethane		<1
Dichlorodifluoromethane		<1
Vinyl Chloride		<1
Chloroethane		<1
Methylene Chloride	$\leq 1,580^b$	<1
Trichlorofluoromethane		<1
1,1-Dichloroethene	$\leq 3.2^b$	<1
1,1-Dichloroethane		<1
trans-1,2-Dichloroethene		<1
Chloroform	$\leq 470.8^b$	<1

Table 2.3.4-1. Summary of Water Quality Conditions in the HPS Cooling Reservoir at the Intake--
1993 (Page 3 of 6)

Parameter	Class III Standard	September 1993 Data
<u>Volatile Organics (Continued)</u>		
1,2-Dichloroethane		<1
1,1,1-Trichloroethane	≤173,000	<1
Carbon Tetrachloride	≤4.42 ^b	<1
Bromodichloromethane		<1
1,2-Dichloropropane		<1
Benzene	≤71.28 ^b	<1
Trichloroethene	≤80.7 ^b	<1
Dibromochloromethane	≤22 ^b	<1
1,1,2-Trichloroethane		<1
cis-1,3-Dichloropropene		<1
2-Chloroethylvinyl ether		<1
Bromoform	≤360 ^b	<1
1,1,2,2-Tetrachloroethane	≤10.8 ^b	<1
Tetrachloroethene		<1
Toluene		<1
Chlorobenzene		<1
Ethylbenzene		<1
1,3-Dichlorobenzene		<1
1,2-Dichlorobenzene		<1
1,4-Dichlorobenzene		<1
para and meta Xylenes		<1
ortho Xylene		<1
Styrene		<1
NTBE		<5
<u>Semivolatile Organics (all units μg/L, all 1993 compounds were analyzed for, but none were detected at the specified value except for *)</u>		
phenol	≤4,600,000	<5
2-chlorophenol	≤400	<5
1,3-dichlorobenzene		<5
1,4-dichlorobenzene		<5
1,2-dichlorobenzene		<5
2-methylphenol		<5
4-methylphenol		<5
hexachloroethane		<5
2-nitrophenol		<5

Table 2.3.4-1. Summary of Water Quality Conditions in the HPS Cooling Reservoir at the Intake--
1993 (Page 4 of 6)

Parameter	Class III Standard	September 1993 Data
<u>Semivolatile Organics (Continued)</u>		
2,4-dimethylphenol		<5
2,4-dichlorophenol	≤790	<5
1,2,4-trichlorobenzene		<5
naphthalene		<5
hexachlorobutadiene	≤49.7 ^b	<5
4-chloro-3-methylphenol		<5
2-methylnaphthalene		<5
hexachlorocyclopentadiene		<5
2,4,6-trichlorophenol	≤6.5 ^b	<5
2,4,5-trichlorophenol		<25
2-chloronaphthalene		<5
Diethyl Phthalate		<5
Acenaphthene	≤2,700	<5
Acenaphthylene		<5
2,4-Dinitrophenol	≤14.26	<25
dimethyl phthalate		<5
fluorene	≤14,000	<5
4,6-dinitro-2-methylphenol		<5
hexachlorobenzene		<5
pentachlorophenol	≤8.2 ^b , ≤30 max	<5
phenanthrene	≤0.031	<5
anthracene	≤110,000	<5
di-n-butyl phthalate		32 ^a
fluoranthene	≤370	<5
pyrene	≤11,000	<5
butyl benzyl phthalate		<5
benzo(a)anthracene	≤0.031 ^b	<5
bis(2-ethylhexyl)phthalate		<5
chrysene	≤0.031 ^b	<5
di-n-octyl phthalate		<5
benzo(b)fluoranthene	≤0.031 ^b	<5
benzo(k)fluoranthene	≤0.031 ^b	<5
benzo(a)pyrene	≤0.031 ^b	<5
Indeno(1,2,3-cd)pyrene	≤0.031 ^b	<5
dibenzo(a,h)anthracene	≤0.031 ^b	<5

Table 2.3.4-1. Summary of Water Quality Conditions in the HPS Cooling Reservoir at the Intake--
1993 (Page 5 of 6)

Parameter	Class III Standard	September 1993 Data
<u>Semivolatile Organics (Continued)</u>		
benzo(g,h,i)perylene	$\leq 0.031^b$	< 5
<u>Pesticides/PCBs & Herbicides (all units $\mu\text{g/L}$, all 1993 compounds were analyzed for, but none were detected at the specified value)</u>		
alpha-BHC		< 0.05
beta-BHC	$\leq 0.046^b$	< 0.05
delta-BHC		< 0.05
Lindane	$\leq 0.063^b$, < 0.08 max	< 0.05
Heptachlor	$\leq 0.00021^b$, < 0.0038 max	< 0.05
Aldrin	$\leq 0.00014^b$, < 3 max	< 0.05
Heptachlor epoxide		< 0.05
Endosulfan I		< 0.05
Dieldrin	$\leq 0.00014^b$, < 0.0019 max	< 0.1
4,4'-DDE		< 0.1
Endrin	0.0023	< 0.1
Endosulfan II		< 0.1
4,4'-DDD		< 0.1
Endosulfan sulfate		< 0.1
4,4'-DDT	0.00059 ^b , < 0.001 max	< 0.1
Methoxychlor		< 0.5
Endrin ketone		< 0.1
alpha-chlordane		< 0.5
gamma-chlordane		< 0.5
Toxaphene	≤ 0.0002	< 1
PCB-1016		< 0.5
PCB-1221		< 0.5
PCB-1232		< 0.5
PCB-1242		< 0.5
PCB-1248		< 0.5
PCB-1254		< 0.5
PCB-1260		< 1
Mirex	≤ 0.001	< 0.5
Chlordane	$\leq 0.00059^b$, < 0.0043 max	NA
Demeton	≤ 0.1	NA
Endosulfan	≤ 0.056	NA
Guthion	≤ 0.01	NA

Table 2.3.4-1. Summary of Water Quality Conditions in the HPS Cooling Reservoir at the Intake--
1993 (Page 6 of 6)

Parameter	Class III Standard	September 1993 Data
<u>Pesticides/PCBs and Herbicides (Continued)</u>		
Malathion	≤ 0.1	NA
Parathion	≤ 0.04	NA
Silvex		NA
2,4-D		< 1
2,4,5-TP		< 1
<u>Organophosphate Pesticides (all units $\mu\text{g/L}$, all 1993 compounds were analyzed for, but none were detected at the specified value)</u>		
Azinphos methyl		< 5
Bolstar		< 1
Chloropyriphos		< 0.5
Chloropyriphos methyl		< 1
Diazinon		< 1
Dichlorvos		< 1
Disulfoton		< 1
Ethoprop		< 0.5
Fensulfothion		< 5
Fenthion		< 1
Merphos		< 1
Mevinphos		< 5
Perathion methyl		< 1
Phorate		< 1
Ronnel		< 1
Stirofos		< 1
Tokuthion		< 0.5
Demeton	≤ 0.1	< 1
Coumaphos		< 2
Naled		< 1
Trichlronate		< 1

^a Above natural background conditions.^b Annual average.^c Standard calculated according to equation in DEP 17-302.530 and using overall minimum hardness of 66.4 mg/L as CaCO_3 .^d Monthly average.Sources: TPS/SECI, 1989.
KBN, 1994.

Table 2.3.4-2. Summary of Historical Flows on Payne Creek at Bowling Green and Estimated Flows at the HPS Site

Water Year	Daily Streamflow (cfs)		
	Mean	Maximum	Minimum
At Bowling Green			
1964	111	928	3.6
1965	118	2,060	1.9
1966	71	892	4.3
1967	78	1,310	1.2
1968	171	1,920	2.0
1980	109	981	25
1981	48	276	6.4
1982	125	2,500	11
1983	165	1,380	27
1984	73	357	11
1985	64	635	4.4
Annual ^a	103	981	4.4
At HPS Site (estimated)			
1964	24	197	0.8
1965	25	438	0.4
1966	15	189	0.9
1967	17	278	0.3
1968	36	408	0.4
1980	23	208	5.3
1981	10	59	1.4
1982	27	531	2.3
1983	35	293	5.7
1984	16	76	2.3
1985	14	135	0.9
Annual ^a	22	208	0.9

Note: Cubic feet per second (cfs) x 0.028 = cubic meters per second (m³/s).

^a Annual "average" for maximum and minimum streamflow values for both the Bowling Green and HPS site stations are given as the median values for the period of record.

Source: TPS/SECI, 1989.

Table 2.3.4-3. Estimated Low Flows on Payne Creek Near the HPS Site

Recurrence Interval (years)	Low-Flow Discharge (cfs) for Various Durations (days)								
	1	3	7	14	30	60	90	120	183
2	0.7	0.8	1.0	1.2	1.7	2.8	3.8	4.9	7.6
5	0.3	0.4	0.5	0.5	0.7	1.1	1.8	2.5	3.8
10	0.3	0.3	0.3	0.4	0.4	0.6	1.2	1.9	2.5
20	0.2	0.2	0.3	0.3	0.3	0.4	0.8	1.5	1.7

Note: Cubic feet per second (cfs) x 0.028 = cubic meters per second (m³/s).

Source: TPS/SECI, 1989.

Table 2.3.4-4. Estimated Flood Flows on Payne Creek at the HPS Site

Recurrence Interval (years)	Regression Constant C	Regression Exponents			Estimated Flood Flow (cfs)
		B1	B2	B3	
2	93.4	0.756	0.268	-0.803	690
5	192	0.722	0.255	-0.759	1,310
10	274	0.708	0.248	-0.738	1,810
25	395	0.696	0.24	-0.717	2,530
50	496	0.690	0.234	-0.705	3,130
100	609	0.685	0.227	-0.695	3,780
200	779	0.674	0.205	-0.694	4,510
500	985	0.668	0.196	-0.687	5,550

Note: Drainage Area = 25.7 square miles.
Slope = 5 ft/mi.
Non-Contributing Lake Area = 0 percent.

Regression Equation:

$$QT = C DA^{B1} SL^{B2} (LK + 3.0)^{B3}$$

Cubic feet per second (cfs) x 0.028 = cubic meters per second (m³/s).

Source: TPS/SECI, 1989.

Table 2.3.4-5. Stage and Flow Data for Payne Creek at Station PC-2 Near the HPS Site

Date	Stage (ft)	Flow (cfs)
October 11, 1988	2.62	12.2
November 8, 1988	2.52	11.6
December 8, 1988	2.06	4.7
January 11, 1989	1.76	2.3
February 15, 1989	1.81	3.0
March 15, 1989	1.85	4.2
April 13, 1989	1.59	1.9

Note: cubic feet per second (cfs) x 0.028 = cubic meters per second (m³/s).
feet (ft) x 0.3 = meters (m).

Source: TPS/SECI, 1989.

Table 2.3.4-6. Summary of Historic Payne Creek Surface Water Quality in the Vicinity of HPS, 1975-1986 (all available data) (Page 1 of 6)

Parameter/Location	Concentration ^a			Number of Samples
	Average	Maximum	Minimum	
Flow (cfs)				
Station 1	7.00	12.50	2.00	4
Station 2	--	--	--	0
Station 3	--	--	--	0
Station 4	55.80	105.20	10.60	4
Temperature (°F)				
Station 1	74.0	84.2	60.0	22
Station 2	72.9	85.0	59.0	8
Station 3	71.4	85.0	58.0	11
Station 4	72.1	82.0	58.0	22
Total Suspended Solids				
Station 1	5.6	10.4	3.4	12
Station 2	6.4	26.3	1.2	8
Station 3	5.1	28.3	1.0	8
Station 4	2.4	4.2	1.0	12
Total Dissolved Solids				
Station 1	273	374	188	8
Station 2	191	252	141	8
Station 3	194	284	120	11
Station 4	186	244	126	10
Dissolved Oxygen				
Station 1	1.7	4.2	0.1	22
Station 2	2.1	5.0	0.4	8
Station 3	3.2	9.5	0.1	11
Station 4	7.1	9.0	4.4	22
pH				
Station 1	7.1	7.8	6.6	16
Station 2	6.8	7.1	6.3	8
Station 3	7.0	7.2	6.5	11
Station 4	7.4	7.8	6.9	16
Specific Conductivity (μmho/cm)				
Station 1	347	577	191	8
Station 2	215	258	142	8
Station 3	288	860	156	11
Station 4	228	271	135	8

Table 2.3.4-6. Summary of Historic Payne Creek Surface Water Quality in the Vicinity of HPS, 1975-1986 (all available data) (Page 2 of 6)

Parameter/Location	Concentration ^a			Number of Samples
	Average	Maximum	Minimum	
Calcium				
Station 4	25	34	15	2
Magnesium				
Station 4	9.4	12.0	6.9	2
Sodium				
Station 4	8.1	9.0	7.1	2
Total Hardness				
Station 4	100	134	65	2
Bicarbonate Alkalinity (mg/L as CaCO ₃)				
Station 1	155	283	56	8
Station 2	61	72	50	8
Station 3	64	90	46	11
Station 4	63	98	29	8
Sulfate				
Station 1	22	68	1	4
Station 2	35	59	18	4
Station 3	32	50	17	4
Station 4	37	61	15	4
Chloride				
Station 4	15	17	13	2
Biochemical Oxygen Demand (5-day)				
Station 1	4.88	6.7	2.8	8
Station 2	1.61	4.0	0.9	8
Station 3	1.23	3.0	0.4	11
Station 4	2.46	7.1	0.8	10
Chemical Oxygen Demand				
Station 4	30	47	12	2
Fecal Strep (Number per 100 mL)				
Station 4	183	360	5	2

Table 2.3.4-6. Summary of Historic Payne Creek Surface Water Quality in the Vicinity of HPS, 1975-1986 (all available data) (Page 3 of 6)

Parameter/Location	Concentration ^a			Number of Samples
	Average	Maximum	Minimum	
Fluoride				
Station 1	1.32	1.88	0.74	16
Station 2	0.82	1.88	0.46	8
Station 3	0.94	1.91	0.56	11
Station 4	1.16	1.78	0.37	16
Silicon				
Station 1	2.22	3.30	1.20	4
Station 2	--	--	--	0
Station 3	--	--	--	0
Station 4	3.02	3.84	2.60	4
Sulfide				
Station 4	0.02	0.04	0.00	2
Turbidity (NTU)				
Station 1	2.9	6.2	0.5	16
Station 2	3.6	15.0	1.0	8
Station 3	2.9	18.0	0.8	11
Station 4	2.3	10.0	0.5	18
Ammonia				
Station 1	0.16	0.51	< 0.02	8
Station 2	0.29	0.90	0.03	8
Station 3	0.15	0.36	0.02	8
Station 4	0.04	0.09	0.02	8
Nitrate				
Station 1	0.90	5.90	< 0.01	11
Station 2	0.15	0.36	< 0.01	8
Station 3	0.33	1.25	< 0.01	11
Station 4	0.18	1.00	< 0.01	12
Nitrite				
Station 1	0.01	0.02	< 0.01	8
Station 2	0.06	0.39	< 0.01	8
Station 3	0.02	0.05	< 0.01	8
Station 4	0.01	0.02	< 0.01	8

Table 2.3.4-6. Summary of Historic Payne Creek Surface Water Quality in the Vicinity of HPS, 1975-1986 (all available data) (Page 4 of 6)

Parameter/Location	Concentration ^a			Number of Samples
	Average	Maximum	Minimum	
Total Kjeldahl Nitrogen				
Station 1	0.79	1.14	0.37	8
Station 2	0.62	1.44	0.17	8
Station 3	0.34	0.63	0.16	8
Station 4	0.59	2.70	0.22	10
Total Nitrogen				
Station 1	2.31	12.70	0.41	12
Station 2	0.83	1.76	0.37	8
Station 3	0.71	2.65	0.23	11
Station 4	0.51	1.42	0.02	12
Total Phosphate				
Station 1	0.51	0.60	0.42	4
Station 2	--	--	--	0
Station 3	0.36	0.50	0.18	3
Station 4	0.45	0.58	0.28	4
Total Phosphorus				
Station 1	0.74	1.12	0.35	8
Station 2	0.62	1.80	0.29	8
Station 3	0.45	0.72	0.15	8
Station 4	0.47	0.79	0.25	8
Arsenic				
Station 1	0.009	0.030	<0.001	4
Station 2	0.009	0.030	<0.001	4
Station 3	0.009	0.030	<0.001	4
Station 4	0.006	0.030	<0.001	6
Barium				
Station 1	--	--	--	0
Station 2	--	--	--	0
Station 3	<0.01	<0.01	<0.01	3
Station 4	--	--	--	0
Beryllium				
Station 1	--	--	--	0
Station 2	--	--	--	0
Station 3	0.24	0.69	<0.01	3
Station 4	--	--	--	0

Table 2.3.4-6. Summary of Historic Payne Creek Surface Water Quality in the Vicinity of HPS, 1975-1986 (all available data) (Page 5 of 6)

Parameter/Location	Concentration ^a			Number of Samples
	Average	Maximum	Minimum	
Cadmium				
Station 1	0.01	0.02	<0.005	4
Station 2	0.01	0.02	<0.005	4
Station 3	0.01	0.01	<0.005	4
Station 4	0.01	0.01	<0.002	6
Chromium				
Station 1	--	--	--	0
Station 2	--	--	--	0
Station 3	0.07	0.10	<0.01	3
Station 4	0.03	0.03	<0.02	2
Copper				
Station 1	--	--	--	0
Station 2	--	--	--	0
Station 3	0.01	0.01	<0.01	3
Station 4	0.02	0.03	<0.01	2
Iron				
Station 1	1.21	2.94	0.22	8
Station 2	1.30	5.60	0.32	8
Station 3	0.81	4.77	0.05	11
Station 4	0.33	1.01	0.10	10
Lead				
Station 1	0.02	0.05	<0.01	4
Station 2	0.02	0.05	<0.01	4
Station 3	0.07	0.20	<0.01	7
Station 4	0.02	0.05	<0.01	6
Manganese				
Station 1	0.03	0.05	0.02	8
Station 2	0.03	0.06	0.01	8
Station 3	0.02	0.05	0.01	8
Station 4	0.02	0.05	0.01	8
Nickel				
Station 4	0.01	0.01	<0.002	2
Selenium				
Station 4	0.0025	0.005	<0.014	2

Table 2.3.4-6. Summary of Historic Payne Creek Surface Water Quality in the Vicinity of HPS, 1975-1986 (all available data) (Page 6 of 6)

Parameter/Location	Concentration ^a			Number of Samples
	Average	Maximum	Minimum	
Zinc				
Station 1	--	--	--	0
Station 2	--	--	--	0
Station 3	0.04	0.05	< 0.01	3
Station 4	0.07	0.10	0.04	2
Hexane Solubles				
Station 4	22	24	20	2
Methyl Blue Active Substances				
Station 4	0.13	0.25	< 0.01	2
Phenols				
Station 4	0.01	0.03	0.00	2
Gross Alpha (pCi/L)				
Station 1	4.7	14.0	< 0.1	8
Station 2	1.5	7.5	< 0.1	8
Station 3	2.1	8.4	< 0.1	11
Station 4	3.2	10.2	< 0.1	8

Note: All values are total concentrations unless noted.

Cubic feet per second (cfs) x 0.028 = cubic meters per second (m³/s).

Degrees Fahrenheit (°F) - 32 x 5/9 = degrees Celsius (°C).

^a All values mg/L unless otherwise noted.

Source: TPS/SECI, 1989.

Table 2.3.4-7. *In Situ* Water Quality Data for Payne Creek, 1988-1989 and 1993

Station	Parameter	1988 - 1989 Data				1993 Data	
		Minimum	Maximum	Mean	Standard Deviation	October	December
PC-1	Temperature (°C)	17.3	25.1	20.3	2.5	23.9	15.93
	pH	6.0	6.7	6.4	0.3	6.1	6.3
	Dissolved Oxygen (mg/L)	1.0	6.9	4.9	1.9	4.64	10.04
	Conductivity (µmho/cm)	148	208	183	21.2	204	243
	Secchi (ft)	NA	>2.5	NA	NA	NA	NA
	Total Chlorine (mg/L)	0.0	<0.1	<0.1	NA	NA	NA
PC-2	Temperature (°C)	16.9	25.0	19.6	2.6	24.2	16.78
	pH	6.4	7.1	6.7	0.3	6.4	7.1
	Dissolved Oxygen (mg/L)	4.1	7.7	6.6	1.2	5.91	11.64
	Conductivity (µmho/cm)	174	214	193	14.7	256	283
	Secchi (ft)	NA	>3	NA	NA	NA	NA
	Total Chlorine (mg/L)	<0.1	<0.2	<0.1	NA	NA	NA
PC-3	Temperature (°C)	17.3	25.7	20.4	2.7	26.03	17.21
	pH	6.5	7.2	6.7	0.2	6.6	6.9
	Dissolved Oxygen (mg/L)	5.5	7.0	6.4	0.5	6.93	10.89
	Conductivity (µmho/cm)	197	247	216	17.7	274	288
	Secchi (ft)	NA	>4	NA	NA	NA	NA
	Total Chlorine (mg/L)	<0.1	<0.2	<0.1	NA	NA	NA
PC-4	Temperature (°C)	18.1	24.9	20.2	2.2	NA	NA
	pH	6.5	7.2	6.9	0.2	NA	NA
	Dissolved Oxygen (mg/L)	5.7	7.9	7.3	1.6	NA	NA
	Conductivity (µmho/cm)	243	334	286	97.8	NA	NA
	Secchi (ft)	NA	>3	NA	NA	NA	NA
	Total Chlorine (mg/L)	0.0	<0.2	<0.1	NA	NA	NA

Note: NA = not available or not applicable.
Feet (ft) x 0.3 = meters (m).

Sources: TPS/SECI, 1989.
KBN, 1994.

Table 2.3.4-8. Summary of Water Quality Conditions in Payne Creek-PC-1, 1988 - 1989 and 1993 (Page 1 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
Water Quality Data						
Alkalinity (Bicarbonate), mg CaCO ₃ /L	>20	60	48	50.67	56	64
Alkalinity (Carbonate), mg CaCO ₃ /L		<0.5	<0.5	<0.5	—	<1
Cyanide, mg/L	≤0.0052	<0.004	<0.004	0.004	<0.005	<0.005
Fluoride, mg/L	≤10	0.8	0.6	0.7	0.247	0.419
Hardness, mg/L as CaCO ₃		85.4	77.8	74.98	66.4	79.7
Methylene Blue Active Substances, mg/L		0.05	<0.025	0.029	—	—
Total Kjeldahl Nitrogen, mg/L		0.864	0.338	0.656	0.5	0.38
Ammonia Nitrogen, mg/L		0.345	<0.005	0.084	0.01	<0.005
Organic Nitrogen, mg/L		0.743	0.323	0.574	—	0.38
Unionized Ammonia, mg/L	≤0.02	—	—	—	<0.005	<0.005
Nitrate + Nitrite-Nitrogen, mg/L		0.608	0.19	0.358	0.047	0.166
Total Nitrogen, mg/L		1.42	0.772	1.014	0.55	0.55
Oil and Grease, mg/L	<5	<5	<5	<5	<5	<5
Carbonaceous Biochemical Oxygen Demand, 5-day, mg/L		<1	<1	<1	1.2	<1.0
Chemical Oxygen Demand, mg/L		66	<10	29.5	61	30
Orthophosphorus, mg/L		0.5	0.288	0.38	0.518	0.256
Total Phosphorus, mg/L		0.573	0.318	0.392	0.629	0.284
Sulfate, mg/L		25	9.2	19.98	18.2	27.4
Turbidity, NTU	<29 ^a	1.6	0.8	1.142	1.4	0.6
Aluminum, µg/L		137	45	83.17	78	27
Antimony, µg/L	≤4,300	<10	<10	10	<5	—
Arsenic, µg/L	≤50	<5	<5	<5	<5	<5
Beryllium, µg/L	≤0.13 ^b	<3	<3	<3	<0.1	<0.1
Cadmium, µg/L	0.82 ^c	<0.4	<0.4	0.4	<5	<5
Calcium, mg/L		17.4	12.3	15.37	12.9	16
Chromium, µg/L	148 ^c	<10	<10	10	<5	<5
Chromium +6, µg/L	≤11	—	—	—	<10	<10
Copper, µg/L	8.3 ^c	<7	<6	6.333	<10	<10
Iron, µg/L	≤1,000	648	224	338.5	661	171
Lead, µg/L	1.9 ^c	6.7	<5	5.283	<5	6.7
Magnesium, mg/L		10.2	7	8.9	8.31	—
Manganese, µg/L		16	3	6.533	18	6.7
Mercury, µg/L	≤0.012	0.5	<0.200	0.25	<0.200	<0.2
Nickel, µg/L	111.5 ^c	<17	<12	14.83	<30	<30
Potassium, mg/L		0.9	<0.5	0.7	<0.500	<0.5
Selenium, mg/L	≤0.005	<5	<5	<5	<5	<5
Silver, µg/L	≤0.07	<0.08	<0.08	0.08	<0.070	<0.07
Sodium, mg/L		9.8	6.3	7.783	10.3	13.2
Thallium, µg/L	≤48	—	—	—	<5	<5
Zinc, µg/L	74.9 ^c (≤1,000)	7.0	<5	5.333	<10	10

Table 2.3.4-8. Summary of Water Quality Conditions in Payne Creek-PC-1, 1988 - 1989 and 1993 (Page 2 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
Water Quality Data (Continued)						
Total Coliforms, colonies/100 mL	≤1,000 ^d , ≤2,400 max	364	46	153.2	400	1,000
Fecal Coliforms, colonies/100 mL	200 ^d , 800 max	73	<1	28.83	<1	180
Radiation Data						
Alpha, Gross (pCi/L) gross alpha + Radium 226	≤15	3.6	0.5	1.967	0.8	<0.6
Beta, Gross (pCi/L)		2.3	0	0.917	0.8	<1.4
Radium 226 (pCi/L) Radium 226 + Radium 228	≤5	0.8	0.3	0.667	0.4	0.4
Radium 228 (pCi/L) Radium 226 + Radium 228	≤5	1.3	0	0.433	<1.000	<1.000
Strontium-90 (pCi/L)		<0.500	<0.500	0.5	<1.000	<1.2
Chlorophyll-a, mg/m ³		<1	<1	<1	3.2	<1.0
Chloride, mg/L		12.6	12.6	12.6	--	--
Total Dissolved Solids, mg/L		126	126	126	--	--
Silica, dissolved reactive, mg/L		3.1	3.1	3.1	6.44	6.14
Volatile Organics (all units μg/L, all compound were analyzed for, but none detected at the specified value)						
Chloromethane	≤470.8 ^b	--	--	--	<1	NA
Bromomethane		--	--	--	<1	NA
Dichlorodifluoromethane		--	--	--	<1	NA
Vinyl Chloride		--	--	--	<1	NA
Chloroethane		--	--	--	<1	NA
Methylene Chloride	≤1,580 ^b	--	--	--	<1	NA
Trichlorofluoromethane		--	--	--	<1	NA
1,1-Dichloroethene	≤3.2 ^b	--	--	--	<1	NA
1,1-Dichloroethane		--	--	--	<1	NA
trans-1,2-Dichloroethene		--	--	--	<1	NA
Chloroform	≤470.8 ^b	--	--	--	<1	NA
1,2-Dichloroethane		--	--	--	<1	NA
1,1,1-Trichloroethane	≤173,000	--	--	--	<1	NA
Carbon Tetrachloride	≤4.42 ^b	--	--	--	<1	NA
Bromodichloromethane		--	--	--	<1	NA
1,2-Dichloropropane		--	--	--	<1	NA
Benzene	≤71.28 ^b	--	--	--	<1	NA
Trichloroethene	≤80.7 ^b	--	--	--	<1	NA
Dibromochloromethane	≤22 ^b	--	--	--	<1	NA
1,1,2-Trichloroethane		--	--	--	<1	NA
cis-1,3-Dichloropropene		--	--	--	<1	NA
2-Chloroethylvinyl ether		--	--	--	<1	NA
Bromoform	≤360 ^b	--	--	--	<1	NA
1,1,2,2-Tetrachloroethane	≤10.8 ^b	--	--	--	<1	NA
Tetrachloroethene		--	--	--	<1	NA
Toluene		--	--	--	<1	NA

Table 2.3.4-8. Summary of Water Quality Conditions in Payne Creek--PC-1, 1988 - 1989 and 1993 (Page 3 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
<u>Volatile Organics (Continued)</u>						
Chlorobenzene		--	--	--	<1	NA
Ethylbenzene		--	--	--	<1	NA
1,3-Dichlorobenzene		--	--	--	<1	NA
1,2-Dichlorobenzene		--	--	--	<1	NA
1,4-Dichlorobenzene		--	--	--	<1	NA
para and meta Xylenes		--	--	--	<1	NA
ortho Xylene		--	--	--	<1	NA
Styrene		--	--	--	<1	NA
NTBE		--	--	--	<5	NA
<u>Semivolatile Organics (all units $\mu\text{g/L}$, all 1993 compounds were analyzed for, but none were detected at the specified value)</u>						
phenol	$\leq 4,600,000$	<5	<5	<5	<5	NA
2-chlorophenol	≤ 400	--	--	--	<5	NA
1,3-dichlorobenzene		<10	<10	<10	<5	NA
1,4-dichlorobenzene		<10	<10	<10	<5	NA
1,2-dichlorobenzene		<10	<10	<10	<5	NA
2-methylphenol		--	--	--	<5	NA
4-methylphenol		--	--	--	<5	NA
hexachloroethane		<10	<10	<10	<5	NA
2-nitrophenol		--	--	--	<5	NA
2,4-dimethylphenol		--	--	--	<5	NA
2,4-dichlorophenol	≤ 790	--	--	--	<5	NA
1,2,4-trichlorobenzene		<10	<10	<10	<5	NA
naphthalene		--	--	--	<5	NA
hexachlorobutadiene	$\leq 49.7^b$	<10	<10	<10	<5	NA
4-chloro-3-methylphenol		--	--	--	<5	NA
2-methylnaphthalene		--	--	--	<5	NA
hexachlorocyclopentadiene		<10	<10	<10	<5	NA
2,4,6-trichlorophenol	$\leq 6.5^b$	--	--	--	<5	NA
2,4,5-trichlorophenol		--	--	--	<2.5	NA
2-chloronaphthalene		<10	<10	<10	<5	NA
Diethyl Phthalate		--	--	--	<5	NA
Acenaphthene	$\leq 2,700$	--	--	--	<5	NA
Acenaphthylene		--	--	--	<5	NA
2,4-Dinitrophenol	≤ 14.26	--	--	--	<2.5	NA
dimethyl phthalate		--	--	--	<5	NA
fluorene	$\leq 14,000$	--	--	--	<5	NA
4,6-dinitro-2-methylphenol		--	--	--	<5	NA
hexachlorobenzene		--	--	--	<5	NA
pentachlorophenol	$\leq 8.2^b, \leq 30 \text{ max}$	--	--	--	<5	NA
phenanthrene	≤ 0.031	--	--	--	<5	NA
anthracene	$\leq 110,000$	--	--	--	<5	NA

Table 2.3.4-8. Summary of Water Quality Conditions in Payne Creek--PC-1, 1988 - 1989 and 1993 (Page 4 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
<u>Semivolatile Organics (Continued)</u>						
di-n-butyl phthalate		--	--	--	<5	NA
fluoranthene	≤370	--	--	--	<5	NA
pyrene	≤11,000	--	--	--	<5	NA
butyl benzyl phthalate		--	--	--	<5	NA
benzo(a)anthracene	≤0.031 ^b	--	--	--	<5	NA
bis(2-ethylhexyl)phthalate		--	--	--	<5	NA
chrysene	≤0.031 ^b	--	--	--	<5	NA
di-n-octyl phthalate		--	--	--	<5	NA
benzo(b)fluoranthene	≤0.031 ^b	--	--	--	<5	NA
benzo(k)fluoranthene	≤0.031 ^b	--	--	--	<5	NA
benzo(a)pyrene	≤0.031 ^b	--	--	--	<5	NA
Indeno(1,2,3-cd)pyrene	≤0.031 ^b	--	--	--	<5	NA
dibenzo(a,h)anthracene	≤0.031 ^b	--	--	--	<5	NA
benzo(g,h,i)perylene	≤0.031 ^b	--	--	--	<5	NA
<u>Pesticides/PCBs & Herbicides (all units µg/L, all 1993 compounds were analyzed for, but none were detected at the specified value)</u>						
alpha-BHC		--	--	--	<0.05	NA
beta-BHC	≤0.046 ^b	--	--	--	<0.05	NA
delta-BHC		--	--	--	<0.05	NA
Lindane	≤0.063 ^b , <0.08 max	<0.010	<0.010	<0.010	<0.05	NA
Heptachlor	≤0.00021 ^b , <0.0038 max	<0.001	<0.001	<0.001	<0.05	NA
Aldrin	<0.00014 ^b , <3 max	<0.003	<0.003	<0.003	<0.05	NA
Heptachlor epoxide		--	--	--	<0.05	NA
Endosulfan I		--	--	--	<0.05	NA
Dieldrin	≤0.00014 ^b , <0.0019 max	<0.003	<0.003	<0.003	<0.1	NA
4,4'-DDE		--	--	--	<0.1	NA
Endrin	0.0023	0.004	0.004	0.004	<0.1	NA
Endosulfan II		--	--	--	<0.1	NA
4,4'-DDD		--	--	--	<0.1	NA
Endosulfan sulfate		--	--	--	<0.1	NA
4,4'-DDT	0.00059 ^b , <0.001 max	<0.001	<0.001	<0.001	<0.1	NA
Methoxychlor		<0.030	<0.030	<0.030	<0.5	NA
Endrin ketone		--	--	--	<0.1	NA
alpha-chlordane		--	--	--	<0.5	NA
gamma-chlordane		--	--	--	<0.5	NA
Toxaphene	≤0.0002	<0.005	<0.005	<0.005	<1	NA
PCB-1016		<0.001	<0.001	<0.001	<0.5	NA
PCB-1221		<0.001	<0.001	<0.001	<0.5	NA
PCB-1232		<0.001	<0.001	<0.001	<0.5	NA
PCB-1242		<0.001	<0.001	<0.001	<0.5	NA
PCB-1248		<0.001	<0.001	<0.001	<0.5	NA
PCB-1254		<0.001	<0.001	<0.001	<0.5	NA

Table 2.3.4-8. Summary of Water Quality Conditions in Payne Creek-PC-1, 1988 - 1989 and 1993 (Page 5 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
<u>Pesticides/PCBs and Herbicides (Continued)</u>						
PCB-1260		<0.001	<0.001	<0.001	<1	NA
Mirex	≤0.001	<0.001	<0.001	<0.001	<0.5	NA
Chlordane	≤0.00059 ^a , <0.0043 max	<0.010	<0.010	<0.010	—	NA
Demeton	≤0.1	<0.100	<0.100	<0.100	—	NA
Endosulfan	≤0.056	<0.003	<0.003	<0.003	—	NA
Guthion	≤0.01	<0.010	<0.010	<0.010	—	NA
Malathion	≤0.1	<0.100	<0.100	<0.100	—	NA
Parathion	≤0.04	<0.040	<0.040	<0.040	—	NA
Silvex		<20	<20	<20	—	NA
2,4-D		<10	<10	<10	<1	NA
2,4,5-TP		—	—	—	<1	NA
<u>Organophosphate Pesticides (all units µg/L, all 1993 compounds were analyzed for, but none were detected at the specified value)</u>						
Azinphos methyl		—	—	—	<5	NA
Bolstar		—	—	—	<1	NA
Chlorpyrifos		—	—	—	<0.5	NA
Chlorpyrifos methyl		—	—	—	<1	NA
Diazinon		—	—	—	<1	NA
Dichlorvos		—	—	—	<1	NA
Disulfoton		—	—	—	<1	NA
Ethoprop		—	—	—	<0.5	NA
Fensulfothion		—	—	—	<5	NA
Fenthion		—	—	—	<1	NA
Merphos		—	—	—	<1	NA
Mevinphos		—	—	—	<5	NA
Perathion methyl		—	—	—	<1	NA
Phorate		—	—	—	<1	NA
Ronnel		—	—	—	<1	NA
Stirofos		—	—	—	<1	NA
Tokuthion		—	—	—	<0.5	NA
Demeton	≤0.1	—	—	—	<1	NA
Coumaphos		—	—	—	<2	NA
Naled		—	—	—	<1	NA
Trichlorate		—	—	—	<1	NA

Note: NA = not applicable.

^a Above natural background conditions.^b Annual average.^c Standard calculated according to equation in DEP 17-302.530 and using overall minimum hardness of 66.4 mg/L as CaCO₃.^d Monthly average.Sources: TPS/SECI, 1989.
KBN, 1994.

Table 2.3.4-9. Summary of Water Quality Conditions in Payne Creek-PC-2, 1988 - 1989 and 1993 (Page 1 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
Water Quality Data						
Alkalinity (Bicarbonate), mg CaCO ₃ /L	>20	68	44	54.67	77	83
Alkalinity (Carbonate), mg CaCO ₃ /L		<0.5	<0.5	<0.5	—	<1
Cyanide, mg/L	≤0.0052	<0.004	<0.004	0.004	<0.005	<0.005
Fluoride, mg/L	≤10	0.9	0.6	0.75	0.772	0.738
Hardness, mg/L as CaCO ₃		84.7	68.5	77.32	67.9	80.6
Methylene Blue Active Substances, mg/L		0.054	<0.025	0.03	—	—
Total Kjeldahl Nitrogen, mg/L		0.883	0.245	0.645	0.53	0.42
Ammonia Nitrogen, mg/L		0.325	<0.005	0.066	0.015	<0.005
Organic Nitrogen, mg/L		0.747	0.239	0.579	—	0.42
Unionized Ammonia, mg/L	≤0.02	—	—	—	<0.005	<0.005
Nitrate + Nitrite-Nitrogen, mg/L		0.845	0.209	0.456	0.125	0.131
Total Nitrogen, mg/L		1.73	0.631	1.099	0.66	0.55
Oil and Grease, mg/L	<5	<5	<5	<5	<5	<5
Carbonaceous Biochemical Oxygen Demand, 5-day, mg/L		1.7	<1	1.117	1.13	<1.0
Chemical Oxygen Demand, mg/L		75	<10	31.67	50	44
Orthophosphorus, mg/L		0.509	0.243	0.368	0.53	0.312
Total Phosphorus, mg/L		0.624	0.332	0.399	0.634	0.354
Sulfate, mg/L		25.3	17.4	22.25	18.6	30.5
Turbidity, NTU	<29 ^a	2.3	0.8	1.533	2.1	1.1
Aluminum, µg/L		220	32	111.7	108	36
Antimony, µg/L	≤4,300	<10	<10	10	<5	—
Arsenic, µg/L	≤50	<5	<5	<5	<5	<5
Beryllium, µg/L	≤0.13 ^b	<3	<3	<3	<0.1	<0.1
Cadmium, µg/L	0.82 ^c	0.5	<0.4	0.417	<5	<5
Calcium, mg/L		17.1	13.6	15.97	13.6	16.6
Chromium, µg/L	148 ^c	<10	<10	10	<5	5.3
Chromium +6, µg/L	≤11	—	—	—	<10	<10
Copper, µg/L	8.3 ^c	12	<6	7.667	<10	<10
Iron, µg/L	≤1,000	542	210	279.3	452	172
Lead, µg/L	1.9 ^c	9.8	<5	7.1	<5	9.1
Magnesium, mg/L		10.2	7.6	9.05	8.24	—
Manganese, µg/L		16	3.2	7.133	10	7.2
Mercury, µg/L	≤0.012	0.5	<0.200	0.25	<0.200	<0.2
Nickel, µg/L	111.5 ^c	35	<12	17.83	<30	<30
Potassium, mg/L		0.9	<0.5	0.78	<0.500	<0.5
Selenium, mg/L	≤0.005	<5	<5	<5	<5	<5
Silver, µg/L	≤0.07	<0.08	<0.08	0.08	<0.070	<0.07
Sodium, mg/L		8.8	6.8	7.933	19.5	22.2
Thallium, µg/L	≤48	—	—	—	<5	<5
Zinc, µg/L	74.9 ^c (≤1,000)	36	<5	11	50	22
Total Coliforms, colonies/100 mL	≤1,000 ^d , ≤2,400 max	600	<1	236.7	1200	2,600

Table 2.3.4-9. Summary of Water Quality Conditions in Payne Creek-PC-2, 1988 - 1989 and 1993 (Page 2 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
Water Quality Data (Continued)						
Fecal Coliforms, colonies/100 mL	200 ^d , 800 max	64	9	53	<1	20
Radiation Data						
Alpha, Gross (pCi/L) gross alpha + Radium 226	≤15	3	0.2	1.683	1.4	1.4
Beta, Gross (pCi/L)		5.5	1	2.4	1.1	<1.5
Radium 226 (pCi/L) Radium 226 + Radium 228	≤5	0.6	0.1	0.517	0.2	0.3
Radium 228 (pCi/L) Radium 226 + Radium 228	≤5	0.1	0	0.017	<1	<1.0
Strontium-90 (pCi/L)		<0.500	<0.500	0.5	<1.000	<1.2
Chlorophyll-a, mg/m ³		<1	<1	<1	2.7	<1.0
Chloride, mg/L		11.6	11.6	11.6	--	--
Total Dissolved Solids, mg/L		125	125	125	--	--
Silica, dissolved reactive, mg/L		2.8	2.8	2.8	6	4.81
Volatile Organics (all units µg/L, all compound were analyzed for, but none detected at the specified value)						
Chloromethane	≤470.8 ^b	--	--	--	<1	NA
Bromomethane		--	--	--	<1	NA
Dichlorodifluoromethane		--	--	--	<1	NA
Vinyl Chloride		--	--	--	<1	NA
Chloroethane		--	--	--	<1	NA
Methylene Chloride	≤1,580 ^b	--	--	--	<1	NA
Trichlorofluoromethane		--	--	--	<1	NA
1,1-Dichloroethene	≤3.2 ^b	--	--	--	<1	NA
1,1-Dichloroethane		--	--	--	<1	NA
trans-1,2-Dichloroethene		--	--	--	<1	NA
Chloroform	≤470.8 ^b	--	--	--	<1	NA
1,2-Dichloroethane		--	--	--	<1	NA
1,1,1-Trichloroethane	≤173,000	--	--	--	<1	NA
Carbon Tetrachloride	≤4.42 ^b	--	--	--	<1	NA
Bromodichloromethane		--	--	--	<1	NA
1,2-Dichloropropane		--	--	--	<1	NA
Benzene	≤71.28 ^b	--	--	--	<1	NA
Trichloroethene	≤80.71 ^b	--	--	--	<1	NA
Dibromochloromethane	≤22 ^b	--	--	--	<1	NA
1,1,2-Trichloroethane		--	--	--	<1	NA
cis-1,3-Dichloropropene		--	--	--	<1	NA
2-Chloroethylvinyl ether		--	--	--	<1	NA
Bromoform	≤360 ^b	--	--	--	<1	NA
1,1,2,2-Tetrachloroethane	≤10.8 ^b	--	--	--	<1	NA
Tetrachloroethene		--	--	--	<1	NA
Toluene		--	--	--	<1	NA
Chlorobenzene		--	--	--	<1	NA
Ethylbenzene		--	--	--	<1	NA

Table 2.3.4-9. Summary of Water Quality Conditions in Payne Creek-PC-2, 1988 - 1989 and 1993 (Page 3 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
<u>Volatile Organics (Continued)</u>						
1,3-Dichlorobenzene		--	--	--	<1	NA
1,2-Dichlorobenzene		--	--	--	<1	NA
1,4-Dichlorobenzene		--	--	--	<1	NA
para and meta Xylenes		--	--	--	<1	NA
ortho Xylene		--	--	--	<1	NA
Styrene		--	--	--	<1	NA
NTBE		--	--	--	<5	NA
<u>Semivolatile Organics (all units $\mu\text{g/L}$, all 1993 compounds were analyzed for, but none were detected at the specified value)</u>						
phenol	$\leq 4,600,000$	<5	<5	<5	<5	NA
2-chlorophenol	≤ 400	--	--	--	<5	NA
1,3-dichlorobenzene		<10	<10	<10	<5	NA
1,4-dichlorobenzene		<10	<10	<10	<5	NA
1,2-dichlorobenzene		<10	<10	<10	<5	NA
2-methylphenol		--	--	--	<5	NA
4-methylphenol		--	--	--	<5	NA
hexachloroethane		<10	<10	<10	<5	NA
2-nitrophenol		--	--	--	<5	NA
2,4-dimethylphenol		--	--	--	<5	NA
2,4-dichlorophenol	≤ 790	--	--	--	<5	NA
1,2,4-trichlorobenzene		<10	<10	<10	<5	NA
naphthalene		--	--	--	<5	NA
hexachlorobutadiene	$\leq 49.7^b$	<10	<10	<10	<5	NA
4-chloro-3-methylphenol		--	--	--	<5	NA
2-methylnaphthalene		--	--	--	<5	NA
hexachlorocyclopentadiene		<10	<10	<10	<5	NA
2,4,6-trichlorophenol	$\leq 6.5^b$	--	--	--	<5	NA
2,4,5-trichlorophenol		--	--	--	<2.5	NA
2-chloronaphthalene		<10	<10	<10	<5	NA
Diethyl Phthalate		--	--	--	<5	NA
Acenaphthene	$\leq 2,700$	--	--	--	<5	NA
Acenaphthylene		--	--	--	<5	NA
2,4-Dinitrophenol	≤ 14.26	--	--	--	<2.5	NA
dimethyl phthalate		--	--	--	<5	NA
fluorene	$\leq 14,000$	--	--	--	<5	NA
4,6-dinitro-2-methylphenol		--	--	--	<5	NA
hexachlorobenzene		--	--	--	<5	NA
pentachlorophenol	$\leq 8.2^b, \leq 30 \text{ max}$	--	--	--	<5	NA
phenanthrene	≤ 0.031	--	--	--	<5	NA
anthracene	$\leq 110,000$	--	--	--	<5	NA
di-n-butyl phthalate		--	--	--	<5	NA
fluoranthene	≤ 370	--	--	--	<5	NA
pyrene	$\leq 11,000$	--	--	--	<5	NA

Table 2.3.4-9. Summary of Water Quality Conditions in Payne Creek-PC-2, 1988 - 1989 and 1993 (Page 4 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
<u>Semivolatile Organics (Continued)</u>						
butyl benzyl phthalate		--	--	--	<5	NA
benzo(a)anthracene	≤0.031 ^b	--	--	--	<5	NA
bis(2-ethylhexyl)phthalate		--	--	--	<5	NA
chrysene	≤0.031 ^b	--	--	--	<5	NA
di-n-octyl phthalate		--	--	--	<5	NA
benzo(b)fluoranthene	≤0.031 ^b	--	--	--	<5	NA
benzo(k)fluoranthene	≤0.031 ^b	--	--	--	<5	NA
benzo(a)pyrene	≤0.031 ^b	--	--	--	<5	NA
Indeno(1,2,3-cd)pyrene	≤0.031 ^b	--	--	--	<5	NA
dibenzo(a,h)anthracene	≤0.031 ^b	--	--	--	<5	NA
benzo(g,h,i)perylene	≤0.031 ^b	--	--	--	<5	NA
<u>Pesticides/PCBs & Herbicides (all units µg/L, all 1993 compounds were analyzed for, but none were detected at the specified value)</u>						
alpha-BHC		--	--	--	<0.05	NA
beta-BHC	≤0.046 ^b	--	--	--	<0.05	NA
delta-BHC		--	--	--	<0.05	NA
Lindane	≤0.063 ^b , <0.08 max	<0.010	<0.010	<0.010	<0.05	NA
Heptachlor	≤0.00021 ^b , <0.0038 max	<0.001	<0.001	<0.001	<0.05	NA
Aldrin	≤0.00014 ^b , <3 max	<0.003	<0.003	<0.003	<0.05	NA
Heptachlor epoxide		--	--	--	<0.05	NA
Endosulfan I		--	--	--	<0.05	NA
Dieldrin	≤0.00014 ^b , <0.0019 max	<0.003	<0.003	<0.003	<0.1	NA
4,4'-DDE		--	--	--	<0.1	NA
Endrin	0.0023	0.004	0.004	0.004	<0.1	NA
Endosulfan II		--	--	--	<0.1	NA
4,4'-DDD		--	--	--	<0.1	NA
Endosulfan sulfate		--	--	--	<0.1	NA
4,4'-DDT	0.00059 ^b , <0.001 max	<0.001	<0.001	<0.001	<0.1	NA
Methoxychlor		<0.030	<0.030	<0.030	<0.5	NA
Endrin ketone		--	--	--	<0.1	NA
alpha-chlordane		--	--	--	<0.5	NA
gamma-chlordane		--	--	--	<0.5	NA
Toxaphene	≤0.0002	<0.005	<0.005	<0.005	<1	NA
PCB-1016		<0.001	<0.001	<0.001	<0.5	NA
PCB-1221		<0.001	<0.001	<0.001	<0.5	NA
PCB-1232		<0.001	<0.001	<0.001	<0.5	NA
PCB-1242		<0.001	<0.001	<0.001	<0.5	NA
PCB-1248		<0.001	<0.001	<0.001	<0.5	NA
PCB-1254		<0.001	<0.001	<0.001	<0.5	NA
PCB-1260		<0.001	<0.001	<0.001	<1	NA
Mirex	≤0.001	<0.001	<0.001	<0.001	<0.5	NA
Chlordane	≤0.00059 ^b , <0.0043 max	<0.010	<0.010	<0.010	--	NA
Demeton	≤0.1	<0.100	<0.100	<0.100	--	NA

Table 2.3.4-9. Summary of Water Quality Conditions in Payne Creek-PC-2, 1988 - 1989 and 1993 (Page 5 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
<u>Pesticides/PCBs and Herbicides (Continued)</u>						
Endosulfan	≤0.056	<0.003	<0.003	<0.003	--	NA
Guthion	≤0.01	<0.010	<0.010	<0.010	--	NA
Malathion	≤0.1	<0.100	<0.100	<0.100	--	NA
Parathion	≤0.04	<0.040	<0.040	<0.040	--	NA
Silvex		<20	<20	<20	--	NA
2,4-D		<10	<10	<10	<1	NA
2,4,5-TP		--	--	--	<1	NA
<u>Organophosphate Pesticides (all units µg/L, all 1993 compounds were analyzed for, but none were detected at the specified value)</u>						
Azinphos methyl		--	--	--	<5	NA
Bolstar		--	--	--	<1	NA
Chloropyrifos		--	--	--	<0.5	NA
Chloropyrifos methyl		--	--	--	<1	NA
Diazinon		--	--	--	<1	NA
Dichlorvos		--	--	--	<1	NA
Disulfoton		--	--	--	<1	NA
Ethoprop		--	--	--	<0.5	NA
Fensulfothion		--	--	--	<5	NA
Fenthion		--	--	--	<1	NA
Merphos		--	--	--	<1	NA
Mevinphos		--	--	--	<5	NA
Perathion methyl		--	--	--	<1	NA
Phorate		--	--	--	<1	NA
Ronnel		--	--	--	<1	NA
Stirofos		--	--	--	<1	NA
Tokuthion		--	--	--	<0.5	NA
Demeton	≤0.1	--	--	--	<1	NA
Coumaphos		--	--	--	<2	NA
Naled		--	--	--	<1	NA
Trichlronate		--	--	--	<1	NA

Note: NA = not applicable.

^a Above natural background conditions.^b Annual average.^c Standard calculated according to equation in DEP 17-302.530 and using overall minimum hardness of 66.4 mg/L as CaCO₃.^d Monthly average.Sources: TPS/SECI, 1989.
KBN, 1994.

Table 2.3.4-10. Summary of Water Quality Conditions in Payne Creek--PC-3, 1988 - 1989 and 1993 (Page 1 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
Water Quality Data						
Alkalinity (Bicarbonate), mg CaCO ₃ /L	>20	60	36	53	73	78
Alkalinity (Carbonate), mg CaCO ₃ /L		<0.5	<0.5	<0.5	—	<1
Cyanide, mg/L	≤0.0052	<0.004	<0.004	0.004	<0.005	<0.005
Fluoride, mg/L	≤10	1.3	0.5	0.867	1.04	0.707
Hardness, mg/L as CaCO ₃		112	71.9	86.63	77	82.5
Methylene Blue Active Substances, mg/L		0.033	<0.025	0.026	—	—
Total Kjeldahl Nitrogen, mg/L		1.53	0.566	0.87	0.93	0.52
Ammonia Nitrogen, mg/L		0.486	<0.005	0.106	0.03	0.020
Organic Nitrogen, mg/L		1.53	0.542	0.766	—	0.5
Unionized Ammonia, mg/L	≤0.02				<0.005	<0.005
Nitrate + Nitrite-Nitrogen, mg/L		0.951	0.4	0.619	0.335	0.488
Total Nitrogen, mg/L		2.17	1.06	1.49	1.26	1.01
Oil and Grease, mg/L	<5	<5	<5	<5	<5.0	<5.0
Carbonaceous Biochemical Oxygen Demand, 5-day, mg/L		2.4	<1	1.3	2.4	<1.0
Chemical Oxygen Demand, mg/L		78	<10	40.33	61	55
Orthophosphorus, mg/L		0.572	0.378	0.482	0.739	0.457
Total Phosphorus, mg/L		0.703	0.444	0.529	0.946	0.511
Sulfate, mg/L		49.7	16.9	30.08	25.4	29.6
Turbidity, NTU	<29 ^a	6.1	1	2.567	2.7	1.8
Aluminum, µg/L		169	74	117.7	576	216
Antimony, µg/L	≤4,300	<10	<10	10	<5	—
Arsenic, µg/L	≤50	<5	<5	<5	<5	<5
Beryllium, µg/L	≤0.13 ^b	<3	<3	<3	<0.1	<0.1
Cadmium, µg/L	0.82 ^c	<0.4	<0.4	0.4	<5	<5
Calcium, mg/L		24.9	15.7	18.65	17	17.4
Chromium, µg/L	148 ^c	<10	<10	10	5.1	6.8
Chromium +6, µg/L	≤11	—	—	—	<10	<10
Copper, µg/L	8.3 ^c	<7	<6	6.333	<10	<10
Iron, µg/L	≤1,000	440	215	261.5	617	745
Lead, µg/L	1.9 ^c	9.6	<5	5.967	<5	6.3
Magnesium, mg/L		12	7.7	9.717	8.39	—
Manganese, µg/L		15	7	9.95	12	21
Mercury, µg/L	≤0.012	0.4	<0.200	0.233	<0.200	<0.2
Nickel, µg/L	111.5 ^c	<17	<12	14.83	<30	<30
Potassium, mg/L		2.6	1.7	2.2	1.3	1.5
Selenium, mg/L	≤0.005	<5	<5	<5	<5	<5
Silver, µg/L	≤0.07	<0.08	<0.08	0.08	0.21	0.21
Sodium, mg/L		11	7.5	9.15	20.7	20.7
Thallium, µg/L	≤48	—	—	—	<5	<5
Zinc, µg/L	74.9 ^c (≤1,000)	8.8	<5	5.983	18	26
Total Coliforms, colonies/100 mL	≤1,000 ^d , ≤2,400 max	2,000	45	698.5	8,400	1,600

Table 2.3.4-10. Summary of Water Quality Conditions in Payne Creek--PC-3, 1988 - 1989 and 1993 (Page 2 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
<u>Water Quality Data (Continued)</u>						
Fecal Coliforms, colonies/100 mL	200 ^d , 800 max	327	36	169.5	60	200
<u>Radiation Data</u>						
Alpha, Gross (pCi/L) (gross alpha + Radium 226)	≤15	3.5	0	1.583	3.5	1.8
Beta, Gross (pCi/L)		6.1	1.8	3.517	2.9	3.0
Radium 226 (pCi/L) (Radium 226 + Radium 228)	≤5	1.1	0	0.7	0.4	0.5
Radium 228 (pCi/L) (Radium 226 + Radium 228)	≤5	1.7	0	0.75	<1	<1.0
Strontium-90 (pCi/L)		<0.500	<0.500	0.5	<1	<1.2
Chlorophyll-a, mg/m ³		<1	<1	6.78	8.5	1.9
Chloride, mg/L		15.2	15.2	15.2	--	--
Total Dissolved Solids, mg/L		149	149	149	--	--
Silica, dissolved reactive, mg/L		4.8	4.8	4.8	5.9	5.98
<u>Volatile Organics (all units µg/L, all compound were analyzed for, but none detected at the specified value)</u>						
Chloromethane	≤470.8 ^b	--	--	--	<1	NA
Bromomethane		--	--	--	<1	NA
Dichlorodifluoromethane		--	--	--	<1	NA
Vinyl Chloride		--	--	--	<1	NA
Chloroethane		--	--	--	<1	NA
Methylene Chloride	≤1,580 ^b	--	--	--	<1	NA
Trichlorofluoromethane		--	--	--	<1	NA
1,1-Dichloroethene	≤3.2 ^b	--	--	--	<1	NA
1,1-Dichloroethane		--	--	--	<1	NA
trans-1,2-Dichloroethene		--	--	--	<1	NA
Chloroform	≤470.8 ^b	--	--	--	<1	NA
1,2-Dichloroethane		--	--	--	<1	NA
1,1,1-Trichloroethane	≤173,000	--	--	--	<1	NA
Carbon Tetrachloride	≤4.42 ^b	--	--	--	<1	NA
Bromodichloromethane		--	--	--	<1	NA
1,2-Dichloropropane		--	--	--	<1	NA
Benzene	≤71.28 ^b	--	--	--	<1	NA
Trichloroethene	≤80.7 ^b	--	--	--	<1	NA
Dibromochloromethane	≤22 ^b	--	--	--	<1	NA
1,1,2-Trichloroethane		--	--	--	<1	NA
cis-1,3-Dichloropropene		--	--	--	<1	NA
2-Chloroethylvinyl ether		--	--	--	<1	NA
Bromoform	≤360 ^b	--	--	--	<1	NA
1,1,2,2-Tetrachloroethane	≤10.8 ^b	--	--	--	<1	NA
Tetrachloroethene		--	--	--	<1	NA
Toluene		--	--	--	<1	NA
Chlorobenzene		--	--	--	<1	NA
Ethylbenzene		--	--	--	<1	NA

Table 2.3.4-10. Summary of Water Quality Conditions in Payne Creek-PC-3, 1988 - 1989 and 1993 (Page 3 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
<u>Volatile Organics (Continued)</u>						
1,3-Dichlorobenzene		--	--	--	<1	NA
1,2-Dichlorobenzene		--	--	--	<1	NA
1,4-Dichlorobenzene		--	--	--	<1	NA
para and meta Xylenes		--	--	--	<1	NA
ortho Xylene		--	--	--	<1	NA
Styrene		--	--	--	<1	NA
NTBE		--	--	--	<5	NA
<u>Semivolatile Organics (all units $\mu\text{g/L}$, all 1993 compounds were analyzed for, but none were detected at the specified value)</u>						
phenol	$\leq 4,600,000$	<5	<5	<5	<5	NA
2-chlorophenol	≤ 400	--	--	--	<5	NA
1,3-dichlorobenzene		<10	<10	<10	<5	NA
1,4-dichlorobenzene		<10	<10	<10	<5	NA
1,2-dichlorobenzene		<10	<10	<10	<5	NA
2-methylphenol		--	--	--	<5	NA
4-methylphenol		--	--	--	<5	NA
hexachloroethane		<10	<10	<10	<5	NA
2-nitrophenol		--	--	--	<5	NA
2,4-dimethylphenol		--	--	--	<5	NA
2,4-dichlorophenol	≤ 790	--	--	--	<5	NA
1,2,4-trichlorobenzene		<10	<10	<10	<5	NA
naphthalene		--	--	--	<5	NA
hexachlorobutadiene	$\leq 49.7^b$	<10	<10	<10	<5	NA
4-chloro-3-methylphenol		--	--	--	<5	NA
2-methylnaphthalene		--	--	--	<5	NA
hexachlorocyclopentadiene		<10	<10	<10	<5	NA
2,4,6-trichlorophenol	$\leq 6.5^b$	--	--	--	<5	NA
2,4,5-trichlorophenol		--	--	--	<2.5	NA
2-chloronaphthalene		<10	<10	<10	<5	NA
Diethyl Phthalate		--	--	--	<5	NA
Acenaphthene	$\leq 2,700$	--	--	--	<5	NA
Acenaphthylene		--	--	--	<5	NA
2,4-Dinitrophenol	≤ 14.26	--	--	--	<2.5	NA
dimethyl phthalate		--	--	--	<5	NA
fluorene	$\leq 14,000$	--	--	--	<5	NA
4,6-dinitro-2-methylphenol		--	--	--	<5	NA
hexachlorobenzene		--	--	--	<5	NA
pentachlorophenol	$\leq 8.2^b, \leq 30 \text{ max}$	--	--	--	<5	NA
phenanthrene	≤ 0.031	--	--	--	<5	NA
anthracene	$\leq 110,000$	--	--	--	<5	NA
di-n-butyl phthalate		--	--	--	<5	NA
fluoranthene	≤ 370	--	--	--	<5	NA
pyrene	$\leq 11,000$	--	--	--	<5	NA

Table 2.3.4-10. Summary of Water Quality Conditions in Payne Creek-PC-3, 1988 - 1989 and 1993 (Page 4 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
<u>Semivolatile Organics (Continued)</u>						
butyl benzyl phthalate		--	--	--	<5	NA
benzo(a)anthracene	≤0.031 ^b	--	--	--	<5	NA
bis(2-ethylhexyl)phthalate		--	--	--	<5	NA
chrysene	≤0.031 ^b	--	--	--	<5	NA
di-n-octyl phthalate		--	--	--	<5	NA
benzo(b)fluoranthene	≤0.031 ^b	--	--	--	<5	NA
benzo(k)fluoranthene	≤0.031 ^b	--	--	--	<5	NA
benzo(a)pyrene	≤0.031 ^b	--	--	--	<5	NA
Indeno(1,2,3-cd)pyrene	≤0.031 ^b	--	--	--	<5	NA
dibenzo(a,h)anthracene	≤0.031 ^b	--	--	--	<5	NA
benzo(g,h,i)perylene	≤0.031 ^b	--	--	--	<5	NA
<u>Pesticides/PCBs & Herbicides (all units µg/L, all 1993 compounds were analyzed for, but none were detected at the specified value)</u>						
alpha-BHC		--	--	--	<0.05	NA
beta-BHC	≤0.046 ^b	--	--	--	<0.05	NA
delta-BHC		--	--	--	<0.05	NA
Lindane	≤0.063 ^b , <0.08 max	<0.010	<0.010	<0.010	<0.05	NA
Heptachlor	≤0.00021 ^b , <0.0038 max	<0.001	<0.001	<0.001	<0.05	NA
Aldrin	≤0.00014 ^b , <3 max	<0.003	<0.003	<0.003	<0.05	NA
Heptachlor epoxide		--	--	--	<0.05	NA
Endosulfan I		--	--	--	<0.05	NA
Dieldrin	≤0.00014 ^b , <0.0019 max	<0.003	<0.003	<0.003	<0.1	NA
4,4'-DDE		--	--	--	<0.1	NA
Endrin	0.0023	0.004	0.004	0.004	<0.1	NA
Endosulfan II		--	--	--	<0.1	NA
4,4'-DDD		--	--	--	<0.1	NA
Endosulfan sulfate		--	--	--	<0.1	NA
4,4'-DDT	0.00059 ^b , <0.001 max	<0.001	<0.001	<0.001	<0.1	NA
Methoxychlor		<0.030	<0.030	<0.030	<0.5	NA
Endrin ketone		--	--	--	<0.1	NA
alpha-chlordane		--	--	--	<0.5	NA
gamma-chlordane		--	--	--	<0.5	NA
Toxaphene	≤0.0002	<0.005	<0.005	<0.005	<1	NA
PCB-1016		<0.001	<0.001	<0.001	<0.5	NA
PCB-1221		<0.001	<0.001	<0.001	<0.5	NA
PCB-1232		<0.001	<0.001	<0.001	<0.5	NA
PCB-1242		<0.001	<0.001	<0.001	<0.5	NA
PCB-1248		<0.001	<0.001	<0.001	<0.5	NA
PCB-1254		<0.001	<0.001	<0.001	<0.5	NA
PCB-1260		<0.001	<0.001	<0.001	<1	NA
Mirex	≤0.001	<0.001	<0.001	<0.001	<0.5	NA
Chlordane	≤0.00059 ^b , <0.0043 max	<0.010	<0.010	<0.010	--	NA
Demeton	≤0.1	<0.100	<0.100	<0.100	--	NA

Table 2.3.4-10. Summary of Water Quality Conditions in Payne Creek-PC-3, 1988 - 1989 and 1993 (Page 5 of 5)

Parameter	Class III Standard	1988-1989 Data			1993 Data	
		Max	Min	Mean	September	December
<u>Pesticides/PCBs and Herbicides (Continued)</u>						
Endosulfan	≤0.056	<0.003	<0.003	<0.003	—	NA
Guthion	≤0.01	<0.010	<0.010	<0.010	—	NA
Malathion	≤0.1	<0.100	<0.100	<0.100	—	NA
Parathion	≤0.04	<0.040	<0.040	<0.040	—	NA
Silvex		<20	<20	<20	—	NA
2,4-D		<10	<10	<10	<1	NA
2,4,5-TP		—	—	—	<1	NA
<u>Organophosphate Pesticides (all units µg/L, all 1993 compounds were analyzed for, but none were detected at the specified value)</u>						
Azinphos methyl		—	—	—	<5	NA
Bolstar		—	—	—	<1	NA
Chloropyriphos		—	—	—	<0.5	NA
Chloropyriphos methyl		—	—	—	<1	NA
Diazinon		—	—	—	<1	NA
Dichlorvos		—	—	—	<1	NA
Disulfoton		—	—	—	<1	NA
Ethoprop		—	—	—	<0.5	NA
Fensulfothion		—	—	—	<5	NA
Fenthion		—	—	—	<1	NA
Merphos		—	—	—	<1	NA
Mevinphos		—	—	—	<5	NA
Perathion methyl		—	—	—	<1	NA
Phorate		—	—	—	<1	NA
Ronnel		—	—	—	<1	NA
Stirofos		—	—	—	<1	NA
Tokuthion		—	—	—	<0.5	NA
Demeton	≤0.1	—	—	—	<1	NA
Coumaphos		—	—	—	<2	NA
Naled		—	—	—	<1	NA
Trichlronate		—	—	—	<1	NA

Note: NA = not applicable.

^a Above natural background conditions.^b Annual average.^c Standard calculated according to equation in DEP 17-302.530 and using overall minimum hardness of 66.4 mg/L as CaCO₃.^d Monthly average.Sources: TPS/SECI, 1989.
KBN, 1994.

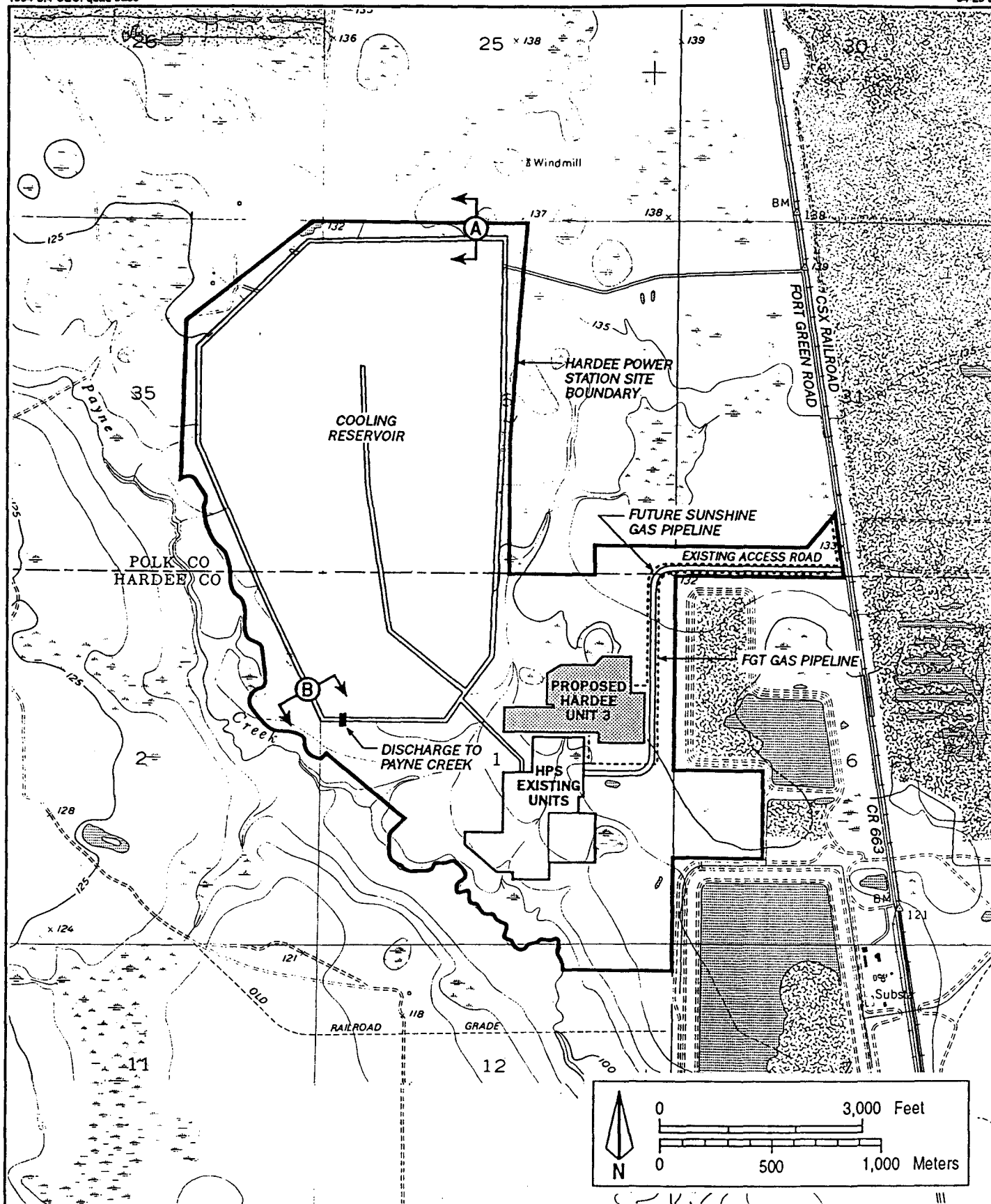


Figure 2.3.4-1
Plan Location of Cooling Reservoir Edge Cross Sections

Sources: USGS, 1987; TPS/SECI, 1989; KBN, 1994.



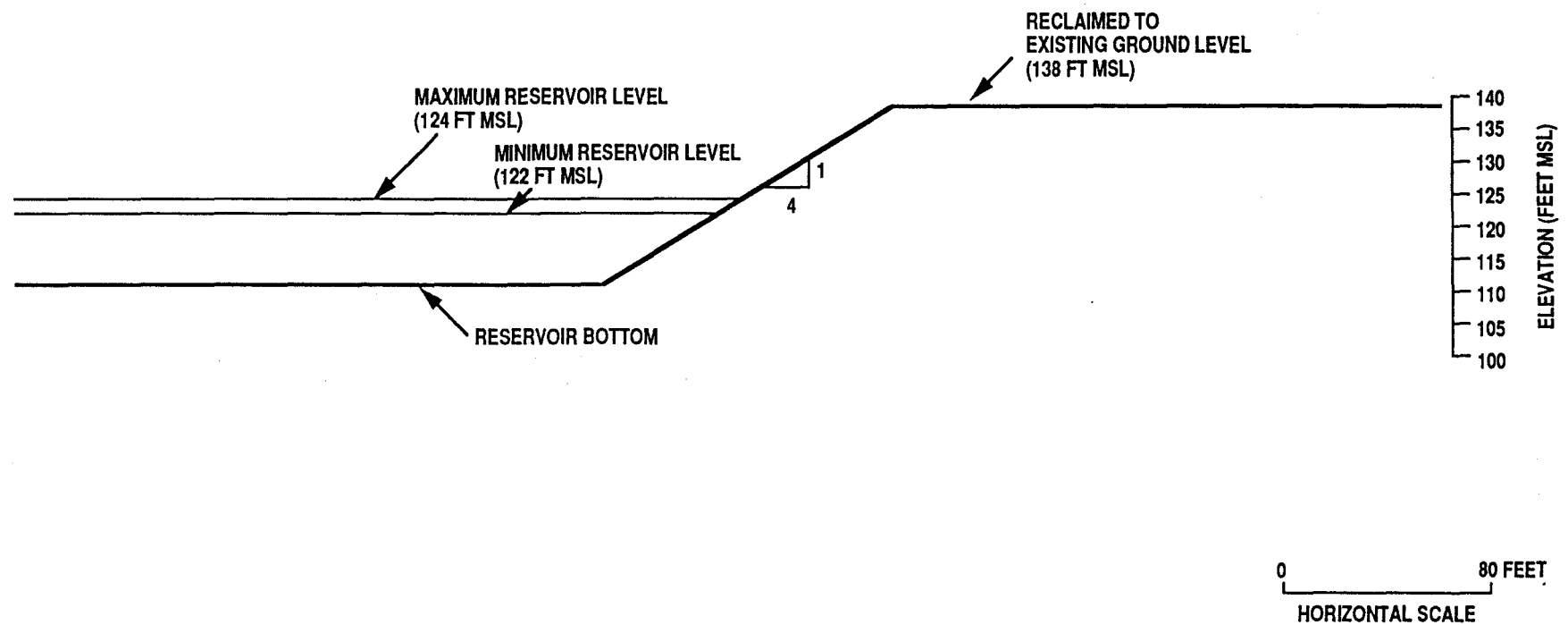


Figure 2.3.4-2
Cross Section A: Typical Belowgrade Edge of Reservoir

Source: TPS/SECI, 1989.



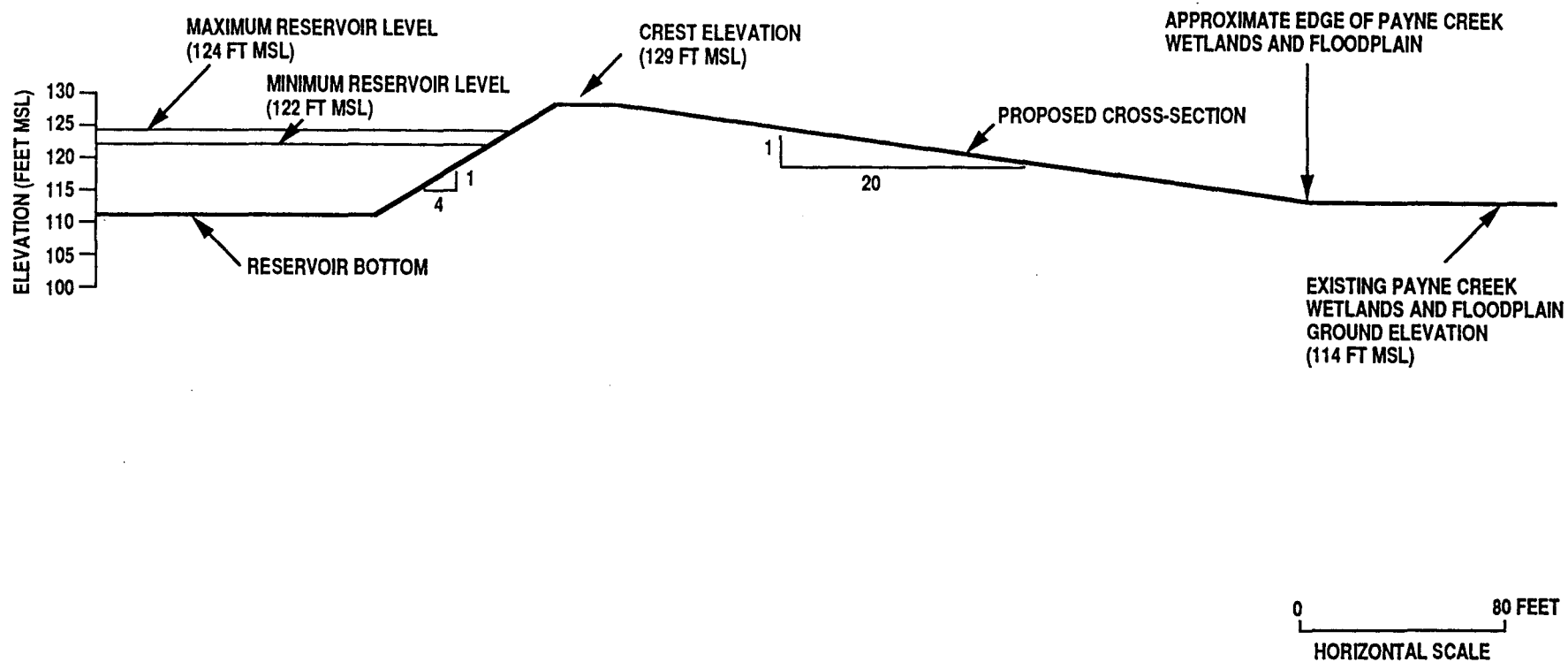
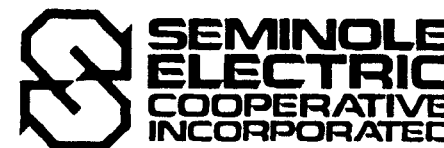


Figure 2.3.4-3
Cross Section B: Typical Abovegrade Edge of Reservoir
(Adjacent to Payne Creek)

Source: TPS/SECI, 1989.



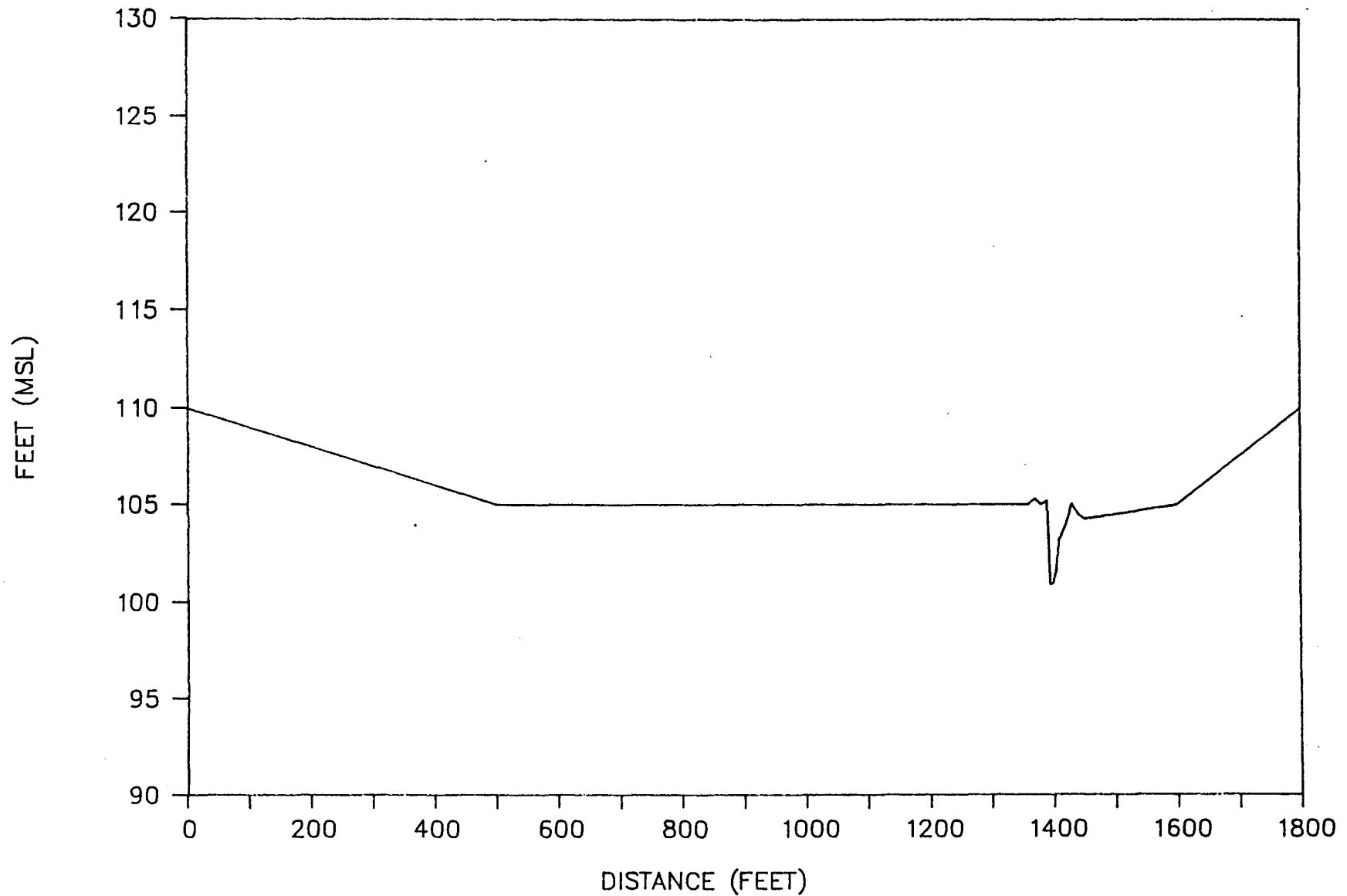


Figure 2.3.4-4
Typical Cross Section of Payne Creek and Floodplain Near the HPS Site
(Looking Upstream)

Source: TPS/SECI, 1989.



NOTE: Elevations are in feet above mean sea level.

Fence
Contour

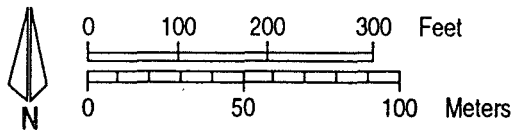
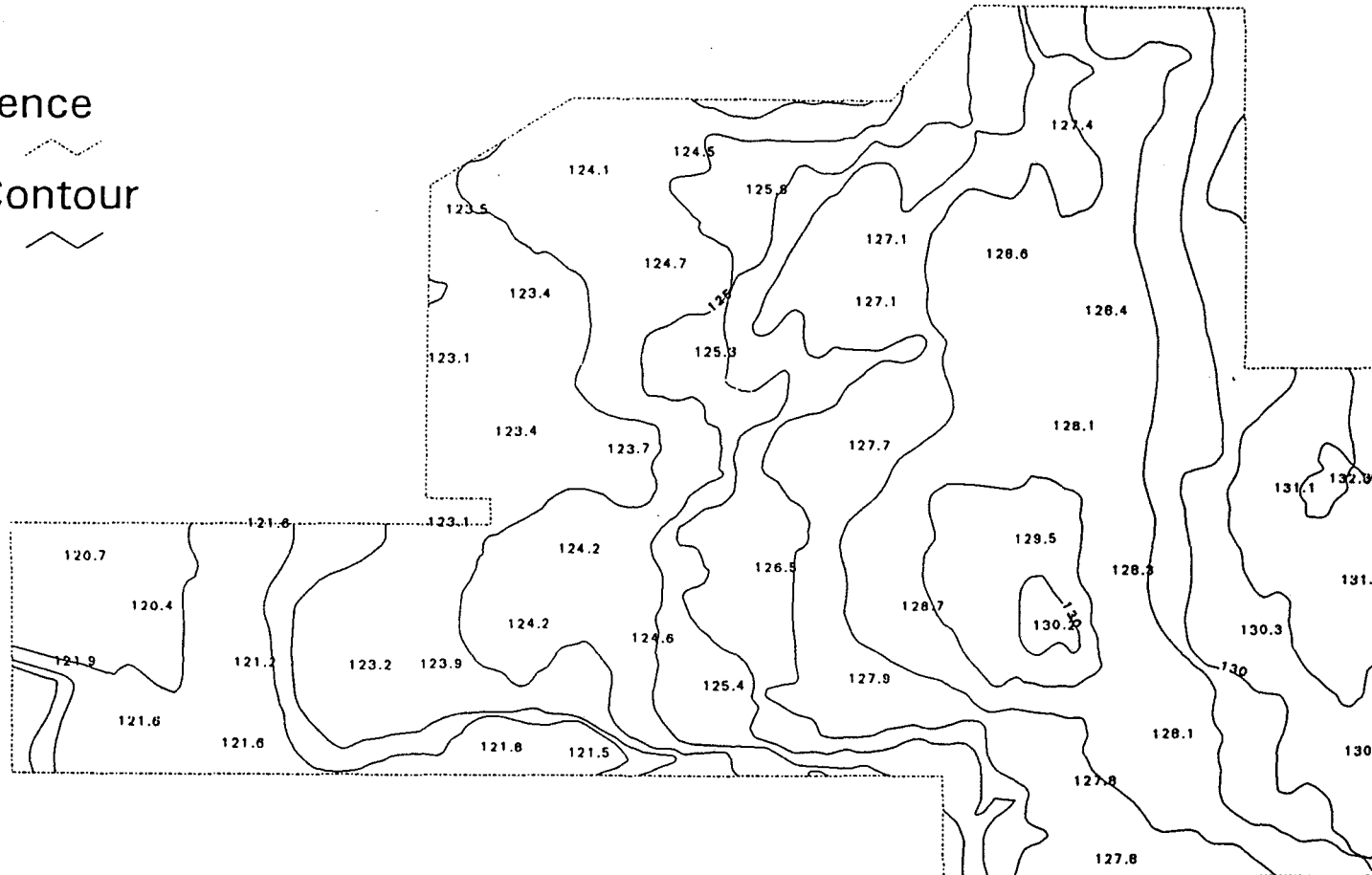


Figure 2.3.4-5
Topography of the Hardee Unit 3 Site

Source: KBN, 1994.

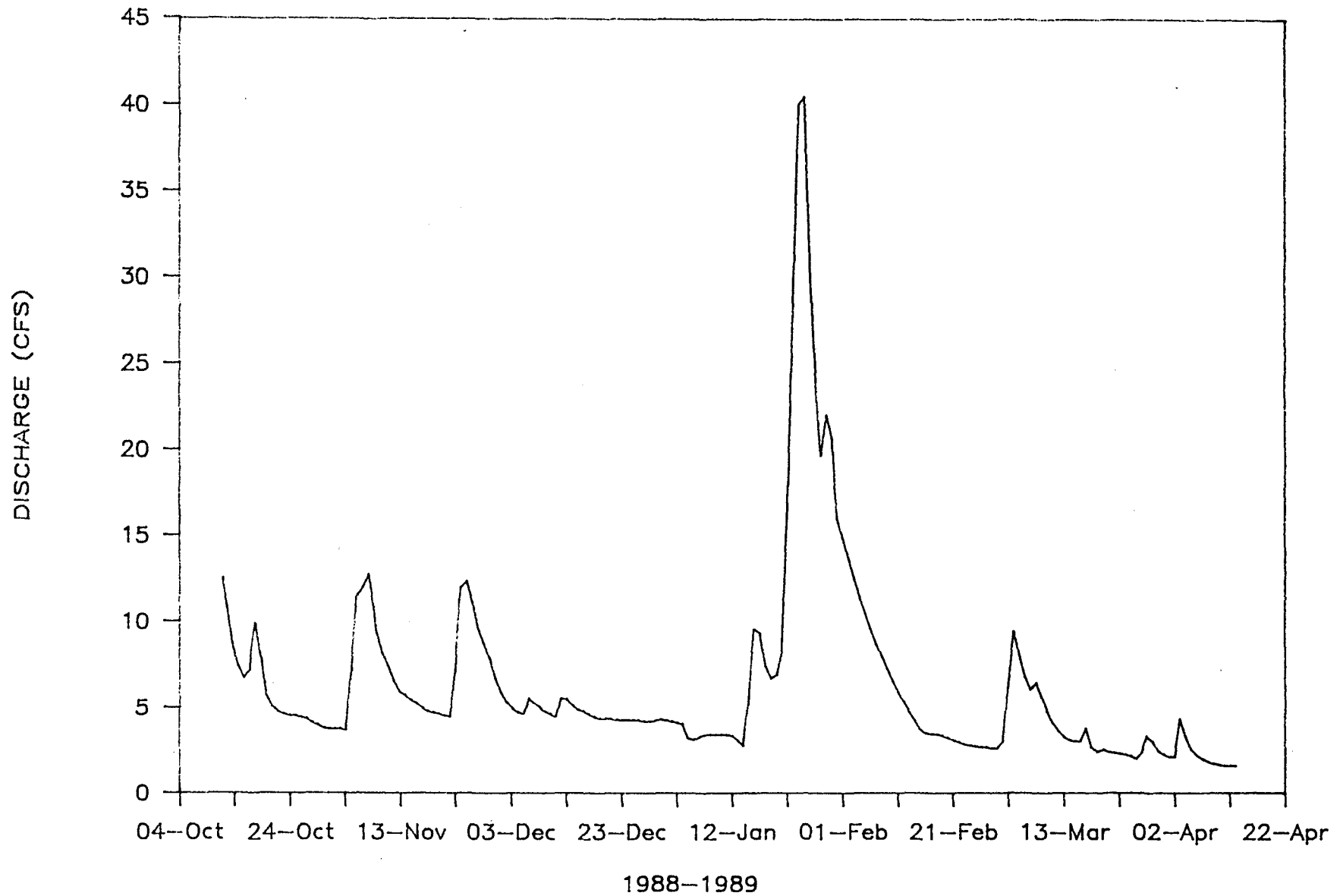


Figure 2.3.4-6
Discharge Hydrograph for Payne Creek Near the HPS Site

Source: TPS/SECI, 1989.



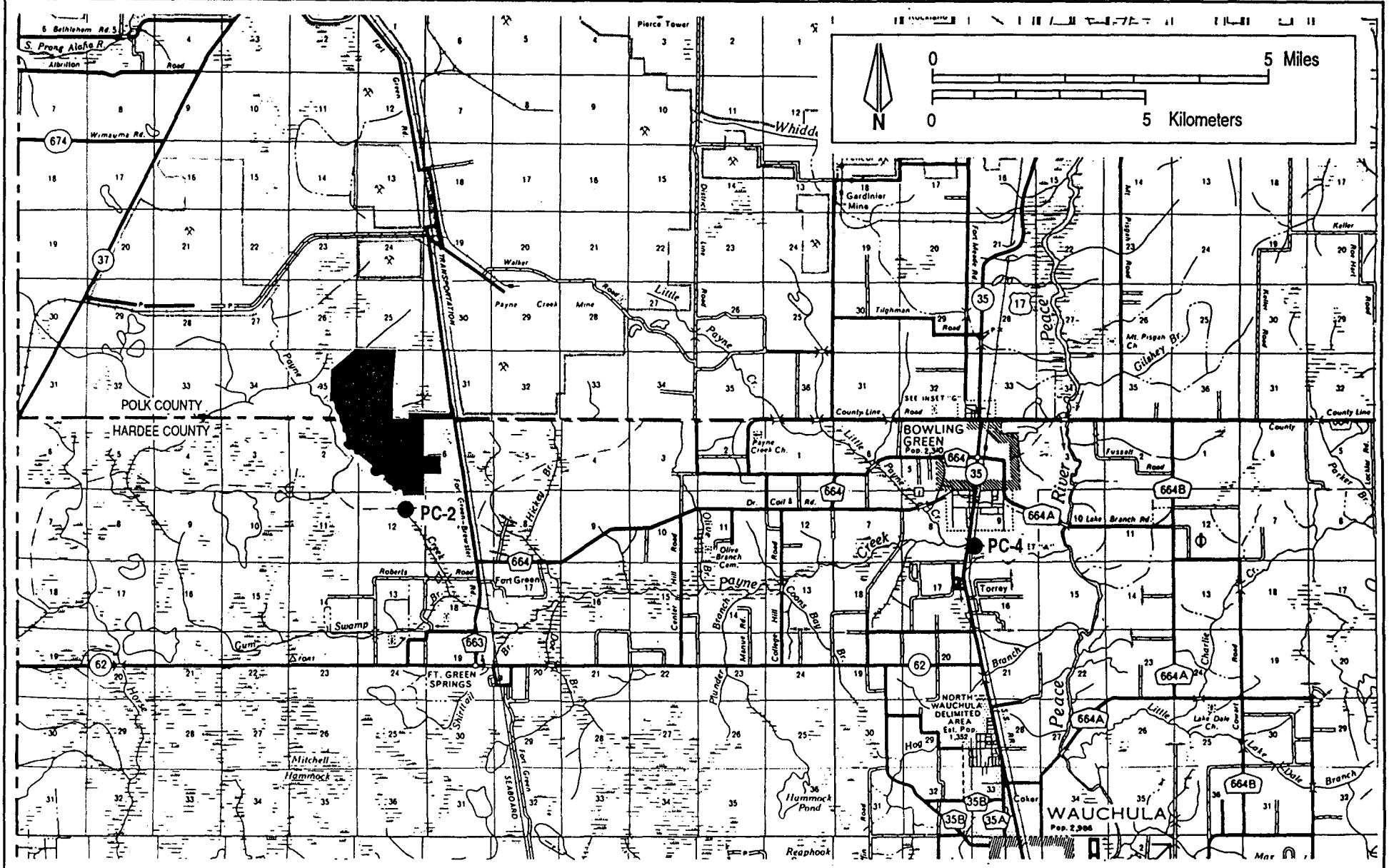


Figure 2.3.4-7
Payne Creek Streamflow Measurement Locations

Source: TPS/SECI, 1989.



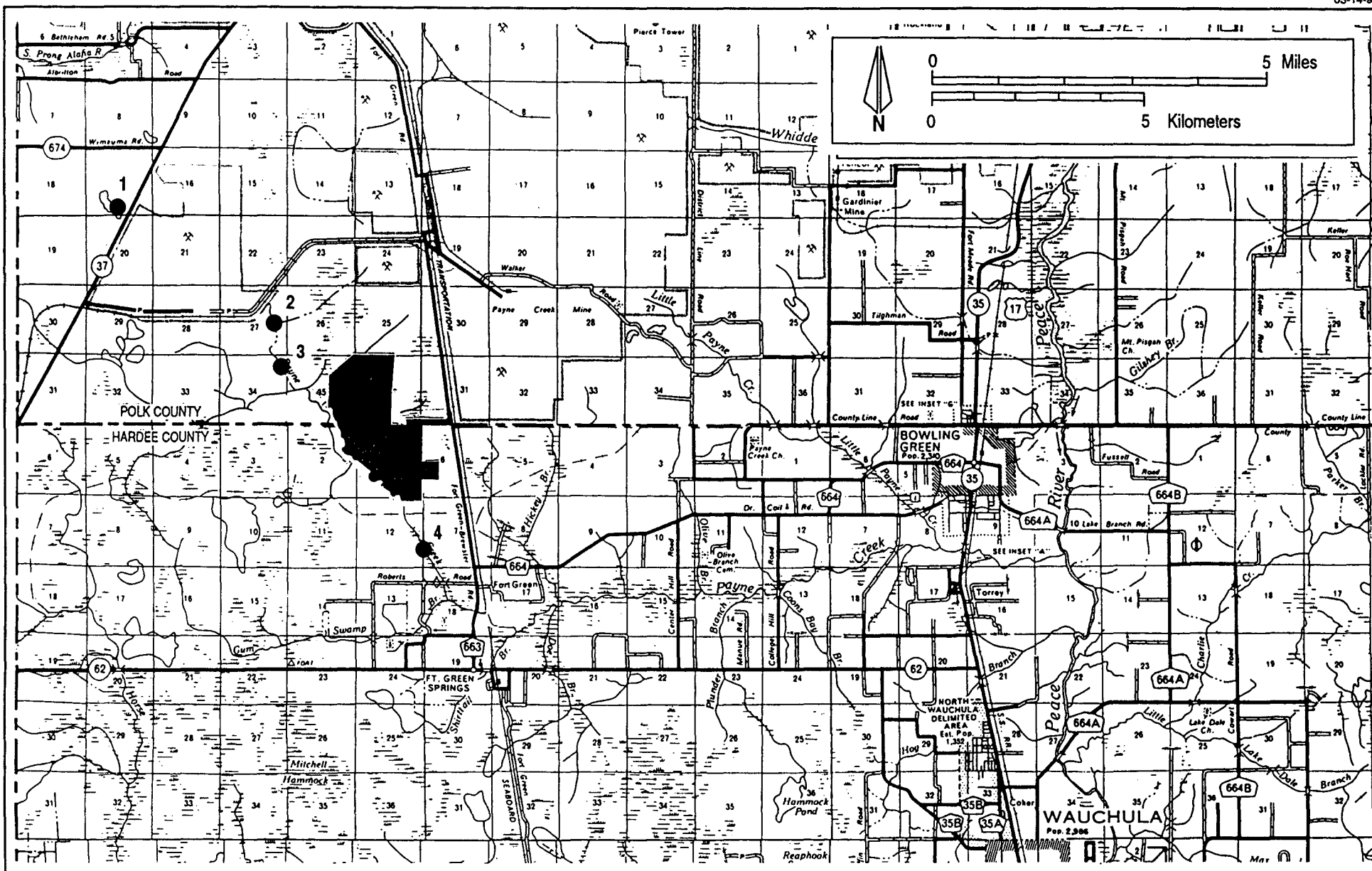


Figure 2.3.4-8
Historic Surface Water Quality Monitoring Locations
for Agricola and Dames & Moore Studies (1975-1986)

Source: TPS/SECI, 1989.



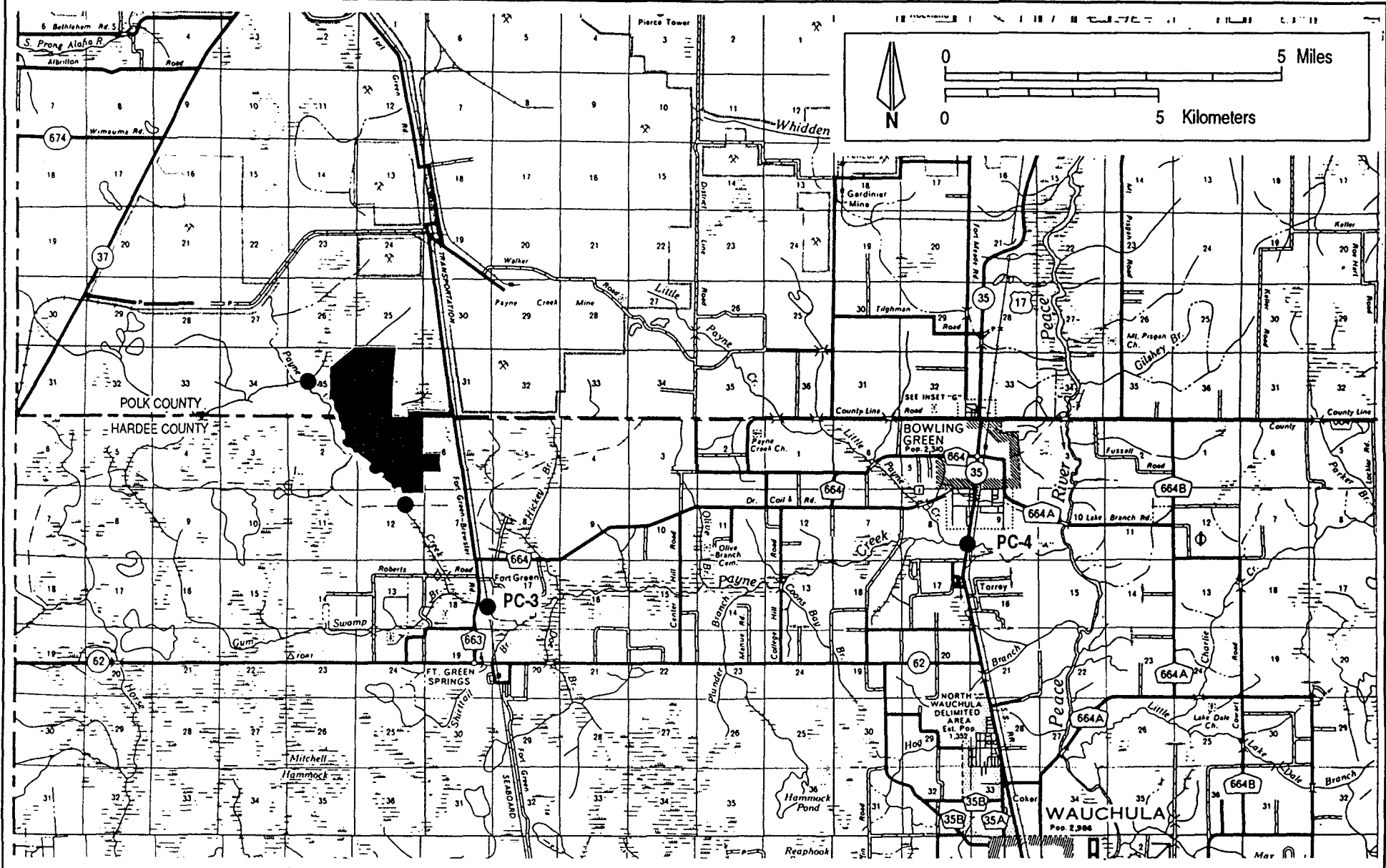


Figure 2.3.4-9
Surface Water Quality Monitoring Locations
(October 1988–March 1989 and September 1993)

Sources: TPS/SECI, 1989; KBN, 1994.



2.3.5 VEGETATION/LAND USE

The Hardee Unit 3 facility site is sited primarily in reclaimed upland pasture (Figure 2.3.5-1). Based on detailed field studies in 1988 and 1989 and field reconnaissance in 1993, major land uses and vegetative communities onsite include reclaimed mined lands, a disturbed unnamed wetland tributary crossing the northern portion of the site and continuing toward the southwest where it connects to Payne Creek, and several small weedy shrub wetlands inadvertently formed during reclamation. The Payne Creek floodplain, which is located south and west of the Hardee Unit 3 Project site and separated from the site by the HPS existing units and cooling reservoir, is a combination of forested wetland and pine flatwoods.

The Florida Land Use, Cover, and Forms Classification System (FLUCFCS) Level III code for reclaimed land, bottomlands, and bottomlands/pine flatwoods communities are 165, 615, and 615/411, respectively. Figure 2.3.5-2 shows the vegetation communities and the areas adjoining the Hardee Unit 3 site. Each community is described in detail in Section 2.3.6.1. All species observed in each community are listed in Table 2.3.5-1.

Table 2.3.5-1. Plant Species Associated With the HPS Site (Page 1 of 2)

Scientific Name	Common Name	Pasture	Flatwoods	Wetlands*
Trees				
<i>Acer rubrum</i>	Red maple			x
<i>Diospyros virginiana</i>	Persimmon			x
<i>Fraxinus caroliniana</i>	Pop ash			x
<i>Gordonia lasianthus</i>	Loblolly bay			x
<i>Liquidambar styraciflua</i>	Sweetgum			x
<i>Magnolia virginiana</i>	Sweetbay magnolia			x
<i>Nyssa sylvatica</i> var. <i>biflora</i>	Black gum			x
<i>Persea borbonia</i>	Red bay			
<i>Quercus laurifolia</i>	Swamp laurel oak			x
<i>Quercus nigra</i>	Water oak			x
<i>Quercus virginiana</i>	Live oak	x	x	
<i>Pinus elliotii</i>	Slash pine	x	x	x
<i>Pinus palustris</i>	Longleaf pine	x	x	
<i>Salix caroliniana</i>	Carolina willow			x
Shrubs and Vines				
<i>Ampelopsis arborea</i>	Pepper vine			x
<i>Baccharis glomeruliflora</i>	Stalkless groundsel bush			x
<i>Cephalanthus occidentalis</i>	Buttonbush			x
<i>Gelsemium sempervirens</i>	Yellow jessamine			x
<i>Ilex cassine</i>	Dahoon holly			x
<i>Itea virginica</i>	Virginia willow			x
<i>Liquidambar styraciflua</i>	Sweetgum	x		
<i>Myrica cerifera</i>	Wax myrtle		x	x
<i>Osmanthus americana</i>	Wild olive			x
<i>Rhododendron viscosum</i>	Swamp honeysuckle			x
<i>Serenoa repens</i>	Saw palmetto	x	x	x
<i>Smilax auriculata</i>	Catbrier		x	x
<i>Smilax bona-nox</i>	Greenbrier		x	x
<i>Smilax laurifolia</i>	Bamboo vine			x
<i>Toxicodendron radicans</i>	Poison ivy			x
<i>Vaccinium corymbosum</i>	Highbush blueberry			x
<i>Viburnum obovatum</i>	Small viburnum			x
<i>Vitis</i> sp.	Grape			x
Herbaceous Species				
<i>Aeschynomene americana</i>	Aeschynomene	x		
<i>Andropogon brachystachyus</i>	Shortspike broomgrass		x	
<i>Andropogon glomeratus</i>	Bushy broomgrass	x		
<i>Andropogon virginicus</i>	Broom grass	x		
<i>Aristida spiciformis</i>	Bottlebrush grass		x	
<i>Aster subulatus</i>	Annual marsh aster	x		
<i>Blechnum serrulatum</i>	Swamp fern			x
<i>Canna flaccida</i>	Golden canna			x
<i>Cassia nictitans</i> var. <i>aspera</i>	Wild sensitive plant	x		
<i>Centella asiatica</i>	Coinwort	x		
<i>Conyza canadensis</i>	Horseweed	x		
<i>Cyperus polystachyos</i>	Texas sedge	x		
<i>Desmodium incanum</i>	Creeping beggarweed	x		
<i>Desmodium triflorum</i>	Sagotia beggarweed	x		
<i>Digitaria ciliaris</i>	Southern crab grass	x		

Table 2.3.5-1. Plant Species Associated With the HPS Site (Page 2 of 2)

Scientific Name	Common Name	Pasture	Flatwoods	Wetlands ^a
Herbaceous Species (Continued)				
<i>Diodia teres</i>	Poor joe	x		
<i>Eichornia crassipes</i>	Water hyacinth			x
<i>Eleocharis</i> sp.	Spikerush	x		
<i>Elephantopus elatus</i>	Florida elephant's foot	x		
<i>Encyclia tampensis</i>	Butterfly orchid			x
<i>Eremenchloa ophiuroides</i>	Centipede grass	x		
<i>Eupatorium capillifolium</i>	Dog fennel	x		
<i>Euthamia minor</i>	Flattop goldenrod	x		
<i>Habenaria repens</i> ^b	Water spider orchid			x
<i>Hartwrightia floridana</i> ^b	Hartwrightia			x
<i>Heterotheca subaxillaris</i>	Camphor weed	x		
<i>Hypoxis juncea</i>	Yellow star grass		x	
<i>Indigofera hirsuta</i>	Hairy indigo	x		
<i>Juncus scirpoides</i>	Rush			x
<i>Ludwigia peruviana</i>	Primrose willow			x
<i>Mitchella repens</i>	Partridge berry			x
<i>Murdannia nudiflora</i>	Dove weed	x		
<i>Osmunda cinnamomea</i> ^b	Cinnamon fern			x
<i>Panicum anceps</i>	Beaked panicum			x
<i>Panicum rigidulum</i>	Redtop panicum			x
<i>Paspalum distichum</i>	Knot grass	x		
<i>Paspalum notatum</i>	Bahia grass	x		
<i>Paspalum urvillei</i>	Vasey grass	x		
<i>Phlebodium aureum</i> ^b	Golden polypody			x
<i>Polygonum hydropiperoides</i>	Smartweed			x
<i>Pontederia cordata</i>	Pickernelweed			x
<i>Pteridium aquilinum</i>	Braken	x		
<i>Pteroglossapsis ecristata</i> ^b	Wild coco		x	
<i>Rhynchelytrum repens</i>	Natal grass			
<i>Sacciolepis indica</i>	Cupscale	x		
<i>Saururus cernuus</i>	Lizards-tail			x
<i>Scirpus validus</i>	Bulrush			x
<i>Sesbania vesicaria</i>	Bladderpod	x		
<i>Thalia geniculata</i>	Fireflag			x
<i>Thelypteris hispidula</i> ^b	Hairy maiden fern			x
<i>Thelypteris interrupta</i> ^b	Spreading tri-vein fern			x
<i>Tillandsia fasciculata</i>	Wild pine			x
<i>Tillandsia recurvata</i>	Ball-moss	x		x
<i>Tillandsia setacea</i> ^b	Red needle-leaf air plant			x
<i>Tillandsia usneoides</i>	Spanish moss	x	x	x
<i>Typha</i> sp.	Cattail			x
<i>Urena lobata</i>	Caesar weed	x		x
<i>Vittaria lineata</i> ^b	Shoestring fern			x
<i>Woodwardia areolata</i>	Chain fern			x
<i>Woodwardia virginiana</i>	Virginia chain fern			x
<i>Xyris platylepis</i>	Broadscale yellow-eyed-grass	x		

^a Includes Payne Creek, wetland tributary, and shrub wetlands.^b Listed species; see Table 2.3.6-9.Sources: TPS/SECI, 1989.
KBN, 1994.



Figure 2.3.5-1
Aerial Photograph of Hardee Unit 3 Project Location

Source: SECI, 1994.



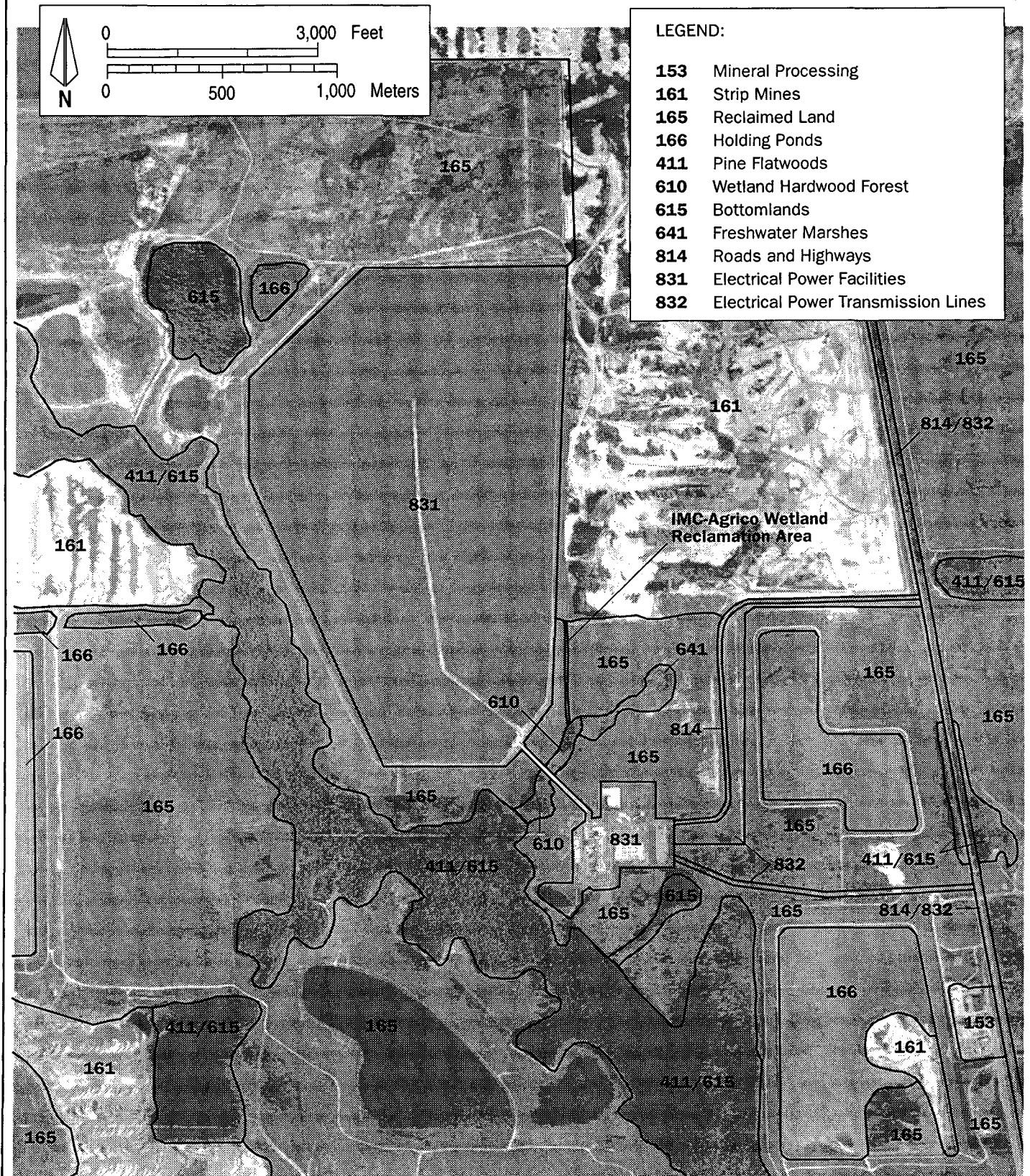


Figure 2.3.5-2
Land Use and Vegetation of the Hardee Unit 3 Site
and Associated Facilities

Source: KBN, 1994.



2.3.6 ECOLOGY

An ecological assessment of the overall HPS site and Payne Creek was included in the SCA/EA document prepared for the original HPS (TPS/SECI, 1989). Detailed site-specific data were collected on both aquatic and terrestrial ecological resources including threatened and endangered species. The data collected for the HPS site are considered to be representative of the Hardee Unit 3 Project site. The field reconnaissance conducted in 1993 confirmed the conditions of the detailed surveys and provided the basis for the description of the current project area in this section.

2.3.6.1 SPECIES-ENVIRONMENTAL RELATIONSHIPS

2.3.6.1.1 Aquatic Systems

Payne Creek and its unnamed tributaries are the only natural aquatic systems in the immediate vicinity of the Hardee Unit 3 facility. Payne Creek is a relatively shallow stream situated on the western boundary of the HPS site. Mining and reclamation activities have occurred on both sides of the Payne Creek floodplain (see the following terrestrial systems discussion). The creek bottom is typically a combination of detritus, sand, and silt. The Payne Creek floodplain has been subject to hydrologic change resulting from sedimentation, ditching of its tributaries for agricultural operations, and mining. Field reconnaissance conducted in 1993 showed conditions in Payne Creek to be similar to those reported in the original SCA (TPS/SECI, 1989).

Fishes

Based on the results of the ichthyofaunal sampling in 1988 and 1989 (see Figure 2.3.6-1) Payne Creek is characterized as a typical, and relatively healthy stream ecosystem. From the standpoint of ichthyofaunal composition, the species captured represented the typical suite of fishes expected in a south-central peninsular Florida stream. Although large-mouth bass (*Micropterus salmoides*) was not found in the samples collected, it is likely to occur in Payne Creek. The predominance of two salt-tolerant secondary freshwater species, the flagfish (*Jordanella floridae*) and the sailfin molly (*Poecilia latipinna*), collected in 1988 at the upstream sampling Station (PC-1) and the presence of the walking catfish (*Clarias batrachus*) at this station indicate connections to drainage ditches, which traditionally host this exotic and the previous two species.

Mosquitofishes (*Gambusia holbrooki*), predictably, dominated the catches numerically during the 1988 sampling. This species is ecologically tolerant and is the most abundant fish in Florida

freshwaters. The brook silverside (*Labidesthes sicculus*) and the golden shiner (*Notemigonus crysoleucas*), when found in an appropriate habitat such as the upstream station, are frequently abundant. The golden topminnow (*Fundulus chrysotus*) and least killifish (*Heterandria formosa*) are characteristically common components of vegetated habitats.

Ecologically, the ichthyofauna of Payne Creek can be broken down into three major assemblages (Table 2.3.6-1). The dominant grouping involves killifish (families Cyprinodontidae and Poeciliidae), sunfish (Centrarchidae), and gar (Lepisosteidae). This assemblage characteristically occupies vegetated habitats, including areas with submergent, emergent, and overhanging plants. Next in importance is an open-water group consisting of minnows (Cyprinidae) and a silverside (Atherinidae), plus sunfishes. Adult centrarchids frequently assemble at the interface between vegetated habitats and open water. The third assemblage, involving catfishes (Ictaluridae and Clariidae) and darters (Percidae), is closely associated with the bottom.

Benthic Macroinvertebrates

Macroinvertebrate sampling for the HPS site emphasized benthic infaunal and epifaunal communities (TPS/SECI, 1989). These sampling efforts were carried out during October 1988 and February 1989, concurrent with the fish surveys (see Figure 2.3.6-1 for sampling locations). A total of 153 macroinvertebrate taxa were collected from Payne Creek during the study.

A total of 90 taxa were collected by the artificial substrates. The midge family Chironomidae were the numerically dominant group of invertebrates collected on the artificial substrates in Payne Creek. This family comprised from 64 to 91 percent of all invertebrates collected (Table 2.3.6-2). *Polypedilum* was the most common genus of Chironomidae occurring on the artificial substrates, and *Polypedilum convictum* was the most common species at the two upstream sites, and occasionally comprised over 40 percent of the total fauna. Simpson and Bode (1980) state that these organisms are filter feeders and that their occurrence seems to be primarily governed by current speed and the amount of suspended material in the water. Other chironomids that were abundant were the *Endochironomus* group, the *Rheotanytarsus exiguus* group, *Tanytarsus* spp., the *Thienemanniella fusca* group, and occasionally the *Corynoneura taris* group. Of these, the *R. exiguus* group, the *T. fusca* group, and the *C. taris* group are also described as occurring in areas of moderate to high flow water containing high amounts of suspended organic matter.

The hydropsychid caddisfly larvae, *Cheumatopsyche* sp., was also very abundant.

Cheumatopsyche are also filter-feeders that require current of adequate speed and substantial quantities of suspended organics. Simpson and Bode (1980) noted that *Cheumatopsyche* and *R. exiguus* are frequently found together and are indicative of a community having an abundance of suspended foodstuffs.

Mayflies and stoneflies are generally an indicator of clean environmental conditions. Although numerically they only comprised a small portion of the fauna (between 2 and 8 percent), due to their large size, as compared with the smaller chironomids, they are actually quite significant in terms of the total amount of food available for fish and the total productivity of the system. Common mayflies included *Stenacron interpunctatum*, *Stenonema exiguum*, and *Caenis diminuta*.

A total of 82 taxa were collected in 1988 and 1989 by ponar sampling from Payne Creek (Table 2.3.6-3). The rich infauna benthic populations observed in the upstream stations may be due to several reasons. First, much of the creek bottom in this area is covered with leaf packs which provides excellent habitat for these invertebrates. Second, the flow is moderate to swift, which keeps the area just above the substrate well oxygenated. Finally, the creek appears relatively undisturbed in the upstream areas sampled, even though mining and reclamation has occurred in the vicinity of both banks.

Macroinvertebrates from the dip net samples revealed over 50 taxa (Table 2.3.6-4) with grass shrimp, *Palaemonetes paludosus*, and chironomids dominated the vegetation, leaf packs, submerged roots and sticks in the streams. Cambarid crayfish were also abundant.

In summary, the macroinvertebrate community composition in Payne Creek also indicates that the creek is a typical central Florida small sandy bottom streams.

2.3.6.1.2 Terrestrial Systems--Flora

Reclaimed Pasture

Reclaimed upland pasture is the dominant community on the Hardee Unit 3 site (Figure 2.3.5-1, FLUCFCS Code 165). The power block and other facilities will be built on unmined and reclaimed upland pasture. The dominant grass in the pasture is bahia grass (*Paspalum notatum*).

The upland pasture has been colonized by early successional species which are indicative of highly disturbed habitats. These species include hairy indigo (*Indigofera hirsuta*), natal grass (*Rhynchelytrum repens*), bahia grass, camphorweed (*Heterotheca subaxillaris*), dogfennel (*Eupatorium capillifolium*), flattop goldenrod (*Euthamia minor*), aeschynomeme (*Aeschynomeme americana*), and chalky bluestem (*Andropogon glomeratus*).

Areas of the upland pasture were mined for phosphate. Consequently, the soil is less permeable than during pre-mine conditions due to a higher clay content of overburden material. Many moisture-tolerant species occur among the pasture grasses, especially in the transitional areas adjacent to the depressional areas.

Several small depressional areas (ranging from 0.05 to 1.9 ha, or 0.13 to 4.6 acres in size) are present within the reclaimed pasture on the south side of the wetland tributary and were inadvertently created during the reclamation process. These wetlands were presumably historical uplands as suggested by a remaining live oak in the vicinity and photographs taken prior to mining. These depressional areas are described in the following paragraphs on onsite wetlands.

Onsite Wetlands

The wetland systems located on the Hardee Unit 3 site include a partially mined and reclaimed unnamed tributary wetland, a wetland reclamation site reclaimed by IMC/Agrico, and several low-lying areas which were inadvertently created during the reclamation process (Figure 2.3.6-3). A description of each wetland system follows.

The unnamed tributary wetland forms the northern boundary of the Hardee Unit 3 site. This wetland was partially mined and reclaimed by IMC/Agrico (Program AGR-PC-PC1, 1990). The headwaters of this remnant tributary wetland are fringed by a thick band of primrose willow. Scattered Carolina willow, saltbush (*Baccharis halimifolia*), wax myrtle (*Myrica cerifera*), and dogfennel contribute to this vegetation zone. The headwaters were historically a forested wetland as suggested by the existing dead trees.

The wetland extends southwest and grades into an open-water system. Although the wetland is void of plants in the center, it is lined with different species, including water hyacinth (*Eichornia*

crassipes), pickerelweed (*Pontederia cordata*), bulrush (*Scirpus validus*), cattail, fireflag (*Thalia geniculata*), smartweed (*Polygonum hydropiperoides*), buttonbush (*Cephalanthus occidentalis*), primrose willow, and Carolina willow. Duckweed covers the water surface in many areas.

West of the headwater area is a forested segment of the tributary wetland. Live oaks (*Quercus virginiana*) surround the forested segment, and black gums (*Nyssa sylvatica* var. *biflora*) occupy the inner section. Saw palmettos (*Serenoa repens*) form clumps around the base of live oak trees. Although this segment represents an unmined segment of the wetland, the overall health is declining as evidenced by several dead trees. It appears that the natural hydroperiod has changed so the water levels remain high and are affecting the trees. Weedy wetland species are encroaching in and around this forested segment.

The second wetland system located on the Hardee Unit 3 site is an IMC/Agrico wetland reclamation area (Figure 2.3.6-3). Reclamation was required by the former Florida Department of Natural Resources (FDNR) for mining the site (Program AGR-PC-PC1, 1990). Additionally, several large reclamation areas are currently being constructed directly north of the project site. These reclamation areas will be connected to, and form the western end of, the unnamed tributary wetland.

Native trees were planted approximately 2 years ago at the onsite reclamation areas to reestablish the floodplain around the unnamed tributary wetland and to connect the reclamation areas north of the site to the unnamed tributary wetland. Species planted include slash pine (*Pinus elliottii*), live oak, laurel oak (*Quercus laurifolia*), American elm (*Ulmus americana*), dahoon holly (*Ilex cassine*), sweet bay (*Magnolia virginiana*), sweetgum (*Liquidambar styraciflua*), and red maple (*Acer rubrum*).

The third onsite wetland system consists of several small depressional areas scattered among the reclaimed pasture on the south side of the unnamed tributary wetland (Figure 2.3.6-3). These depressional areas were inadvertently created during the reclamation process. These wetlands were presumably historical uplands as suggested by a remaining live oak in the vicinity and photographs taken prior to mining. These depressional wetlands are very poor quality and are colonized primarily by primrose willow (*Ludwigia peruviana*), cattail (*Typha* spp.), and Carolina willow (*Salix caroliniana*). Hemp vine covers many plants.

Offsite Payne Creek Floodplain

Detailed observations of the Payne Creek floodplain were conducted in 1988 and 1989 for certification of the HPS existing units. The following description of Payne Creek floodplain is based on these earlier observations and is extracted from the SCA/EA (TPS/SECI, 1989). Field reconnaissance in October and November 1993 revealed that site conditions have not changed substantially since these earlier observations.

Since the 1990 certification, mining has ceased on both sides of the floodplain in the vicinity of the HPS site, and reclamation has been implemented. The creek has a clearly incised channel, although the channel becomes shallower and wider in some areas. Parts of the floodplain have terraced elevations with sloughs or channels behind the higher terraced areas. Near the mining operation, large areas of sand have deposited in the creek bed. The differences in elevation throughout the floodplain have resulted in very different plant communities adjacent to each other. Saw palmetto, slash pine, sweetgum and laurel oak occur at the higher elevations and pop ash (*Fraxinus caroliniana*), buttonbush, red maple, and other wetland species grow at the lower elevations (Figure 2.3.5-1 FLUCFCS Code 411/615). High dense saw palmetto or grasses (*Aristida stricta*, *Aristida spiciformis*, *Andropogon brachystachus*) are between the pasture and the forested wetland. These upland areas and the wetland bordering the creek comprise the floodplain. The property south of Payne Creek and its bordering vegetation has been mined for phosphate and reclaimed.

Detailed vegetation studies of the Payne Creek floodplain in 1988 and 1989 (TPS/SECI, 1989) showed the dominant tree in the upper floodplain was laurel oak, with an importance value of 82.4 percent (Table 2.3.6-5). The average basal area of this species was 711.5 cm². Sweetgum and red maple were also abundant. Total basal area of the tree canopy was 42.5 cm²/m². Saw palmetto with an importance value of 32.6 percent was the most abundant shrub. Greenbrier (*Smilax* spp.) and groundsel tree (*Baccharis glomeruliflora*) were also abundant in the shrub layer. Redtop panicum (*Panicum rigidulum*) was a common groundcover in open areas of the floodplain. Epiphytes were common in the canopy trees and included Spanish moss, ball-moss, wild pine (*Tillandsia fasciculata*), and butterfly orchid (*Encyclia tampensis*). Red maple and sweetgum saplings were abundant in the understory and overtop the saw palmetto in many areas. This part of the floodplain is typical of flatwoods that have not burned for a long time; if fire continues to be excluded, a hardwood floodplain forest will replace much of the saw palmetto.

Species associations on the floodplain varied with slope and height as shown in a generalized depiction of these relationships (Figure 2.3.6-2). Cross-Section A shows the floodplain which was characterized as low banks with a terrace. The vegetation in this type of area was comprised of pickerelweed, redtop panicum, pop ash, and buttonbush. Adjacent to this was an area approximately 1 meter higher with saw palmetto, sweetgum and laurel oak, festooned with yellow jessamine. In areas with terraced banks (Cross-Section B), the vegetation pattern was characterized by a high shrubby area adjacent to the creek channel of grass, greenbrier, persimmon, yellow jessamine, groundselbush, grape, and wax myrtle with scattered young sweetgum, red maple and laurel oak. The few overstory trees were live oak and sweet gum. This zone was approximately 7 m (23 ft) wide. Adjacent to it, the bank rose sharply 1 to 2 m (3 to 7 ft) higher to a palmetto-pine-sweetgum zone. Lichen lines on the sweetgum tree trunks about 30 cm (12 in) from the ground surface indicated occasional flooding in this region.

Parts of the floodplain have low flat banks (Cross-Section D). They support pop ash, elm, and laurel oak. The understory is almost bare with no litter, shrubs, or groundcover. This zone is approximately 8 m (26 ft) wide and is adjacent to a 2 m (6.6 ft) wide zone of dense saw palmetto and some sweetgum trees which rises sharply to a high bank of poison ivy, greenbrier, and peppervine (*Ampelopsis arborea*).

Figure 2.3.6-2, Cross-Section D, depicts the floodplain in areas with high banks and swales. Lichen lines on sweetgum and laurel oak trees in swales behind the banks are approximately 1 m (3 ft) from the ground surface indicating that flooding to that height is sufficiently frequent to keep the lichens from growing any lower. Persimmon and primrose willow are growing on a large sandbar in the center of the creek.

The upper floodplain is a vegetation zone dominated by saw palmetto, yellow jessamine, bracken fern, sweetgum and laurel oak saplings, and swamp honeysuckle. Further upland is a zone with laurel oak, slash pine, sweetgum, and very dense saw palmetto. The lichen lines extend to the base of the trees indicating little flooding in this section. Many small drainages from the upland area of the site dissect this zone. Beyond this zone to the north, the saw palmetto drops out, there is slight litter on the ground, and groundsel bush, greenbrier, young sweetgum, water oak seedlings, and caesarweed predominate.

The Payne Creek floodplain near the southeast corner of the HPS site has a wide floodplain and the stream channel is less than 1 m (3 ft) deep. Large areas are dominated by ferns [cinnamon fern, swamp fern (*Blechnum serrulatum*), chain ferns], lizards-tail, and smartweed (*Polygonum hydropiperoides*). The most common tree is young red maple and red maple leaf litter approximately 10 cm (4 in) deep overlays the peat surface. Laurel oak, pop ash, and slash pine are also present. Moss-covered cypress knees are common, but live cypress has been historically timbered. Few shrubs were observed. The bases of the trees are above the ground exposing the roots; this could indicate peat subsidence due to a lowered water level, but the charred trunks of the older slash pine indicate a peat fire in the recent past.

2.3.6.1.3 Terrestrial Systems--Fauna

The wildlife habitat in the region surrounding the Hardee Unit 3 site has been severely altered by past phosphate mining and reclamation activity. The barren spoil piles and bare ground being reclaimed north of the site provide poor wildlife habitat. The water-filled ditches, excavated ponds, and settling ponds in the general area support wading birds and waterfowl feeding. Much of the previously mined land is being reclaimed to pasture which does not support diverse wildlife populations.

Remnant areas of important wildlife habitats exist in the forested wetlands along Payne Creek. This hardwood habitat supports a greater number of observed and potentially occurring species of animals than the other identified habitats (Tables 2.3.6-6, 2.3.6-7, and 2.3.6-8).

Ubiquitous species (those species actually observed in all habitats), included feral hog, nine-banded armadillo, downy woodpecker, and the blue jay (scientific names are listed in Tables 2.3.6-6 and 2.3.6-7). Feral hogs were abundant in all habitats, and their foraging has created much disturbance, particularly along forest edges.

Forested Wetland

Studies of the forested wetland in 1988 and 1989 and field reconnaissances in 1993 revealed mixed species flocks of migrant and resident small insectivorous birds, including yellow-rumped warblers, blue-gray gnatcatchers, ruby crowned kinglets, tufted titmice, and palm warblers.

Common omnivorous birds included the gray catbird, mockingbird, red-bellied woodpecker, and white-eyed vireo. Northern bobwhites were observed retreating into the forest from the adjacent pasture. The Eastern phoebe was common along the forest edge. The red-shouldered hawk, a carnivore, appeared to be fairly common, while the piscivorous belted king fisher perched in the forest along Payne Creek.

Tracks were found of bobcat and river otter, in this habitat. Tracks of raccoons and deer were also observed. The burrows of crayfish, important prey of river otters and raccoons, were present in the floodplain. Centrarchid fish, another important prey of the river otter, were common in Payne Creek (see Section 2.3.6.1.1).

Gray squirrels occur in the forested wetlands. Amphibians observed included green anoles, green tree frogs, bullfrogs, and southern leopard frogs.

Reclaimed Pasture

The most prominent birds in this habitat were the American kestrel, loggerhead shrike, Eastern meadowlark, and killdeer, all of which are typical species of pasture land.

Other birds observed included red-tailed hawk and the mockingbird. Where growths of dog-fennel provided cover, catbirds and house wrens were present. Small groups of the palm warbler, a species common in open habitats during winter, were observed foraging on the ground. Mammals common to the pasture habitats include various species of rodents, opossum, armadillo, rabbit, and wild hog.

2.3.6.1.4 Threatened and Endangered Species--Flora and Fauna

Species designated by the U.S. Fish and Wildlife Service (USFWS), the Florida Game and Fresh Water Fish Commission (FGFWFC) and the Florida Department of Agriculture and Consumer Services (FDA) as endangered, threatened, species of special concern, commercially exploited, or under review, were included in this category. Sources used to identify such plant and animal species that could potentially occupy the unmined areas of the site included the FNAI database, Florida Committee on Rare and Endangered Plants and Animals (FCREPA) reports, DRI applications for the Agrico site and the CFI mine south of the Agrico site, and endangered species surveys conducted for the HPS site. In October 1993, an endangered plant species survey was

conducted on the Hardee Unit 3 site. Following are descriptions of species whose occurrence or range includes the Hardee Unit 3 site.

Flora

Species that occur or potentially occur on the Hardee Unit 3 site are listed in Table 2.3.6-9. The probability of their occurrence is assessed. Detailed descriptions and results of the search for these species follow.

Water Spider Orchid (*Habenaria repens*)--This plant is listed as threatened by the FDA and often occurs in the understory of tributary forests. It is common along the eastern part of the Payne Creek floodplain. Water spider orchid is a weedy species which is common throughout peninsula Florida. However, it was not found on the Hardee Unit 3 site. Although no plants were seen, this annual could easily establish itself during or after construction due to the wind blown dust-like seeds.

Hartwrightia (*Hartwrightia floridana*)--This species is under review (Category 2) for listing by USFWS and is listed as threatened by FDA. This plant occurs in natural, wet, open, boggy areas and seems to favor acidic conditions. The proposed site has been mined and does not seem to be a likely habitat.

Golden Polypody (*Phlebodium aureum*)--This plant is listed as threatened by FDA. This epiphytic fern occurs mostly in the boots at the bases of fronds of cabbage palm. This species is common throughout southern and central peninsula Florida. Its northward limit is determined by freezing temperatures. In years with warm winters, it extends almost to the Georgia border along the coast. This common species spreads by means of airborne spores. Although this species was not found on the Hardee Unit 3 site, it could probably be found on this site in warm years.

Wild Coco (*Pteroglossapsis ecristata*)--This plant is under review (Category 2) by USFWS and is listed as threatened by FDA. It is a tall, fall-blooming plant. Although found in the surrounding area in sandy habitats, it would not likely be found on the proposed site due to recent mining activities.

Red Needle-Leaf Air Plant (*Tillandsia setacea*)--This epiphyte is listed as threatened by FDA. It is quite common in the central and southern peninsula of Florida. This epiphyte has been observed in nearby forests. The only trees onsite of sufficient size to support this species are within the tributary on the western edge of the proposed site. A close examination of the trees in the tributary yielded no sightings. In some cases, the trees contained dense populations of ball-moss (*Tillandsia recurvata*) and Spanish-moss (*Tillandsia usneoides*); therefore, locating any red needle-leaf air plant was almost impossible.

Shoestring Fern (*Vittaria lineata*)--This epiphytic fern is listed as threatened by FDA. Like golden polypody, it occurs in central and southern peninsula Florida with its northern limit in the upper peninsula determined by freezing temperatures. It is of frequent occurrence and is often found on cabbage palm trunks. The only habitat protected from cold is the forested portion of the tributary along the west edge of the proposed site. No plants were seen, but this species could easily become established from wind-blown spores.

Three listed species of ferns were found within the forested areas of the tributary along the west boundary of the proposed site: cinnamon fern (*Osmunda cinnamomea*), listed as commercially exploited by FDA, hairy maiden fern (*Thelypteris hispidula*), and spreading tri-vein fern (*Thelypteris interrupta*). The latter two ferns are both listed as threatened by FDA. None of these species should be affected by construction because the tributary will be minimally disturbed. All three of these common ferns prefer moist to wet shady conditions. Their airborne spores allow them to occur throughout Florida.

Fauna

There are a number of federal and state listed animal species (Table 2.3.6-10) whose ranges include the site and areas around the site. The following describes those species whose ranges include the site area. The probability of their occurrence is assessed.

Bachman's Sparrow (*Aimophila aestivalis*)--The Bachman sparrow is under review for listing by USFWS but substantial evidence of vulnerability is lacking (C2). It occurs in upland habitat. The likelihood for occurrence is low because of the lack of suitable habitat onsite.

Limpkin (*Aramus guarauna*)--The limpkin is listed as a species of special concern by FGFWFC. It is a wetlands species. The likelihood for occurrence is moderate because of the presence of suitable habitat in the area.

Burrowing Owl (*Athene cunicularia*)--The burrowing owl, listed as a species of special concern by FGFWFC, was not observed during the HPS or the Hardee Unit 3 surveys. Suitable habitat (e.g. ruderal areas such as pasture) is present, but the likelihood of occurrence is low because of past and present mining activities.

Little Blue Heron (*Egretta caerulea*)--The little blue heron is under review for listing by USFWS; however, substantial evidence of vulnerability is lacking (C2), and it is listed as a species of special concern by FGFWFC. It is a wetlands species. The likelihood for occurrence is moderate because of the presence of suitable habitat in the area.

Snowy Egret (*Egretta thula*)--The snowy egret is listed as a species of special concern by FGFWFC. It is a wetlands species. The likelihood for occurrence is moderate because of the presence of suitable habitat in the area.

Tricolor Heron (*Egretta tricolor*)--The tricolor heron is listed as a species of special concern by FGFWFC. It is a wetlands species. The likelihood for occurrence is moderate because of the presence of suitable habitat in the area.

Peregrine Falcon (*Falco peregrinus*)--The peregrine falcon is listed as threatened by USFWS and as endangered by FGFWFC. It is found in upland and wetland habitats. The likelihood of occurrence onsite is low because of development activities associated with the site area.

Southeastern American Kestrel (*Falco sparverius paulus*)--The Southeastern American kestrel is listed as threatened by FGFWFC and is under review for listing by USFWS, but substantial evidence of vulnerability is lacking (C2). Two subspecies of kestrels occur in Florida. Eastern American kestrel is a winter resident only, while the Southeastern American kestrel is a year-round resident occupying upland and wetland habitats. In 1988 and 1989, American kestrels (*Falco sparverius*) were found to be fairly common in the open pasture of the HPS site, but their

subspecies could not be determined. The likelihood of occurrence is low because of the low-quality habitat onsite.

Florida Sandhill Crane (*Grus canadensis pratensis*)--The Florida sandhill crane is listed as threatened by FGFWFC. It is a wetlands and dry prairie species.

Bald Eagle (*Haliaeetus leucocephalus*)--The bald eagle is listed as threatened by FGFWFC and endangered by USFWS. The closest nests are approximately 6.5 km (4 miles) southeast and 8 km (5 miles) north of the Hardee Unit 3 site. Bald eagles utilize open water habitats in the area for feeding. No nesting habitat occurs on the Hardee Unit 3 site. Some of the trees in the wetland tributary onsite may be large enough to be used for occasional roosting sites. The likelihood of occurrence onsite is very low because of the lack of suitable nesting habitat.

Wood Stork (*Mycteria americana*)--Listed as endangered by both FGFWFC and USFWS. Several birds were observed circling overhead during surveys. A rookery occurs several miles north of the site. Nesting habitat does not occur onsite. Suitable feeding habitat (e.g. wetland areas) is present onsite and in the vicinity. The likelihood of occurrence for feeding is considered moderate because of feeding habitats on the HPS site.

Audubon's Crested Caracara (*Polyboros plancus audoboni*)--The crested caracara is listed as threatened by both FGFWFC and USFWS. It was not observed during the 1988 and 1989 surveys, but has been recorded within 4.8 km (3 miles) of the study site, and suitable feeding habitat (e.g., pasture) occurs onsite. The likelihood of occurrence for feeding is considered low because of the development activities on the HPS site.

Florida Long-Tailed Weasel (*Mustela frenata peninsulae*)--The long-tailed weasel is listed as C2 by USFWS, and was not observed. However, mesic hardwood forest along creeks may provide suitable habitat. The likelihood of occurrence onsite is considered low because of the lack of suitable habitat.

Round-Tailed Muskrat (*Neofiber alleni*)--The round-tailed muskrat is listed as under review for listing by USFWS but substantial evidence of vulnerability is lacking (C2). It is found in wetland

habitats, particularly floodplain marshes. The likelihood of occurrence onsite is low because of the development activities associated with the site.

Eastern Indigo Snake (*Drymarchon corais couperi*)--The eastern indigo snake is listed as threatened by both FGFWFC and USFWS. In 1988 and 1989 it was observed in palmetto on lands to be mined and has been reported in other areas within 8 km (5 miles) of study site. The mesic hardwood forest provide suitable habitat. The likelihood of occurrence onsite is low because of lack of suitable habitat.

American Alligator (*Alligator mississippiensis*)--The alligator is listed as threatened due to similarity of appearance by USFWS and listed as a species of special concern by FGFWFC. This species is commonly associated with wetland and freshwater areas and has been seen in the cooling reservoir and in the tributary wetland. The likelihood for occurrence on the Hardee Unit 3 site is high.

In summary, there are a number of federally and state listed plants and animals that are associated with the Hardee Unit 3 site. This is not surprising because of the presence of the adjacent wetland and the presence of these species in the vicinity of the site. The wetland tributary contains one commercially exploited fern species and two threatened species of fern. All three species are common in the area and can reestablish themselves from air-borne spores. A number of wetland dependent animal species have the potential to use the wetland tributary for resting and feeding. These species are also common to the area and use other similar habitats which are found throughout the surrounding region.

2.3.6.2 PRE-EXISTING STRESSES

2.3.6.2.1 Aquatic Systems

Payne Creek is located in an area of extensive phosphate mining. Prior to construction of the HPS site, extensive mining took place north and east of the HPS site on either side of Payne Creek. Since that time reclamation has occurred or is being completed in these areas. Historically, Payne Creek has been altered by ditching of its tributaries for agricultural operations, and, more recently, by the elimination of tributaries as a result of mining.

2.3.6.2.2 Terrestrial Systems

The greatest pre-existing stress to regional vegetation, including the site, is the result of extensive phosphate mining. Not only the vegetation, but the natural topography, soils, and hydrology are extensively altered. Wildlife habitat is disrupted and natural drainage features are modified. Active mining is occurring in the vicinity of the site. Areas surrounding the site have been reclaimed. Reclamation land uses consist predominantly of pasture, lakes, and wetlands.

Agriculture is another industry influencing natural vegetation and wildlife in the area. Agriculture is likely to be the dominant industry when mining operations are complete. Cattle ranching and citrus and vegetable farming are the major agricultural enterprises (TPS/SECI, 1989).

2.3.6.3 MEASUREMENT PROGRAMS

2.3.6.3.1 Aquatic Ecology

The baseline aquatic ecology program was designed to characterize the surface waters which may be potentially impacted by inputs of cooling reservoir discharges and stormwater runoff from the proposed plant. This program supplemented the biological data collected during the certification of the HPS (TPS/SECI, 1989). Because sufficient baseline aquatic ecology data were collected for the HPS existing units to characterize Payne Creek and associated tributaries, additional baseline monitoring was not conducted. Site reconnaissances of Payne Creek were made in October and November 1993 to verify the relative health of the stream ecosystem as compared to conditions in the 1988 study.

2.3.6.3.2 Terrestrial Ecology

The site has been mined, reclaimed, and the HPS existing units built. Therefore, site reconnaissances were made on October and November 1993 to confirm floral and faunal present, as well as listed species as described in the previous study (TPS/SECI, 1989).

Jurisdictional wetland boundaries were flagged in the fall of 1993 and confirmed by SWFWMD, FDEP, and USACE in February 1994 (see supplemental wetland information in Appendix 10.1.4).

Table 2.3.6-1. Characterization of Ecological Assemblages of Fishes Collected in Upper Payne Creek in 1988 and 1989

Scientific Name	Common Name	Ecological Assemblages		
		Vegetation	Open Water	Benthic
<i>Elassoma evergladei</i>	Everglades pygmy sunfish	X		
<i>Fundulus chrysotus</i>	Golden topminnow	X		
<i>Fundulus seminolis</i>	Seminole killifish	X		
<i>Gambusia holbrooki</i>	Mosquito fish	X		
<i>Heterandria formosa</i>	Least killifish	X		
<i>Jordanella floridae</i>	Flagfish	X		
<i>Lepisosteus platyrinchus</i>	Florida gar	X		
<i>Lucania goodei</i>	Bluefin killifish	X		
<i>Poecilia latipinna</i>	Sailfin molly	X		
<i>Lepomis gulosus</i>	Warmouth	X	X	
<i>Lepomis macrochirus</i>	Bluegill	X	X	
<i>Lepomis marginatus</i>	Dollar sunfish	X	X	
<i>Lepomis microlophus</i>	Redear sunfish	X	X	
<i>Lepomis punctatus</i>	Spotted sunfish	X	X	
<i>Labidesthes sicculus</i>	Brook silverside		X	
<i>Notemigonus crysoleucas</i>	Golden shiner		X	
<i>Notropis emiliae</i>	Pugnose minnow		X	
<i>Notropis petersoni</i>	Coastal minnow		X	
<i>Clarias batrachus</i>	Walking catfish			X
<i>Etheostoma fusiforme</i>	Swamp darter			X
<i>Ictalurus natalis</i>	Yellow bullhead			X
<i>Noturus gyrinus</i>	Tadpole madtom			X

Sources: TPS/SECI, 1989.
KBN, 1994.

Table 2.3.6-2. Density, Diversity, and Number of Taxa of Macroinvertebrates Collected from Payne Creek Using Artificial Substrates During October/November 1988 and February/March 1989

	October/November 1988			February/March 1989		
	PC-1	PC-2	PC-3	PC-1	PC-2	PC-3
Density ^a	14,296	23,247	^b	31,821	23,385	7,006
Diversity	3.62	3.14	^b	2.74	3.58	4.11
Number of Taxa	32	39	^b	34	39	38
<u>Percent Composition</u>						
Ephemeroptera	5	2	^b	<1	4	8
Chironomidae	64	89	^b	80	91	81
Mollusca	<1	<1	^b	<1	2	4
Other	30	8	^b	18	3	7

^a Per square meter.

^b Samples vandalized.

Source: TPS/SECI, 1989.

Table 2.3.6-3. Density, Diversity, and Number of Taxa of Macroinvertebrates Collected from Payne Creek by Ponar Grab Samples in October 1988 and February 1989

	October/November 1988			February/March 1989		
	PC-1	PC-2	PC-3	PC-1	PC-2	PC-3
Density ^a	13,090	12,090	3,636	27,270	26,906	2,818
Diversity	3.38	4.50	2.07	4.02	4.14	3.75
Number of Taxa	35	47	11	32	35	18
<u>Percent Composition</u>						
Oligochaeta	28	12	61	14	6	19
Ephemeroptera	8	20	<1	3	5	1
Chironomidae	7	21	11	52	61	74
Mollusca	47	38	26	13	7	1
Other	10	9	1	18	21	5

^a Per square meter.

Source: TPS/SECI, 1989.

Table 2.3.6-4. Macroinvertebrates Collected in Qualitative Dip Net Samples from Payne Creek During October 1988 and February 1989 (Page 1 of 2)

Scientific Name	Common Name	October 1988			February 1989		
		PC-1	PC-2	PC-3	PC-1	PC-2	PC-3
<i>Turbellaria</i>	Flatworm		F	F			
<i>Prostoma rubrum</i>	Proboscis worm			P			
Lumbriculidae	Aquatic earthworm						P
Tubificidae	Aquatic earthworm		P	P			
Hirunidea	Aquatic earthworm						P
<i>Batrachobdella phalera</i>	leech	P		P			
<i>Hyaella azteca</i>	Scud	F	C	C		F	C
Gammaridae	Scud	P					
Cambarinae	Crayfish		C	P		F	
<i>Palaenometes paludosus</i>	Shrimp	P	C	AA	C	C	AA
Perlidae	Stonefly		P				
<i>Baetis</i> sp.	Mayfly	A	F				
<i>Callibaetis floridanus</i>	Mayfly			F			
<i>Pseudocloeon alachua</i>	Mayfly						P
<i>Caenis diminuta</i>	Mayfly	A		P			
<i>Stenacron interpunctatum</i>	Mayfly	F		C			
<i>Stenonema</i> spp.	Mayfly		P				
<i>S. exiguum</i>	Mayfly				F		
<i>Chloroterpes hubbelli</i>	Mayfly		F				
<i>Tricorythodes albilineatus</i>	Mayfly				P		
<i>Hetaerina</i> sp.	Damselfly						F
<i>Argia sedula</i>	Damselfly				F	P	F
<i>Anomalagrion hastatum</i>	Damselfly					F	
<i>Nehalennia</i> sp.	Damselfly	A		P	F	P	F
Aeschnidae	Dragonfly			P			
<i>Gomphus minutus</i>	Dragonfly		P		P		
<i>Hagenius brevistypus</i>	Dragonfly				P		
<i>Brachymesia gravida</i>	Dragonfly	F			P	F	
<i>Macromia</i> sp.	Dragonfly		P			F	F
<i>M. taeniolata</i>	Dragonfly				F	F	
<i>Cheumatopsyche</i> sp.	Caddisfly	AA			AA		
<i>Hydropsyche</i> sp.	Caddisfly						F
Hydroptilidae	Caddisfly						
<i>Cyrnellus</i> sp.	Caddisfly		F				
<i>Polycentropus</i> sp.	Caddisfly			P		F	
Homoptera	True bug			P			
<i>Pelocoris</i> sp.	True bug			F			
<i>Ranatra</i> sp.	True bug					C	F
Lepidoptera	Aquatic Caterpillar		F	P		F	F
Chrysomelidae	Weevil beetle		F				
<i>Dubiraphia</i> sp.	Riffle beetle	C					
<i>Heterelmis vulnerata</i>	Riffle beetle	P				P	
<i>Stenelmis fusca</i> group	Riffle beetle						
Gyrinidae	Whirligid beetle	F					
<i>Dineutus</i> sp. (larvae)	Whirligid beetle	F					P

Table 2.3.6-4. Macroinvertebrates Collected in Qualitative Dip Net Samples from Payne Creek During October 1988 and February 1989 (Page 2 of 2)

Scientific Name	Common Name	October 1988			February 1989		
		PC-1	PC-2	PC-3	PC-1	PC-2	PC-3
Halipidae	Crawling beetle		F	C			
Helodida	Beetle			P	C	F	
Noteridae	Burrowing water beetle						F
Ceratopogonidae	Biting midges						
Chironomidae	Midges	AA	AA	AA	AA	AA	A
<i>Simulium</i> sp.	Blackflies						P
Stratiomyidae	Soldier flies			F			
Tabanidae	Horseflies		F				
Tipulidae	Crane flies			P		P	
<i>Laevipex floridana</i>	Limpet		P	P			
<i>Pseudosuccinea columella</i>	Pond snail		P				
<i>Planorbella scalaris</i>	Mesa rams-horn	P		P			
<i>Pomacea paludosa</i>	Apple snail			P			P
<i>Corbicula fluminea</i>	Asiatic clam		F		P	F	P

Note: AA = very abundant (>20 organisms).
 A = abundant (11 to 20 organisms).
 C = common (6 to 10 organisms).
 F = few (2 to 5 organisms).
 P = present (1 organism).

Source: TPS/SECI, 1989.

Table 2.3.6-5. Plant Species^a Abundance in Payne Creek Floodplain at the HPS Site
(number of plots = 4)

Stratum/Species	Abundance Measurements			
	Total Basal Area (cm ² /m ²)	Average Basal Area (cm ²)	Total Density per m ²	Importance Value ^b (%)
Trees				
<i>Quercus laurifolia</i>	15,652	711.5	22	82.4
<i>Liquidambar styraciflua</i>	1,074	214.8	5	11.2
<i>Fraxinus caroliniana</i>	50	25.1	2	3.1
<i>Quercus nigra</i>	77	76.9	1	1.7
<i>Persea borbonia</i>	23	22.9	1	1.6
Total	42.5		.08	
.....				
Shrubs Layer		Total Density	Frequency	Importance Value ^c (%)
<i>Serenoa repens</i>		57	100	32.6
<i>Smilax bona-nox</i>		47	50	22.5
<i>Baccharis glomeruliflora</i>		13	75	14.4
<i>Smilax auriculata</i>		23	50	14.4
<i>Liquidambar styraciflua</i>		5	75	11.6
<i>Quercus laurifolia</i>		3	25	4.5
Total		1.5		
.....				
Ground Layer		Percent Cover per m ² plot	Frequency	Importance Value ^d (%)
<i>Panicum rigidulum</i>		80	25	39.1
<i>Urena lobata</i>		50	25	29.1
<i>Acer rubrum</i>		10	25	15.9
<i>Pteridium aquilinum</i>		10	25	15.9

^a See Table 2.3.5-1 for common name.^b Importance value of trees = (Relative Basal Area + Relative Density) ÷ 2.^c Importance value of shrub layer = (Relative Density + Relative Frequency) ÷ 2.^d Importance value of ground layer = (Relative Percent Cover + Relative Frequency) ÷ 2.

Table 2.3.6-6. Mammal Species Observed or Which Potentially Occur in the Vicinity of the HPS Site

Common Name	Scientific Name	Mesic Hardwoods	Pasture	Upland Oak-Palmetto
Opossum	<i>Didelphis virginiana</i>	P	P	P
Least shrew	<i>Cryptotis parva</i>			
Shorttail shrew	<i>Blarina brevicauda</i>	P	P	P
Eastern mole	<i>Scalopus aquaticus</i>		P	P
Big brown bat	<i>Eptesicus fuscus</i>	P	P	P
Seminole bat	<i>Lasiurus seminolus</i>	P	P	P
Eastern yellow bat	<i>Lasiurus intermedius</i>	P	P	P
Evening bat	<i>Nycticeius humeralis</i>	P	P	P
Eastern big-eared bat	<i>Plectotus rafinesquei</i>		P	P
Mexican free-tailed bat	<i>Tadarida brasiliensis</i>		P	P
Black bear	<i>Ursus brasiliensis</i>	P		P
Raccoon	<i>Procyon lotor</i>	O		P
Longtail weasel ^a	<i>Mustela frenata</i>	P		
Mink	<i>Mustela vison</i>	P		
River otter	<i>Lutra canadensis</i>	O		
Spotted skunk	<i>Spilogale putorius</i>	P		P
Striped skunk	<i>Mephitis mephitis</i>	P		P
Gray fox	<i>Urocyon cinereoargenteus</i>	P	P	P
Bobcat	<i>Lynx rufus</i>	O	P	P
Eastern gray squirrel	<i>Sciurus carolinensis</i>	O		O
Eastern fox squirrel	<i>Sciurus niger</i>	P		P
Southern flying squirrel	<i>Glaucomys volans</i>	P		
Southeastern pocket gopher	<i>Geomys pinetis</i>		P	P
Eastern harvest mouse	<i>Reithrodontomys humulus</i>		P	
Cotton mouse	<i>Peromyscus gossypinus</i>	P		
Florida mouse	<i>Peromyscus floridanus</i>		P	P
Eastern woodrat	<i>Neotoma floridana</i>	P	P	P
Rice rat	<i>Oryzomys palustris</i>	P		
Hispid cotton rat	<i>Sigmodon hispidus</i>		P	P
Round-tailed muskrat ^a	<i>Neofiber alleni</i>	P		
Eastern cottontail	<i>Sylvilagus floridanus</i>	P	P	P
Marsh rabbit	<i>Sylvilagus palustris</i>	P		
White-tailed deer	<i>Odocoileus virginianus</i>	P	P	P
Armadillo	<i>Dasypus novemcinctus</i>	O	O	O
Wild hog	<i>Sus scrofa</i>	O	O	O

Note: O = observed on the site.

P = potentially occurring on the site.

^a Listed species. See Table 2.3.6-10.

Source: TPS/SECI, 1989.

Table 2.3.6-7. Birds Observed or Which Potentially Occur in the Vicinity of the HPS Site (Page 1 of 2)

Common Name	Scientific Name	Forested Wetlands	Pasture	Upland Oak-Palmetto	Water Bodies	Seasonal Status ^a
Double-Crested Cormorant	<i>Phalacrocorax auritus</i>				P	P
White Pelican	<i>Pelecanus erythrorhynchos</i>				P	W
Limpkin ^b	<i>Aramus guarauna</i>	P			P	R
Little Blue Heron ^b	<i>Egretta caerulea</i>	P			O	R
Snowy Egret ^b	<i>Egretta thula</i>	P			O	R
Tricolored Heron ^b	<i>Egretta tricolor</i>	P			P	R
Florida Sandhill Crane ^b	<i>Grus canadensis pratensis</i>	P	P		O	R
Wood Stork ^b	<i>Mycteria americana</i>	P			O	R
Killdeer	<i>Charadrius vociferus</i>		O			RW
Red-Shouldered Hawk	<i>Buteo lineatus</i>	O	O	P		R
Red-Tailed Hawk	<i>Buteo jamaicensis</i>	P	O	P		R
American Kestrel ^b	<i>Falco sparverius</i>	P	O			RW
Peregrine Falcon ^b	<i>Falco peregrinus</i>	P	P		P	W
Bald Eagle ^b	<i>Haliaeetus leucocephalus</i>	P			O	R
Black Vulture	<i>Coragyps atratus</i>	P	P	P	O	RW
Audubon's Crested Caracara ^b	<i>Polyborus plancus</i>		P			R
Burrowing Owl ^b	<i>Athene cunicularia floridana</i>					R
Northern Bobwhite	<i>Colinus virginianus</i>	O	P	P		RW
Belted Kingfisher	<i>Megasceryle alcyon</i>	O				W
Red-Bellied Woodpecker	<i>Melanerpes carolinus</i>	O	O	P		R
Downy Woodpecker	<i>Picoides pubescens</i>	O	O	O		R
Pileated Woodpecker	<i>Dryocopus pileatus</i>	O				R
Yellow-Bellied Sapsucker	<i>Sphyrapicus varius</i>	O		P		W
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	O				S
Eastern Phoebe	<i>Sayornis phoebe</i>	O				W
Tree Swallow	<i>Iridoprocne bicolor</i>	O		O		R
Blue Jay	<i>Cyanocitta cristata</i>	O	O	O		R
Tufted Titmouse	<i>Parus bicolor</i>	O		O		R
Carolina Wren	<i>Thyrothorus ludovicianus</i>	O		P		R
House Wren	<i>Troglodytes aedon</i>	O	O			W
Ruby Crowned Kinglet	<i>Regulus calendula</i>	O		O		W
Blue-Gray Gnatcatcher	<i>Polioptila caerulea</i>	O		O		RW
Brown Thrasher	<i>Toxostoma rufum</i>	O				R
Northern Mockingbird	<i>Mimus polyglottos</i>	O	O	P		R
Gray Catbird	<i>Dumetella carolinensis</i>	O	O			W

Table 2.3.6-7. Birds Observed or Which Potentially Occur in the Vicinity of the HPS Site (Page 2 of 2)

Common Name	Scientific Name	Forested Wetlands	Pasture	Upland Oak-Palmetto	Water Bodies	Seasonal Status ^a
Loggerhead Shrike	<i>Lanius ludovicianus</i>		O			R
White-Eyed Vireo	<i>Vireo griseus</i>	O	O			R
Black-and-White Warbler	<i>Mniotilta varia</i>	O				W
Yellow-Throated Warbler	<i>Dendroica dominica</i>	O				W
Yellow-Rumped Warbler	<i>Dendroica coronata</i>	O				W
Palm Warbler	<i>Dendroica palmarum</i>	O	O	P		W
Common Yellowthroat	<i>Geothlypis trichas</i>	O				R
Red-Winged Blackbird	<i>Agelaius phoeniceus</i>		O			R
Eastern Meadowlark	<i>Sturnella magna</i>		O			R
Northern Cardinal	<i>Cardinalis cardinalis</i>	O		O		R
Rufous-Sided Towhee	<i>Pipilo erythrophthalmus</i>	O	P	P		RW
Henslows Sparrow	<i>Ammodramus henslowii</i>		O			W
Bachman's sparrow ^b	<i>Aimophila aestivalis</i>		P			R

Note: O = observed on the site.

P = potentially occurring on the site.

^a Seasonal Status:

W = winter resident.

S = summer resident.

R = year-round resident.

RW = resident in area but numbers augmented by wintering birds from the north.

^b Listed species. See Table 2.3.6-10.

Source: TPS/SECI, 1989.

Table 2.3.6-8. Terrestrial Reptiles and Amphibians Observed or Which Potentially Occur in the Vicinity of the HPS Site (Page 1 of 2)

Common Name	Scientific Name	Mesic Hardwoods	Open Pine- Pasture	Upland Oak-Palmetto
Eastern coachwhip	<i>Masticophis flagellum</i>	P	P	P
Florida pine snake	<i>Pituophis melaneucus mugitus</i>			P
Yellow rat snake	<i>Elaphe obsoleta quadrivittata</i>	P		P
Corn snake	<i>Elaphe guttata guttata</i>	P	P	P
Florida scarlet snake	<i>Cemophora coccinea coccinea</i>		P	P
Scarlet king snake	<i>Lampropeltis triangulum elapsoides</i>			P
Florida king snake	<i>Lampropeltis getulus floridana</i>	P		
Short-tailed snake	<i>Stilosoma extenuatum</i>			P
Peninsula crowned snake	<i>Tantilla relicta</i>	P		P
Eastern Indigo snake ^a	<i>Drymarchon corais couperi</i>	P		P
Florida cottonmouth	<i>Agkistrodon piscivorous conanti</i>	P		
Dusky pygmy rattlesnake	<i>Sistrurus miliaris barbouri</i>	P	P	
Eastern diamondback rattlesnake	<i>Crotalus adamanteus</i>	P	P	P
Eastern coral snake	<i>Micrurus fulvius fulvius</i>	P	P	P
Southern dusky salamander	<i>Desmognathus auriculatus</i>	P		
Slimy salamander	<i>Plethodon glutinosus</i>	P		
Dwarf salamander	<i>Eurycea quadridigitata</i>	P		
Eastern spadefoot toad	<i>Scaphiopus holbrookii</i>		P	P
Eastern narrowmouth toad	<i>Gastrophyrne carolinensis</i>	P		
Southern toad	<i>Bufo terrestris</i>	P	P	P
Oak toad	<i>Bufo quericus</i>	P	P	P
Florida box turtle	<i>Terrepene carolina bauri</i>	P	P	
Gopher tortoise	<i>Gopherus polyphemus</i>	P	P	P
American alligator ^a	<i>Alligator mississippiensis</i>	O		
Green anole	<i>Anolis carolinensis</i>	O		P
Southern fence lizard	<i>Sceloperus undulatus undulatus</i>	P		P
Ground skink	<i>Scincella laterale</i>	P		P
Southeastern five-lined skink	<i>Eumeces inexpectatus</i>	P		P
Peninsula mole skink	<i>Eumeces egregius onocrepis</i>		P	P
Six-line race runner	<i>Cnemidophorus sexlineatus</i>		P	P
Eastern glass lizard	<i>Ophisaurus ventralis</i>	P	P	
Island glass lizard	<i>Ophisaurus compressus</i>		P	P
Slender glass lizard	<i>Ophisaurus attenuatus</i>		P	
Worm lizard	<i>Rhineura floridana</i>		P	P
Florida green water snake	<i>Nerodia cyclopian floridana</i>	P		
Brown water snake	<i>Nerodia taxispilota</i>	P		
Florida water snake	<i>Nerodia sipedon pictiventris</i>	P		
Florida brown snake	<i>Storeria dekayi victa</i>	P		P
Eastern garter snake	<i>Thamnophis sirtalis</i>	P		
Peninsula ribbon snake	<i>Thamnophis sauritus</i>	P		
Pine woods snake	<i>Rhadinaea flavilata</i>	P		
Florida red-bellied snake	<i>Storeria occipitomaculata</i>	P	P	
Eastern hognose snake	<i>Heterodon platyrhinos</i>		P	P
Southern hognose snake	<i>Heterodon simus</i>		P	P
Southern ringneck snake	<i>Diadophis punctatus</i>	P		
Rough green snake	<i>Opheodrys aestivus</i>	P		
Southern black racer	<i>Colaber constrictor priapus</i>	P	P	P
Barking treefrog	<i>Hyla gratiosa</i>	P		

Table 2.3.6-8. Terrestrial Reptiles and Amphibians Observed or Which Potentially Occur in the Vicinity of the HPS Site (Page 2 of 2)

Common Name	Scientific Name	Mesic Hardwoods	Open Pine- Pasture	Upland Oak-Palmetto
Green treefrog	<i>Hyla cinerea</i>	O		
Squirrel treefrog	<i>Hyla squirella</i>	P		
Pine woods treefrog	<i>Hyla femoralis</i>	P		
Florida chorus frog	<i>Psuedracris negrita verrucosa</i>	P		
Bullfrog	<i>Rana catesbeiana</i>	O		
Pig frog	<i>Rana grylio</i>	P		
Southern leopard frog	<i>Rana sphenoccephala</i>	O		
Florida gopher frog	<i>Rana areolat aesopus</i>	P		

Note: O = observed on the site.

P = potentially occurring on the site.

* Listed species. See Table 2.3.6-10.

Source: TPS/SECI, 1989.

Table 2.3.6-9. Threatened and Endangered Plant Species Potentially Occurring on or Near the Hardee Unit 3 Site

Scientific Name	Common Name	Status ^a		General Habitat Association	Probability of Occurrence ^b
		USFWS	FDA		
<i>Habenaria repens</i>	Water spider orchid		T	Wetlands	M
<i>Hartwrightia floridana</i>	Hartwrightia	C2	T	Marsh grassland or boggy swales Blooms Sept-Nov	L
<i>Phlebodium aureum</i>	Golden polypody		T	Epiphytic in hammocks	M
<i>Pteroglossapsis ecristata</i>	Wild coco	C2	T	Dry sandy pinelands Blooms in Fall	L
<i>Tillandsia setacea</i>	Red needle-leaf air plant		T	Epiphytic in hammocks	M
<i>Vittaria lineata</i>	Shoestring fern		T	Epiphytic in hammocks	M
<i>Osmunda cinnamomum</i>	Cinnamon fern		CE	Moist, shady forests	P
<i>Thelypteris hispidula</i>	Hairy maiden fern		T	Moist, shady forests	P
<i>Thelypteris interrupta</i>	Spreading tri-vein fern		T	Moist, shady forests	P

Note: FDA = Florida Department of Agriculture and Consumer Services.
USFWS = U.S. Fish and Wildlife Service.

^a Status: C2 = under review for listing by USFWS, but substantial evidence of biological vulnerability and/or threat is lacking.
CE = commercially exploited.
T = threatened.

^b Probability of occurrence onsite:
L = low probability of presence.
M = moderate probability of presence.
P = present on site.

Source: KBN, 1994.

Table 2.3.6-10. Federal and State Listed Animal Species Occurring or Potentially Occurring On or Near the Hardee Unit 3 Site

Scientific Name Common Name	Status ^a		General Habitat Association	Probability of Occurrence ^b
	USFWS	FGFWFC		
<u>Bird</u>				
<i>Aimophila aestivalis</i> Bachman's sparrow	C2		Upland	L
<i>Aramus guarana</i> limpkin		SSC	Wetland	M
<i>Athene cunicularia floridana</i> burrowing owl		SSC	Upland	L
<i>Egretta caerulea</i> little blue heron	C2	SSC	Wetland	M
<i>Egretta thula</i> snowy egret		SSC	Wetland	M
<i>Egretta tricolor</i> tricolored heron		SSC	Wetland	M
<i>Falco peregrinus</i> peregrine falcon	T	E	Upland Wetland Freshwater	L
<i>Falco sparverius paulus</i> Southeastern American kestrel	C2	T	Upland Wetland	L
<i>Grus canadensis pratensis</i> Florida sandhill crane		T	Upland Wetland	L
<i>Haliaeetus leucocephalus</i> bald eagle	E	T	Upland Wetland Freshwater	L
<i>Mycteria americana</i> wood stork	E	E	Wetland	M
<i>Polyborus plancus</i> Audubon's crested caracara	T	T	Upland Wetland	L
<u>Mammal</u>				
<i>Mustela frenata peninsulae</i> Florida long-tailed weasel	C2		Upland Wetland	L
<i>Neofiber alleni</i> round-tailed muskrat	C2		Wetland	L
<u>Reptile</u>				
<i>Drymarchon corais couperi</i> Eastern Indigo snake	T	T	Upland Wetland	L
<i>Alligator mississippiensis</i> American alligator	TSA	SSC	Wetland Freshwater	H

Note: FGFWFC = Florida Game and Fresh Water Fish Commission.
USFWS = U.S. Fish and Wildlife Service.

^a Status: C2 = under review.
E = endangered.
SSC = species of special concern.
T = threatened.
TSA = threatened due to similarity of appearance.

^b Probability of Occurrence:
H = high probability.
L = low probability.
M = moderate probability.

2.3.6-29

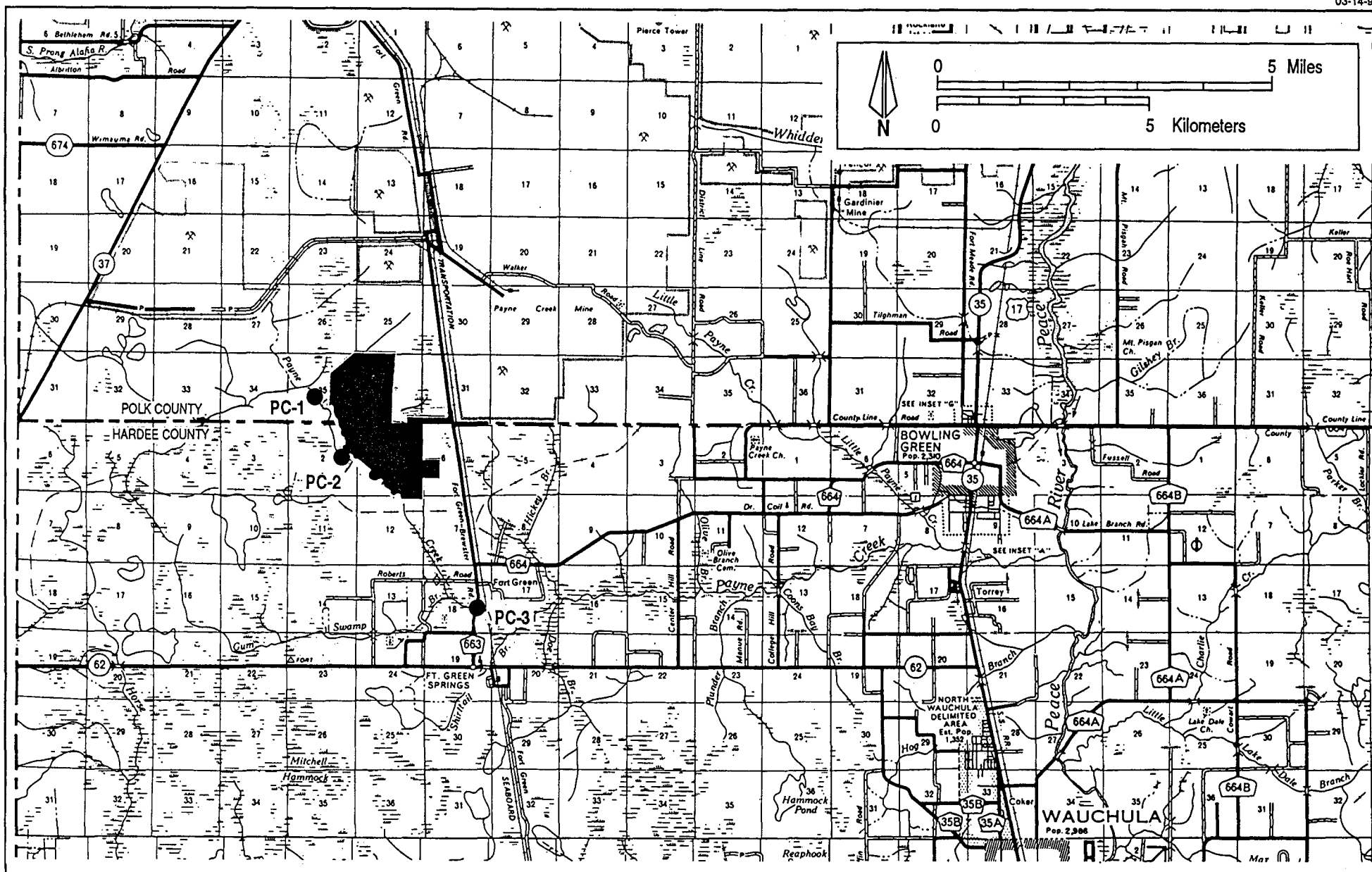


Figure 2.3.6-1
Aquatic Ecology Sampling Station Locations

Source: TPS/SECI, 1989.



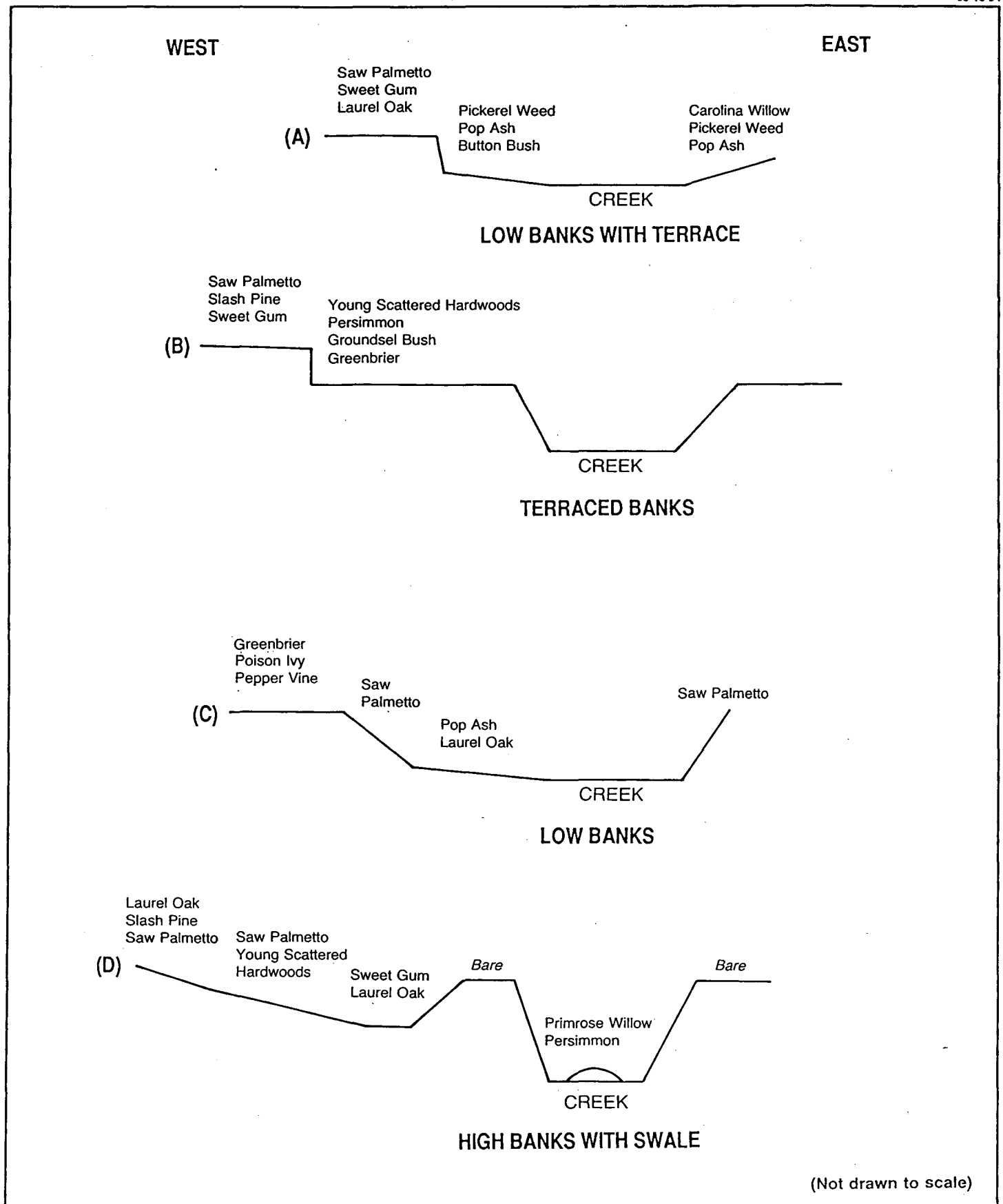


Figure 2.3.6-2
Generalized Relationship of Plant Species to Payne Creek Floodplain
Configurations

Source: TPS/SECI, 1989.



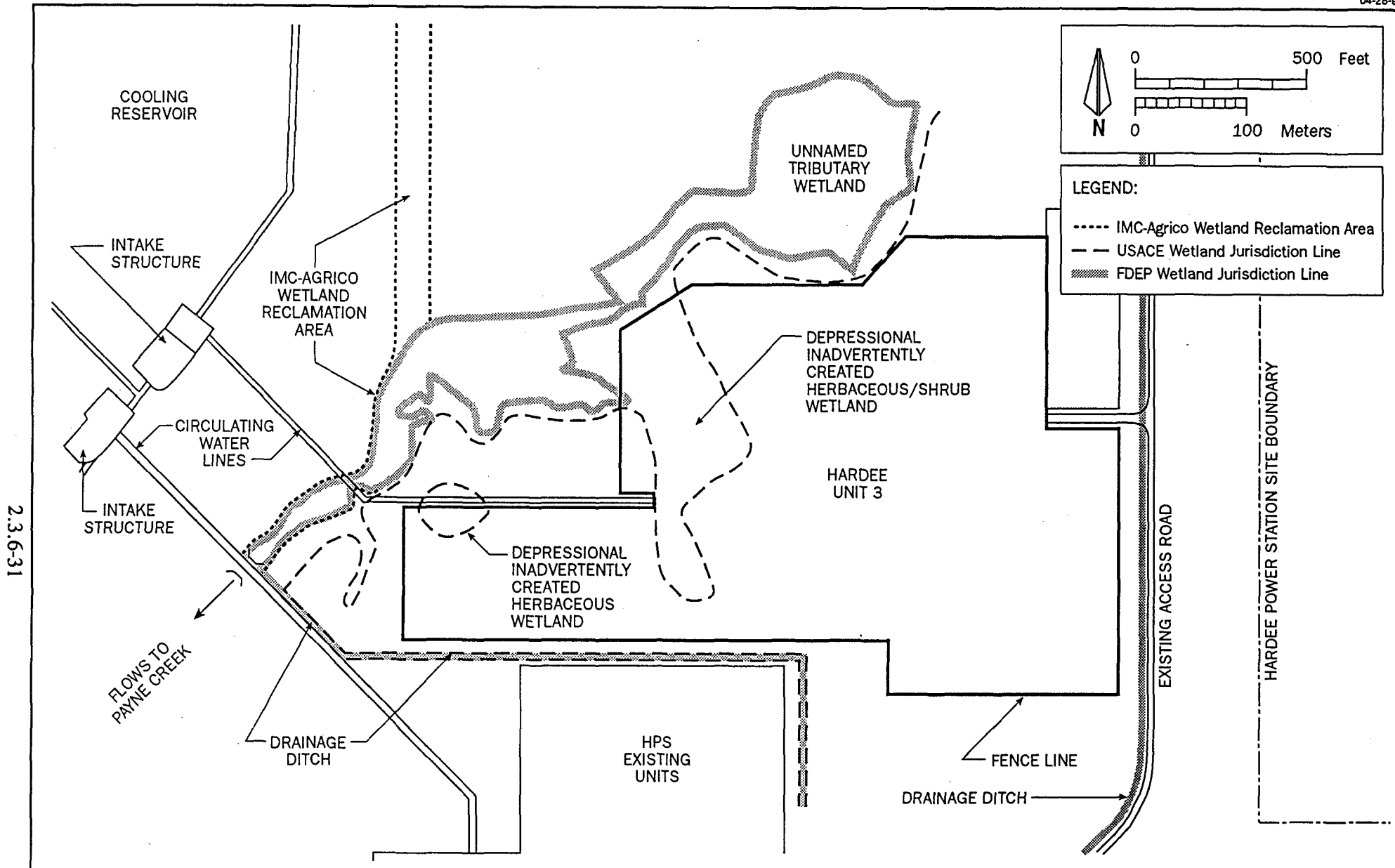


Figure 2.3.6-3
Location of Jurisdictional Wetlands

Source: KBN, 1994.

2.3.7 METEOROLOGY AND AMBIENT AIR QUALITY

2.3.7.1 METEOROLOGY

The meteorological data collected at existing monitoring stations were used to describe the local and regional climatology in the vicinity of the proposed Hardee Unit 3 Project. The closest existing meteorological station to the HPS site with complete meteorological data is the primary National Weather Service (NWS) station located at the Tampa International Airport situated approximately 67 km (42 miles) to the west-northwest of the proposed plant site. NWS has recorded weather observations for more than 40 years at this site, and these data are the most complete for and representative of the region surrounding the proposed 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.

2.3.7.1.1 Temperature

The climate in the Tampa area, including the project site, is subtropical with a marine influence from the Gulf of Mexico. Temperature means and extremes for Tampa are presented in Table 2.3.7-1. The mean annual temperature is approximately 22°C (72°F) with monthly temperatures varying from a maximum of 32.2°C (90.0°F) to a minimum of 10.7°C (51.3°F). Record extreme temperatures range from a low of -7.8°C (18°F) to a record high of 37°C (99°F). Although the sun's elevation is nearly zenith during the summertime, temperatures do not exceed 38°C (100°F). The reason can be attributed to the high relative humidities with subsequent cloud cover formation and the abundant convective-type precipitation.

2.3.7.1.2 Relative Humidity and Precipitation

Relative humidities, which indicate the amount of moisture in the air at a given temperature, are presented in Table 2.3.7-2 for the morning hours of 0100 and 0700 and early afternoon and evening hours of 1300 and 1900. The highest humidities are coincident with the coolest ambient temperatures, which generally occur at 0700, or near dawn. The lowest humidities coincide with the highest ambient temperatures.

Precipitation means and extremes are also presented in Table 2.3.7-2. Approximately 69 percent of the annual precipitation falls during the 6 warmest months, May through October. The mean annual precipitation is approximately 122 cm (48 inches), but this has varied from as little as

74 cm (29 inches) to over 193 cm (76 inches) in the past 46 years. The majority of rain is in the form of short-lived convection showers.

2.3.7.1.3 Wind Patterns

The Tampa area lies entirely within the trade wind belt (i.e., below 30°N latitude), resulting in predominant winds from the east. However, because of the location of the Gulf of Mexico, moderate to strong late afternoon sea breezes occur on days with strong land heating producing local onshore winds (i.e., wind with a westerly component). Annual and seasonal wind roses for the 5-year period from 1982 through 1986 are given in Figures 2.3.7-1 and 2.3.7-2. A summary of the average wind speeds for each season and throughout the year, including calm conditions, is presented in Table 2.3.7-3.

2.3.7.1.4 Atmospheric Stability

Atmospheric stability is a measure of the atmosphere's capability to disperse pollutants. During the daytime with strong insolation, the atmosphere can disperse pollutants very quickly for a relatively short period of time. This condition is considered as very unstable and generally occurs infrequently during the year. During the nighttime under clear skies and light wind speeds, the atmosphere is considered stable with minimal potential to disperse pollutants. Under moderate to high wind speeds, pollutants are dispersed at moderate rates under neutral conditions, which are generally more prevalent throughout the year and can occur any time throughout the day.

The seasonal and annual average occurrences of atmospheric stability classes are shown in Table 2.3.7-4.

During the summer months, unstable stability occurs nearly 40 percent of the time due to strong insolation, whereas unstable stability 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 in this season. The occurrence of stable stability is nearly uniform throughout the year, with a maximum occurrence of approximately 47 percent in the fall.

2.3.7.1.5 Mixing Height

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.

The seasonal and annual average morning and afternoon mixing depths for Tampa determined using the Holzworth method are listed in Table 2.3.7-5. The highest afternoon mixing depths occur in the spring and the lowest morning depths occur in mid-winter.

2.3.7.1.6 Severe Storms

Thunderstorms are the most frequent of severe storms, occurring an average of 87 days per year. These storms occur throughout the year, but about 88 percent occur from May through October.

In the 80-km (50-mile) coastal strip from above Pinellas County to Tampa Bay, there is less than a 10 percent chance that a tropical storm will pass over the Bay area during any given year. For storms of hurricane strength [i.e., wind speeds exceeding 117 km/hr (73 mph)], the chance decreases to 1 in 16 (i.e., 6.2 percent) with a 1 percent chance that the winds will be greater than 200 km/hr (124 mph) (i.e., wind speeds of a great hurricane).

Statistics compiled by the Severe Local Storms (SELS) branch of the National Severe Storms Forecast Center (Pautz, 1969) show that 42 tornadoes were spotted within the 1° latitude by 1° longitude square centered just south of the Tampa area from 1955 to 1967. This averages approximately two tornadoes per year. The tornado recurrence interval for any specific point location within the 1° square was estimated by the methodology of Thom (1963) to be 740 years. Therefore, the mean recurrence interval for a tornado striking a point within this square is 740 years. The most common tornado month is June.

2.3.7.2 AMBIENT AIR QUALITY

2.3.7.2.1 Ambient Standards

The existing applicable 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.

Hardee County is classified as an attainment area for all criteria pollutants. Adjacent counties, such as Polk County, are also classified as attainment areas for all criteria pollutants. The nearest nonattainment areas to the project site are Hillsborough and Pinellas counties, which are classified as nonattainment for ozone, and a portion of Pinellas County, which is classified as nonattainment for lead.

Prevention of significant deterioration (PSD) review is used to determine whether significant air quality deterioration will result from the new or modified source located in attainment areas. Under federal PSD review requirements, all major new or modified sources of air pollutants regulated under the Clean Air Act (CAA) must be reviewed and approved by EPA or an agency delegated with PSD review authority. In Florida, FDEP has been delegated PSD review authority by EPA.

In promulgating the 1977 CAA Amendments, Congress specified that certain increases above an air quality *baseline concentration* level of sulfur dioxide (SO₂) and particulate matter (PM) 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 an impact. Three classifications were designated based on criteria established in the CAA Amendments. Initially, Congress promulgated areas as either Class I [international parks, national wilderness areas, and memorial parks larger than 2,024 ha (5,000 acres), and national parks larger than 2,428 ha (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 NO_x emissions and established PSD increments for NO₂ concentrations. The EPA class designations and allowable PSD increments are presented in Table 2.3.7-7. Florida has adopted the EPA allowable increments for PM, SO₂, and NO₂. On June 3, 1993, EPA promulgated regulations to establish PSD increments for PM with an aerodynamic diameter of 10 micrometers (μm) or less (PM₁₀). These regulations become effective 1 year from the promulgation date or earlier if adopted by Florida; Florida has not yet adopted these regulations.

The term *baseline concentration* evolves from federal and state PSD regulations and denotes a fictitious concentration level corresponding to specified baseline data and certain additional baseline sources. By definition in the PSD regulations, as amended August 7, 1980, baseline concentration means the ambient concentration level which exists in the baseline area at the time of the applicable baseline date. A baseline concentration is determined for each pollutant for which a baseline date is established and includes:

1. The actual emissions representative of sources in existence on the applicable baseline date; and
2. The allowable SO₂ and PM emissions of major stationary sources which commenced construction before January 6, 1975 and NO_x emissions before February 8, 1988 but were not in operation by the applicable baseline date.

The following emissions are not included in the baseline concentration and therefore affect PSD increment consumption:

1. Actual SO₂ and PM emissions from any major stationary source on which construction commenced after January 6, 1975 and NO_x emissions before February 8, 1988; and
2. Actual emission increases and decreases at any stationary source occurring after the baseline date.

Baseline date means the earliest date after August 7, 1977 for SO₂, total suspended particulate (TSP), and PM₁₀ concentrations and February 8, 1988 for NO₂ concentrations, on which the first complete application under 40 CFR 52.21 is submitted by a major stationary source or major modification subject to the requirements of 40 CFR 52.21.

2.3.7.2.2 Ambient Air Quality Data

FDEP has approved an exemption from PSD ambient air quality monitoring for this project. The request was made in the Environmental Licensing Plan of Study (KBN, 1993) and FDEP approved the monitoring exemption in October 1993 (FDEP, 1993). The exemption is appropriate because:

1. The facility's impacts of applicable pollutants are expected to be below the *de minimis* impact levels for certain pollutants (e.g. CO, NO₂). For those pollutants, an exemption from monitoring is available under FDEP rules [17-2.500(3)(e) F.A.C.] for impacts less than *de minimis* impact levels;

2. For those pollutants above the *de minimis* impact levels (i.e., SO₂ and PM10), existing ambient data collected by FDEP, Tampa Electric Company, and FPC are representative of air quality at the project site; and
3. The air dispersion modeling and monitoring analyses for the HPS, proposed to operate at a 660-MW capacity (currently permitted for 295 MW), was exempt from performing preconstruction monitoring. For that project, ambient data collected by FDEP were used to satisfy the preconstruction monitoring requirements. Since the proposed project will have lower emissions and impacts than those considered for HPS, preconstruction monitoring is not warranted since baseline conditions have essentially remained the same since the HPS was originally permitted.

FDEP operates a statewide ambient air monitoring network with monitoring stations nearest to the project site located in Polk County. The network in Polk County consists of several monitoring stations that measure SO₂ and O₃ concentrations. Ambient SO₂ concentrations are measured at monitoring stations located in Mulberry, approximately 28 km (17 miles) from the project site, and in Nichols, located approximately 24 km (15 miles) from the project site. Ambient O₃ concentrations are measured at two monitoring stations, both located in Lakeland, approximately 33 km (21 miles) and 43 km (27 miles) from the project site.

Over the last several years, ambient data have been collected in the vicinity of the site by Tampa Electric Company and FPC. A 1-year program was conducted by Tampa Electric Company at two sites located approximately 10 km (6 miles) to the north of the project site. Ambient SO₂, PM10, and O₃ concentrations were measured from April 1991 through March 1992. A 1-year program was conducted by FPC at one site located approximately 23 km (14 miles) to the northeast of the project site. Ambient SO₂, PM10, and O₃ concentrations were measured from October 1991 through October 1992.

Summaries of observed SO₂, PM10, and O₃ concentrations measured at these stations from 1990 through 1992 are given in Tables 2.3.7-8 through 2.3.7-10.

The SO₂, PM10, and O₃ concentrations observed at these stations are within national and state AAQS. Because these monitors are located in more developed areas and/or in proximity [i.e.,

within 10 km (6.2 miles)] of major sources, the observed concentrations are considered to be higher than those expected to occur at the proposed facility site.

Given the rural nature of the site, existing concentrations of other criteria pollutants, i.e., carbon monoxide (CO), NO₂, and lead (Pb), which are usually associated with an urban environment, should be well below the AAQS.

2.3.7.2.3 Existing Air Pollutant Sources

The proposed plant location is in a rural area with minimal number of air pollution sources. The major source near the site is the HPS existing units located adjacent to the proposed site. The HPS existing units consist of a combined cycle unit (two CTs, associated HRSG, and steam turbine) and simple cycle unit (one CT) with a maximum permitted capacity of 295 MW. Other major air pollution sources are located within 15 km (9 miles) from the site in Polk County. These sources are mainly phosphate rock mining and beneficiation plants. Air pollutant emissions from these sources, in the form of fugitive dusts, are not significant.

Major sources that are proposed for the area include the Tampa Electric Company's Polk Power Station, located approximately 10 kilometers (km) (6 miles) to the north, and Florida Power Corporation's Polk County site, located approximately 19 km (12 miles) to the northeast of the site. The Tampa Electric Company's facility will consist of an integrated coal gasification combined cycle project with maximum electrical generating capacity of 260 MW. The FPC facility will initially consist of four combined cycle generating units with an electrical generating capacity of 470 MW. Both of these proposed facilities have undergone review in the SCA process; the SCAs were approved in January 1994 by the Site Certification Board, which consists of the Governor and State Cabinet.

Because SO₂ and PM concentrations were determined to be significant due to emissions from Hardee Unit 3 (see Section 5.6), a detailed review was conducted to determine SO₂ and PM emission sources located within 55 km (34 miles) of the proposed source. Based on emission data developed by FDEP from previous air permit applications, the major facilities located within 55 km (34 miles) of the site that have SO₂ or PM emissions greater than 20 tons per year (TPY) are presented in Tables 2.3.7-11 and 2.3.7-12, respectively.

Additional major emission sources located more than 55 km (34 miles) from the proposed source were also identified and considered in the air quality modeling analyses.

2.3.7.2.4 Background Concentrations

Background concentrations are air quality concentrations due to air pollutant sources not explicitly accounted for in the air modeling analysis. Because the site is located near very few major sources of SO₂ or PM emissions, background concentrations are expected to be low. As a result, existing monitoring data are used to estimate background concentrations. The ambient data are collected in areas that are more industrialized and have higher emission densities than the proposed site. Therefore, the estimated background concentrations are considered to be conservative (i.e., higher concentrations than actually exist at the proposed plant site).

For SO₂ concentrations, data collected in 1992 by FDEP during the periods that TECO and FPC conducted their monitoring programs were reviewed and used in estimating background concentrations. During these monitoring programs, the highest 3-hour, 24-hour, and annual average concentrations were 256, 50, and 11 µg/m³, respectively (see Table 2.3.7-8). These concentrations were assumed to represent background concentrations.

Similar to the SO₂ concentrations, the PM₁₀ background concentrations were derived from data collected in 1992 by FDEP during the periods that TECO and FPC conducted their monitoring programs. Based on the data review, the highest 24-hour and annual average concentrations of 70 and 20 µg/m³ were assumed to represent background concentrations.

2.3.7.3 MEASUREMENT PROGRAMS

Since the proposed Hardee Unit 3 was exempted by FDEP from ambient air quality monitoring, all information (i.e., meteorology and air quality data) were compiled from offsite monitoring stations maintained and operated by cooperating governmental agencies or from FDEP-approved PSD monitoring programs operated by other air permit applicants. Ambient air quality data were obtained from FDEP which operates ambient air monitoring stations in Polk County. No significant changes in these programs are anticipated after Hardee Unit 3 goes into commercial operation.

Meteorological data were obtained from the NWS surface stations in Tampa and upper-air station in Ruskin. These data were obtained for a 5-year period from 1982 through 1986 from which the joint frequency of wind direction, wind speed, and atmospheric stability and a 5-year average of mixing heights were developed. Since 1965, the wind sensors have been located 6.7 m (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.

Table 2.3.7-1. Temperature Means and Extremes (°F) Measured at Tampa International Airport

Month	Daily Temperatures ^a			Extremes ^b	
	Mean	Maximum	Minimum	Maximum	Minimum
January	60.8	70.2	51.3	86	21
February	62.2	71.7	52.7	88	24
March	66.7	76.2	57.2	91	29
April	71.4	81.1	61.7	93	40
May	77.0	86.4	67.5	98	49
June	80.8	89.2	72.4	99	53
July	82.0	89.8	74.1	97	63
August	82.1	90.0	74.1	98	67
September	80.6	88.6	72.6	96	57
October	74.7	83.3	66.0	94	40
November	67.3	76.7	57.9	90	23
December	62.0	71.5	52.6	86	18
Annual	72.3	81.2	63.4	99	18

Note: °C = 5/9 (°F-32)

^a 30-year period of record, 1963 to 1992.

^b 46-year period of record, 1947 to 1992.

Source: NOAA, 1992.

Table 2.3.7-2. Precipitation and Diurnal Relative Humidity Measured at Tampa International Airport

Month	Precipitation (inches)			Humidity ^c (%) hour (LT)			
	Mean ^a	Maximum ^b	Minimum ^b	0100	0700	1300	1900
January	2.21	8.02	T	85	86	59	73
February	2.77	7.95	0.21	83	86	56	69
March	3.02	12.64	0.06	83	87	55	67
April	2.00	6.59	T	82	87	51	62
May	3.05	17.64	0.10	82	86	52	62
June	6.79	13.75	1.86	84	87	60	69
July	7.67	20.59	1.65	86	88	63	73
August	7.95	18.59	2.35	87	90	64	76
September	6.48	13.98	1.28	87	91	62	75
October	2.60	7.36	0.09	86	89	57	72
November	1.65	6.12	T	86	88	57	74
December	2.02	6.66	0.07	85	87	59	74
Annual	48.20	76.57	28.89	85	88	58	71

Note: LT = local time.

T = trace amount.

inches x 2.540 = cm.

^a 30-year period of record, 1963 to 1992.^b 46-year period of record, 1947 to 1992.^c 29-year period of record, 1964 to 1992.

Source: NOAA, 1992.

Table 2.3.7-3. Wind Direction and Wind Speed Measured at Tampa International Airport^a

Season	Average Wind Speed (mph)	Calm (%)	Prevailing Wind	
			Direction	Average Wind Speed (mph)
Winter	7.9	6.7	East-northeast, East	7.6 7.9
Spring	8.3	6.4	East	8.4
Summer	6.4	10.2	East	6.4
Fall	7.2	7.0	East-northeast	7.7
Annual	7.5	7.6	East	7.6

Note: mph x 1.6093 = km/hr.

^a 5-year period of record, 1982 to 1986.

Source: NOAA, 1986.

Table 2.3.7-4. Occurrences of Atmospheric Stability Classes Determined at Tampa International Airport^a

Season	Occurrence (%) of Stability Class					
	Very Unstable	Moderately Unstable	Slightly Unstable	Neutral	Slightly Stable	Moderately Stable
Winter	0.0	3.8	12.2	42.6	16.7	24.6
Spring	0.8	10.7	17.3	29.6	15.8	25.7
Summer	3.5	17.2	17.4	17.9	15.8	28.2
Fall	0.6	9.3	16.1	26.6	18.3	29.0
Annual	1.2	10.3	15.8	29.1	16.7	26.9

^a 5-year period of record, 1982 to 1986.

Source: NOAA, 1986.

Table 2.3.7-5. Morning and Afternoon Mixing Heights Determined at Tampa International Airport^a

Season	Mixing Height (m)	
	Morning	Afternoon
Winter	464	1,041
Spring	562	1,500
Summer	760	1,428
Fall	565	1,305
Annual	588	1,320

^a 5-year period of record, 1982 to 1986.

Source: NOAA, 1986.

Table 2.3.7-6. National and State of Florida Ambient Air Quality Standards (AAQS)

Pollutant	Averaging Time	AAQS ($\mu\text{g}/\text{m}^3$)		
		National		State of Florida
		Primary Standard	Secondary Standard	
Particulate Matter (PM10)	Annual Arithmetic Mean	50	50	50
	24-Hour Maximum ^a	150	150	150
Sulfur Dioxide	Annual Arithmetic Mean	80	NA	60
	24-Hour Maximum ^b	365	NA	260
	3-Hour Maximum ^b	NA	1,300	1,300
Carbon Monoxide	8-Hour Maximum ^b	10,000	NA	10,000
	1-Hour Maximum ^b	40,000	NA	40,000
Nitrogen Dioxide	Annual Arithmetic Mean	100	100	100
Ozone	1-Hour Maximum ^a	235	235	235
Lead	Calendar Quarter	1.5	1.5	1.5

Note: NA = not applicable.

PM10 = particulate matter with an aerodynamic diameter $\leq 10 \mu\text{m}$.

$\mu\text{g}/\text{m}^3$ = micrograms per cubic meter.

^a Maximum concentration not to be exceeded more than an average of 1 calendar day per year.

^b Maximum concentration not to be exceeded more than once per year.

Sources: 40 CFR, Parts 50 and 52.

Florida Administrative Code (F.A.C.), Chapter 17-2.

Table 2.3.7-7. Federal and State of Florida PSD Allowable Increments

Pollutant/Averaging Time	Allowable Increment ($\mu\text{g}/\text{m}^3$)		
	Class I	Class II	Class III
Particulate Matter (TSP)			
Annual Geometric Mean	5	19	37
24-Hour Maximum ^a	10	37	75
Particulate Matter (PM10) ^c			
Annual Arithmetic Mean	4	17	34
24-Hour Maximum ^a	8	30	60
Sulfur Dioxide			
Annual Arithmetic Mean	2	20	40
24-Hour Maximum ^a	5	91	182
3-Hour Maximum ^a	25	512	700
Nitrogen Dioxide ^b			
Annual Arithmetic Mean	2.5	25	50

Note: PM10 = particulate matter with an aerodynamic diameter less than or equal to 10 μm .
TSP = total suspended particulate.

^a Maximum concentration not to be exceeded more than once per year.

^b Not yet adopted by the State of Florida.

^c Final regulations were promulgated in Federal Register, 58 FR 31622, June 3, 1993; become effective one year after promulgation date or earlier if adopted by State of Florida.

Source: 40 CFR Part 52, Section 52.21.
Florida Administrative Code, Chapter 17-2.

Table 2.3.7-8. Ambient SO₂ Concentrations for Air Monitoring Stations Located Within 55 km of the Hardee Unit 3 Project—1990 to 1992

Location		Site Number	UTM Coordinates (km) ^a		Period		Number of Observations	Concentration (µg/m ³)				
City	County		East	North	Year	Months		3-Hour		24-Hour		Annual
Mulberry	Polk	2860-006-F02	405.5 (1°; 28.3 km)	3086.0	1992	January-December	8,655	256	151	39	38	10
					1991	February-December	7,118	203	176	42	40	12
Nichols	Polk	3680-010-F02	399.5 (347°; 24.2 km)	3081.3	1992	January-December	8,205	213	183	50	48	11
					1991	January-December	8,542	179	167	67	58	10
					1990	January-December	8,612	341	252	66	62	9
Lakeland	Polk	2160-004-F02	412.75 (9°; 51.4 km)	3108.5	1991	January-January	252	31	16	7	5	3
					1990	January-December	8,683	122	122	42	27	5
Homeland ^b	Polk	3680-037-J02	418.7 (36°; 23.1 km)	3076.35	1992	January-October	6,040	170	161	42	42	7
					1991	October-December	1,657	72	49	31	29	6
Nichols ^c	Polk	3680-036-J01	400.1 (330°; 9.8 km)	3066.2	1992	January-March	1,920	199	—	42	—	10
					1991	April-December	5,694	202	136	42	40	8

^a Relative location to proposed Hardee Unit 3 east and north UTM coordinates (km) of 405.0 and 3057.7, respectively, given in parentheses.^b Monitoring station from Florida Power Corporation's Polk County site.^c Monitoring station from Tampa Electric Company's Polk Power Station site.

Sources: FDEP, 1990, 1991, 1992. KBN, 1994.

Table 2.3.7-9. Ambient PM10 Concentrations for Air Monitoring Stations Located Within 55 km of the Hardee Unit 3 Project--1991 to 1992

Location		Site Number	UTM Coordinates (km) ^a		Period		Number of Observations	Concentration ($\mu\text{g}/\text{m}^3$)		
City	County		East	North	Year	Months		24-Hour		Annual
Homeland ^b	Polk	3680-037-J02	418.7 (36°; 23.1 km)	3076.35	1992	January-October	46	70	44	20
					1991	October-December	13	38	24	17
Homeland ^b	Polk	3680-037-J09	418.7 (36°; 23.1 km)	3076.35	1992	January-October	42	60	42	20
Nichols ^c	Polk	3680-035-J01	401.1 (338°; 10.5 km)	3067.4	1992	January-March	16	28	20	14
					1991	March-December	26	43	34	18
Nichols ^c	Polk	3680-036-J01	400.1 (330°; 9.8 km)	3066.2	1992	January-March	16	30	26	14
					1991	March-December	30	48	45	19

^a Relative location to proposed Hardee Unit 3 east and north UTM coordinates (km) of 405.0 and 3057.7, respectively, given in parentheses.

^b Monitoring station from Florida Power Corporation's Polk County site.

^c Monitoring station from Tampa Electric Company's Polk Power Station site.

Sources: FDEP, 1990, 1991, 1992. KBN, 1994.

Table 2.3.7-10. Ambient O₃ Concentrations for Air Monitoring Stations Located Within 55 km of the Hardee Unit 3 Project--1991 to 1992

Location		Site Number	UTM Coordinates (km) ^a		Period		Number of Observations	Concentration [ppm (μg/m ³)]	
City	County		East	North	Year	Months		1-Hour	
								1st	2nd
Lakeland	Polk	2160-005-G01	401.588	3090.755	1992	June-December	4,678	0.098 (192)	0.082 (161)
			(354°; 33.2 km)						
Lakeland	Polk	2160-006-G01	404.435	3100.652	1992	June-December	4,360	0.108 (212)	0.107 (210)
			(359°; 43.0 km)						
Homeland ^b	Polk	3680-037-J02	418.7	3076.35	1992	January-October	6,525	0.095 (186)	0.095 (186)
			(36°; 23.1 km)		1991	October-December	1,845	0.076 (149)	0.076 (149)
Nichols ^c	Polk	3680-036-J01	400.1	3066.2	1992	January-March	1,911	0.075 (147)	—
			(330°; 9.8 km)		1991	April-December	5,911	0.098 (192)	0.096 (188)

^a Relative location to proposed Hardee Unit 3 east and north UTM coordinates (km) of 405.0 and 3057.7, respectively, given in parentheses.

^b Monitoring station from Florida Power Corporation's Polk County site.

^c Monitoring station from Tampa Electric Company's Polk Power Station site.

Sources: FDEP, 1990, 1991, 1992. KBN, 1994.

Table 2.3.7-11. SO₂ Emission Sources (>20 TPY) Within 55 km of the Hardee Unit 3 Project (Page 1 of 2)

Facility Name	Coordinates Relative to Hardee Unit 3 ^a						Maximum Allowable Emissions ^b (TPY)
	UTM Coordinates (km)		Cartesian (km)		Polar		
	East	North	X	Y	Distance (km)	Direction (degrees)	
TPS Hardee Power Station (295 MW) ^c	404.8	3057.3	-0.2	-0.4	0.4	207	2,412
TECO - Polk Power Station ^c	402.5	3067.4	-2.5	9.7	10.0	345	2,010
Imperial Phosphate (Brewer) ^c	404.8	3069.5	-0.2	11.8	11.8	359	275
Gardinier Fort Meade	415.3	3063.3	10.3	5.6	11.7	61	1,173
IMC-Agrico Chem - S. Pierce ^c	407.5	3071.3	2.5	13.6	13.8	10	4,377
Mobil Mining - Big Four Mine ^c	394.8	3067.7	-10.2	10.0	14.3	314	589
U.S. Agri-Chemicals Ft. Meade ^c	416.0	3069.0	11.0	11.3	15.8	46	3,438
Central Florida Power	416.2	3069.2	11.2	11.5	16.1	46	38
City of Wauchula	418.4	3047.0	13.4	-10.7	17.1	129	180
FPC - Polk ^c	414.3	3073.9	9.3	16.2	18.7	30	859
Farmland Industries Green Bay ^c	409.5	3079.5	4.5	21.8	22.3	12	4,087
IMC Agrico Chem- New Wales ^c	396.6	3078.9	-8.4	21.2	22.8	338	13,921
Mulberry Cogeneration ^c	413.6	3080.6	8.6	22.9	24.5	21	464
IMC Agrico Chem - Noralyn Mine	414.7	3080.3	9.7	22.6	24.6	23	505
CF Industries Bartow - Bonnie Mine Road ^c	408.4	3082.4	3.4	24.7	24.9	8	4,982
Kaplan Industries	418.3	3079.3	13.3	21.6	25.4	32	398
American Orange Corp.	429.8	3047.3	24.8	-10.4	26.9	113	198
IMC Agrico/Conserve Nichols ^c	398.4	3084.2	-6.6	26.5	27.3	346	1,593
Mulberry Phosphates (Royster) ^c	406.8	3085.1	1.8	27.4	27.6	4	2,013
Geologic Recovery	401.8	3085.8	-3.2	28.1	28.3	354	98
Mobil Mining -Nichols ^c	398.4	3085.3	-6.6	27.6	28.4	347	2,304
Cargill/Seminole Fertilizer Bartow ^c	409.8	3087.0	4.8	29.3	29.7	9	5,000
IMC Fertilizer - Prairie	402.9	3087.0	-2.1	29.3	29.4	356	109
Orange Co.	418.7	3083.6	13.7	25.9	29.3	28	26
Imperial/Pavex Corp - W Bartow	413.0	3086.2	8.0	28.5	29.6	16	75
FPL - Manatee	367.2	3054.1	-37.8	-3.6	38.0	265	83,351
Laidlaw Env. Services	424.7	3091.9	19.7	34.2	39.5	30	240
Consolidated Minerals Plant City	393.8	3096.3	-11.2	38.6	40.2	344	809
Citrus Hill	447.9	3068.3	42.9	10.6	44.2	76	411
Cargill Citro-America	447.9	3068.3	42.9	10.6	44.2	76	223
Ridge Cogeneration ^c	416.7	3100.4	11.7	42.7	44.3	15	480
Lakeland City Power Larsen ^c	409.2	3102.8	4.2	45.1	45.2	5	5,024
TECO - Big Bend ^c	361.9	3075.0	-43.1	17.3	46.4	292	237,854
FPL-Avon Park	451.4	3050.5	46.4	-7.2	47.0	99	67
Macasphalt Winter Haven	423.1	3101.5	18.1	43.8	47.4	22	48

Table 2.3.7-11. SO₂ Emission Sources (>20 TPY) Within 55 km of the Hardee Unit 3 Project (Page 2 of 2)

Facility Name	Coordinates Relative to Hardee Unit 3 ^a						Maximum Allowable Emissions ^b (TPY)
	UTM Coordinates (km)		Cartesian (km)		Polar		
	East	North	X	Y	Distance (km)	Direction (degrees)	
Cargill/Gardinier Riverview ^c	363.4	3082.4	-41.6	24.7	48.4	301	5,872
Lakeland City Power McIntosh ^c	408.5	3105.8	3.5	48.1	48.2	4	30,567
Auburndale Cogen ^c	420.8	3103.3	15.8	45.6	48.3	19	222
Owens-Brockway	423.4	3102.8	18.4	45.1	48.7	22	120
Coca Cola Auburndale	421.6	3103.7	16.6	46.0	48.9	20	709
Adams Packing Auburndale	421.1	3104.2	16.1	46.5	49.2	19	94
SFE Processing	421.7	3104.2	16.7	46.5	49.4	20	188
Hillsborough RRF ^c	368.2	3092.7	-36.8	35.0	50.8	314	771
CLM/Pacific Chloride	361.8	3088.3	-43.2	30.6	52.9	305	702
TECO - Gannon	360.0	3087.5	-45.0	29.8	54.0	304	93,265
Gulf Coast Lead	364.0	3093.5	-41.0	35.8	54.4	311	1,498
Alcoma Packing	451.6	3085.5	46.6	27.8	54.3	59	327
Additional Sources Outside 55 km Considered in Modeling Analysis							
Lafarge Corp.	357.7	3090.6	-47.3	32.9	57.6	305	20,293
TECO - Hookers Point	358.0	3091.0	-47.0	33.3	57.6	305	13,524
FPC - Bartow	342.4	3082.6	-62.6	24.9	67.4	292	62,618
FPC - Higgins	336.5	3098.4	-68.5	40.7	79.7	301	19,619
FPC - Intercession City ^c	446.3	3126.0	41.3	68.3	79.8	31	17,667

Note: Screening area of 55 km for the proposed unit is based on the project's estimated significant impact distance of 5 km plus 50 km.

^a Proposed Hardee Unit 3 east and north UTM coordinates (km): 405.0 and 3057.7.

^b Generally based on the facility's maximum hourly emission rate for entire year.

^c A PSD increment-consuming source is located at this facility.

Source: KBN, 1994.

Table 2.3.7-12. Particulate Matter (PM) Emission Sources Within 55 km of the Hardee Unit 3 Project (Page 1 of 4)

Facility Name	Coordinates Relative to Hardee Unit 3 ^a						Maximum Allowable Emissions ^b (TPY)
	UTM Coordinates (km)		Cartesian (km)		Polar		
	East	North	X	Y	Distance (km)	Direction (degrees)	
TPS Hardee Power Station (295 MW) ^c	404.8	3057.3	-0.2	-0.4	0.4	207	33
TECO Polk	402.5	3067.4	-2.5	9.7	10.0	346	438
Gardinier Fort Meade	415.3	3063.3	10.3	5.6	11.7	61	132
Imperial Phosphate (Brewer) ^c	404.8	3069.5	-0.2	11.8	11.8	359	162
IMC-Agrico Chemical South Pierce ^c	407.5	3071.3	2.5	13.6	13.8	10	858
Mobil Big Four Mine	394.8	3067.7	-10.2	10.0	14.3	314	68
US Agri-Chemicals Fort Meade ^c	416.0	3069.0	11.0	11.3	15.8	46	1,066
Central Florida Power	416.2	3069.2	11.2	11.5	16.1	46	47
Florida Privatization Inc	418.3	3048.0	13.3	-9.7	16.5	126	281
City of Wachula	418.4	3047.0	13.4	-10.7	17.1	129	21
Estech/Swift	411.5	3074.2	6.5	16.5	17.7	22	311
FPC-POLK ^c	414.3	3073.9	9.3	16.2	18.7	30	149
Estech-Duette Phosphate Mine	388.9	3047.2	-16.1	-10.5	19.2	237	751
IMC Kingsford	398.2	3075.7	-6.8	18.0	19.2	339	417
IMC-Agrico Chemical Co Pierce ^c	403.7	3079.0	-1.3	21.3	21.3	357	841
C & M Products Co	405.5	3079.1	0.5	21.4	21.4	1	162
Farmland Industries Green Bay Plant ^c	409.5	3079.5	4.5	21.8	22.3	12	503
IMC-Agrico New Wales	396.6	3078.9	-8.4	21.2	22.8	338	1,427
Ewell Ind Bonnie Mine Rd	407.7	3080.9	2.7	23.2	23.4	7	96
Mulberry Cogeneration ^c	413.6	3080.6	8.6	22.9	24.5	21	70
IMC-Agrico Noralyn Mine	414.7	3080.3	9.7	22.6	24.6	23	1,690
Ridge Pallets Inc	419.1	3078.1	14.1	20.4	24.8	35	96
CF Industries Bartow Bonnie Mine Road ^c	408.4	3082.4	3.4	24.7	24.9	8	1,748
Bio-Medical Service Corp of GA	413.9	3081.3	8.9	23.6	25.2	21	46
IMC/Uranium Recovery CF Industries ^c	408.4	3082.8	3.4	25.1	25.3	8	1,212
Kaplan Industries	418.3	3079.3	13.3	21.6	25.4	32	53
American Orange Corp	429.8	3047.3	24.8	-10.4	26.9	113	181
Orange Cogen ^c	414.8	3083.0	9.8	25.3	27.1	21	44
IMC-Agrico/Conserve Nichols ^c	398.4	3085.2	-6.6	26.5	27.3	346	1,598
Mulberry Phosphates (Royster)	406.8	3085.1	1.8	27.4	27.6	4	1,394
Kaiser Aluminum	408.3	3085.5	3.3	27.8	28.0	7	106
Mobil Mining & Minerals Nichols	398.4	3085.3	-6.6	27.6	28.4	347	991
Orange Co of Florida	418.7	3083.6	13.7	25.9	29.3	28	119
IMC Fertilizer Prairie	402.9	3087.0	-2.1	29.3	29.4	356	288
Purina Mills	402.0	3087.0	-3.0	29.3	29.5	354	88
Pavex	413.0	3086.2	8.0	28.5	29.6	16	44

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Table 2.3.7-12. Particulate Matter (PM) Emission Sources Within 55 km of the Hardee Unit 3 Project (Page 2 of 4)

Facility Name	Coordinates Relative to Hardee Unit 3 ^a						Maximum Allowable Emissions ^b (TPY)
	UTM Coordinates (km)		Cartesian (km)		Polar		
	East	North	X	Y	Distance (km)	Direction (degrees)	
Cargill/Seminole Fertilizer ^c	409.8	3087.0	4.8	29.3	29.7	9	544
Ridge Pallets Inc.	418.6	3084.1	13.6	26.4	29.7	27	165
US Agri-Chemicals Bartow ^c	413.2	3086.3	8.2	28.6	29.8	16	444
Florida Rock Industries	416.8	3085.8	11.8	28.1	30.5	23	57
Ewell Ind S Florida Ave	406.3	3092.9	1.3	35.2	35.2	2	348
All Sun Products	413.5	3093.8	8.5	36.1	37.1	13	318
FPL - Manatee	367.2	3054.1	-37.8	-3.6	38.0	265	40,765
Manatee Scrap Processing	366.9	3053.8	-38.1	-3.9	38.3	264	108
Sun Pac Foods	422.7	3092.6	17.7	34.9	39.1	27	62
Lykes Pasco Packing	412.4	3096.5	7.4	38.8	39.5	11	48
Consolidated Minerals Inc Plant City	393.8	3096.3	-11.2	38.6	40.2	344	749
Pavers Incorporated	414.0	3098.2	9.0	40.5	41.5	13	479
Schering Berlin Polymers	410.7	3098.9	5.7	41.2	41.6	8	30
Rinker Cencon Corp	412.4	3099.0	7.4	41.3	42.0	10	159
Quikrete of Florida	412.8	3099.0	7.8	41.3	42.0	11	253
Zipperer S. Agape Mortuary Services	363.0	3064.7	-42.0	7.0	42.6	279	21
Florida M&M	362.2	3066.2	-42.8	8.5	43.6	281	21
Alumax Extrusions	385.6	3097.0	-19.4	39.3	43.8	334	172
Ero Industries	427.5	3095.6	22.5	37.9	44.1	31	33
Citrus Hill Mfg	447.9	3068.3	42.9	10.6	44.2	76	66
Florida Brick & Clay Co	384.9	3097.1	-20.1	39.4	44.2	333	26
Ridge Cogeneration ^c	416.7	3100.4	11.7	42.7	44.3	15	414
Union Camp Corp	402.0	3102.0	-3.0	44.3	44.4	356	47
Amcon Concrete	364.0	3075.0	-41.0	17.3	44.5	293	39
Erly Juice Inc	399.0	3101.8	-6.0	44.1	44.5	352	117
Florida Tile	405.4	3102.4	0.4	44.7	44.7	1	309
C-Cure of Florida	386.0	3098.7	-19.0	41.0	45.2	335	21
Lakeland City Power Larsen ^c	409.2	3102.8	4.2	45.1	45.3	5	107
Monier Roof Tile	414.0	3102.5	9.0	44.8	45.7	11	44
Driggers Concrete	360.0	3065.9	-45.0	8.2	45.7	280	21
Palm Harbor Homes	391.8	3101.5	-13.2	43.8	45.7	343	22
Vigoro Industries	427.9	3097.4	22.9	39.7	45.8	30	136
Westcon	375.3	3092.8	-29.7	35.1	46.0	320	21
TECO Big Bend ^c	361.9	3075.0	-43.1	17.3	46.4	292	6,014
Citrus World	441.0	3087.3	36.0	29.6	46.6	51	601

Table 2.3.7-12. Particulate Matter (PM) Emission Sources Within 55 km of the Hardee Unit 3 Project (Page 3 of 4)

Facility Name	Coordinates Relative to Hardee Unit 3 ^a						Maximum Allowable Emissions ^b (TPY)
	UTM Coordinates (km)		Cartesian (km)		Polar		
	East	North	X	Y	Distance (km)	Direction (degrees)	
IMC-Agrico Chemical Big Bend	362.1	3076.1	-42.9	18.4	46.7	293	195
Macasphalt	423.1	3101.5	18.1	43.8	47.4	22	70
Florida Rock Industry	365.8	3085.0	-39.2	27.3	47.8	305	21
Lakeland City Power McIntosh ^c	408.5	3105.8	3.5	48.1	48.2	4	15,151
Auburndale Cogeneration ^c	420.8	3103.3	15.8	45.6	48.3	19	161
Florida Mining & Materials Alabama Lane	420.8	3103.4	15.8	45.7	48.4	19	40
Cargill/Gardiner Fertilizer Riverview	363.4	3082.4	-41.6	24.7	48.4	301	880
Owens-Brockway Glass Container	423.4	3102.8	18.4	45.1	48.7	22	189
Packaging Corp of America	423.4	3102.8	18.4	45.1	48.7	22	38
Coca Cola	421.6	3103.7	16.6	46.0	48.9	20	387
Adams Packing Association	421.1	3104.2	16.1	46.5	49.2	19	144
Eger Concrete Lake Ida & 5th St	428.1	3102.0	23.1	44.3	50.0	28	49
S I Lime Co Division of Longview Lime	362.9	3084.7	-42.1	27.0	50.0	303	48
R C Martin Concrete Products	368.6	3092.1	-36.4	34.4	50.1	313	28
Graves Enterprises Riverview	363.1	3085.3	-41.9	27.6	50.2	303	350
The Florida Brewery	422.8	3104.7	17.8	47.0	50.3	21	121
Hillsborough Co Resource Recovery	368.2	3092.7	-36.8	35.0	50.8	314	172
John Carlos Florida	426.2	3104.1	21.2	46.4	51.0	25	29
Reed Minerals Division	362.2	3085.5	-42.8	27.8	51.0	303	70
Eastern Electric Apparatus Repair Cp	366.6	3092.0	-38.4	34.3	51.5	312	21
Southeastern Galvanizing Division	368.5	3094.5	-36.5	36.8	51.8	315	21
City of Tampa Dept.	364.0	3089.5	-41.0	31.8	51.9	308	48
Kearney Development Company	368.7	3094.8	-36.3	37.1	51.9	316	21
Gaylord Container Corp	366.3	3092.3	-38.7	34.6	51.9	312	108
Southeastern Wire	368.3	3094.5	-36.7	36.8	52.0	315	21
GAF Building Materials Corp	362.2	3087.2	-42.8	29.5	52.0	305	57
Florida Rock Industries	428.0	3105.2	23.0	47.5	52.8	26	55
Leisey Shell Corp	352.7	3064.8	-52.3	7.1	52.8	278	20
Nitram	362.5	3089.0	-42.5	31.3	52.8	306	218
GNB Inc (PAC CHL)	361.8	3088.3	-43.2	30.6	52.9	305	25
Paktank Florida	360.8	3087.3	-44.2	29.6	53.2	304	178
Amcon Products	364.6	3092.8	-40.4	35.1	53.5	311	32
Florida Steel Corp	364.6	3092.8	-40.4	35.1	53.5	311	144
Bay Concrete	365.1	3093.8	-39.9	36.1	53.8	312	37
IMC Port Sutton Terminal	360.1	3087.5	-44.9	29.8	53.9	304	442

Table 2.3.7-12. Particulate Matter (PM) Emission Sources Within 55 km of the Hardee Unit 3 Project (Page 4 of 4)

Facility Name	Coordinates Relative to Hardee Unit 3 ^a						Maximum Allowable Emissions ^b (TPY)
	UTM Coordinates (km)		Cartesian (km)		Polar		
	East	North	X	Y	Distance (km)	Direction (degrees)	
TECO Gannon	360.0	3087.5	-45.0	29.8	54.0	304	5,855
Florida Mega-Mix	364.5	3093.4	-40.5	35.7	54.0	311	22
CSX Transportation Inc	361.0	3089.0	-44.0	31.3	54.0	305	404
David J Joseph Co	364.0	3092.9	-41.0	35.2	54.0	311	123
The Gibson-Homans	365.5	3094.8	-39.5	37.1	54.2	313	21
Holman Inc	359.5	3087.3	-45.5	29.6	54.3	303	55
Holman Inc	359.3	3087.1	-45.7	29.4	54.3	303	54
Gulf Coast Lead	364.0	3093.5	-41.0	35.8	54.4	311	25
Eastern Association Terminal	360.2	3088.9	-44.8	31.2	54.6	305	534
Glen-Mar Concrete Products	363.2	3093.3	-41.8	35.6	54.9	310	22
Additional Sources Outside 55 km Considered in the Modeling Analysis							
TECO Hooker's Point	358.0	3091.0	-47.0	33.3	57.6	305	1,232
LaFarge Corp	357.7	3090.6	-47.3	32.9	57.6	305	1,207
CF Industries Zephyrhills	388.0	3116.0	-17.0	58.3	60.7	344	1,006
FPC - Bartow	342.4	3082.6	-62.6	24.9	67.4	292	9,244
FPC - Higgins	336.5	3098.4	-68.5	40.7	79.7	301	1,082
FPC - Intercession City ^c	446.3	3126.0	41.3	68.3	79.8	31	809

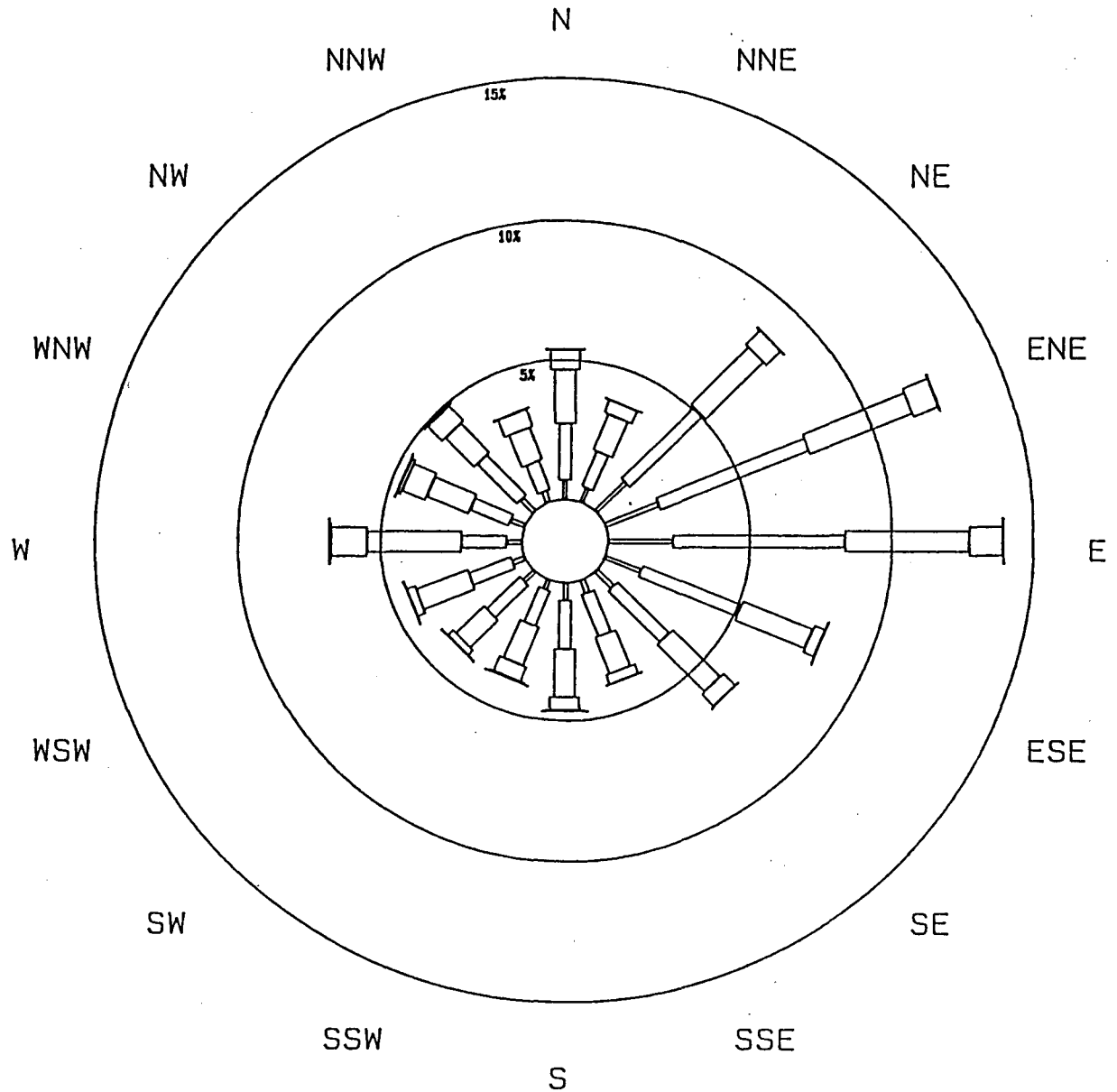
Note: Screening area of 55 km for the proposed unit is based on the project's estimated significant impact distance of 5 km plus 50 km.

^a Proposed Hardee Unit 3 east and north UTM coordinates (km): 405.0 and 3057.7.

^b Generally based on the facility's maximum hourly emission rate for entire year.

^c A PSD increment-consuming source is located at this facility.

Source: KBN, 1994.



SCALE (KNOTS)

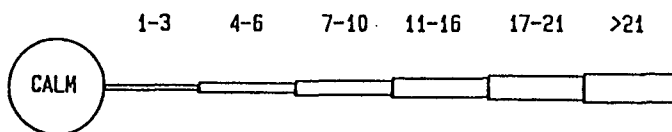


Figure 2.3.7-1
Annual Average Wind Frequency Distribution in Tampa, Florida,
1982-1986

Source: TPS/SECI, 1989.



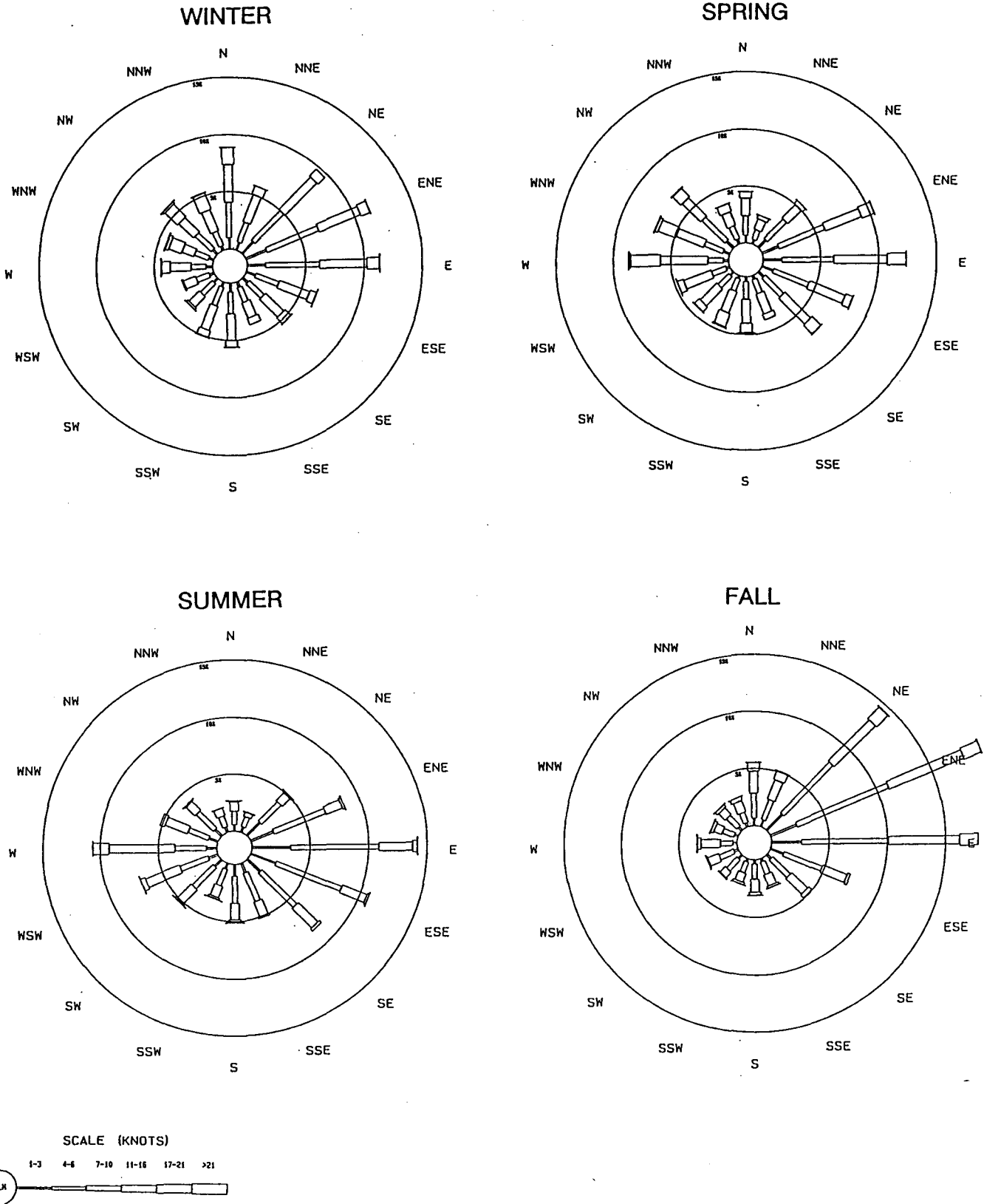


Figure 2.3.7-2
Seasonal Average Wind Frequency Distribution in Tampa, Florida,
1982-1986

Source: TPS/SECI, 1989.



2.3.8 NOISE

2.3.8.1 BACKGROUND

The proposed facility is located in an isolated, undeveloped area (with the exception of the HPS existing units) of open-pit phosphate mining directly south of the Polk-Hardee County line. The unmined topography of woodland/grassland area is predominantly flat with the exception of overburden spoil mounds that range in length from a few meters to hundreds of meters. Directly west of the proposed site is the cooling water reservoir constructed as part of the HPS existing units. Most of the phosphate mining area is undeveloped with the closest residential receptor a little more than 1.6 km (1 mile) south of the proposed facility. Polk County has no adopted noise ordinances or standards, and the Hardee County noise performance standards do not apply to the receiving agriculturally zoned lands surrounding the HPS site.

2.3.8.2 NOISE MEASUREMENT PROCEDURES

An ambient noise monitoring program was performed using the slow response mode to obtain integrated, A-weighted sound pressure levels. A windscreen was used because all measurements were taken outside. The microphone was positioned so that a random incidence response, as specified by the American National Standard Institute (ANSI), was achieved. A continuous record of the sound level meter output data was made on the strip chart during all monitoring. This not only produced a continuous hard copy output of the Model 2230, but also provided a quality control check of the sound level meter operation during monitoring. Integrated sound pressure level (SPL) data consisting of three 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. |
| 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) abovegrade. An output cable connected the sound level meter with the strip chart recorder. The strip chart recorder was located away from the sound level meter so that time marks and comments could be recorded without disturbing or influencing the sound level measurement process. Local wind speed and temperature were measured by a handheld anemometer and

thermometer during the monitoring period. Field notes were recorded during monitoring and included the local meteorological parameters and major noise sources.

A comprehensive baseline noise analysis survey to assess the existing ambient noise levels in the area of the proposed facility was conducted on the October 27 and 28, 1993. SPL data were collected at five different locations (Figure 2.3.8-1) using ANSI measurement techniques. The noise monitoring equipment used during the survey included:

1. Continuous Noise Monitoring Equipment
 - a. Bruel & Kjaer (B&K) Type 2230 Precision Integrating Sound Level Meter
 - b. B&K Type 2639 Microphone Preamplifier
 - c. B&K Type 4155 Prepolarized Condenser Microphone
 - d. Primeline Model 6723 Two-Pen Portable Strip Chart Recorder
 - e. Windscreen, tripod, and various cables
2. Sound Level Meter Calibration Unit
B&K Type 4230 Sound Level Calibrator, 94 decibels (Db) @ 1,000 hertz (Hz).

The B&K Type 2230 sound level meter complies with Type I--Precision requirements set forth by ANSI S1.4 for sound level meters. The specifications for this equipment are presented in Appendix 10.5.1.

The five monitoring locations represent sites that are:

1. At the four sides of the proposed Hardee Unit 3 site (Sites 1, 2, 3, and 4), and
2. Near the center of the proposed facility (Site 5).

Site 1 is located at the eastern boundary of the proposed facility, directly west of the access road to the HPS existing units. Site 2 is immediately south of the Polk-Hardee County line in Section 1, Range 24 East, Township 33 South. Site 3 is along the southeast corner of the HPS cooling reservoir. Site 4 is located approximately 244 m (800 ft) south of the general services building in between the proposed power block. This site is the closest monitoring site to a commercial receptor, the HPS existing units. Site 5 is situated approximately 122 m (400 ft) northeast of the general services building of Hardee Unit 3. The homes on Roberts Road are the closest non-commercial (residential) receptors to the plant site and are more than 1.6 km (1 mile) from the proposed facility.

Ambient SPLs were measured at various times during the day and night time for a minimum of 30 consecutive minutes at each of the five sites. 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 and are presented in Table 2.3.8-1. The average minimum, maximum, and L_{eq} SPLs for each site were calculated. The SPL averages were calculated using the following formula:

$$\text{Average SPL} = 10 \log \frac{\sum_{i=1}^N 10^{(SPL_i/10)}}{N}$$

where: N = number of observations.

SPL_i = individual sound pressure level in data set.

Also included in Table 2.3.8-1 are the wind speed, wind direction, and microphone orientation as well as comments on events and observations occurring during the monitoring program. The SPL data were analyzed and reported in A-weighted decibels (DBA). The higher the decibel value, the louder the sound.

2.3.8.3 EXISTING AMBIENT SOUND PRESSURE LEVEL CONDITIONS

The baseline ambient L_{eq} SPLs in the area of the proposed facility ranged from a low of 39.4 DBA at Site 3 to a high of 54.9 DBA at Site 1. The minimum ambient values varied from 34.0 to 52.9 DBA at Sites 3 and 2, respectively. Sound sources in the proposed area included earthmoving equipment used in the reclamation of previously mined areas, aircraft traffic and vehicular traffic into HPS, as well as various types of songbirds and insects. The intensity of these various noise sources can vary significantly both spatially and temporally.

The HPS existing units were not in operation during the baseline noise study. The only noise emanating from the HPS existing facility was produced from auxiliary equipment (i.e., pumps and motors) and onsite vehicular traffic. However, subsequent baseline noise monitoring was performed when the existing units were in operation.

Table 2.3.8-1. Ambient Sound Pressure Level Data for the Hardee Unit 3 Site

Site No.	Date/Time	Wind Speed (mph)	Wind Direction (degrees)	Microphone Angle (degrees)	Sound Pressure Levels			Comments
					Min	Max	L _{eq}	
1	10/27/93-1600	3-5	045	090	38.0	58.2	44.6	Cars (2)
	10/27/93-2150	0	—	090	50.8	69.4	54.9	Insect noises
	10/28/93-1040	2-4	270	090	36.6	72.9	44.4	Birds and airplanes
	11/30/93-1840	3-5	050	090	44.4	64.8	47.2	HPS existing unit ^a
				Average	46.0	69.0	50.2	
2	10/27/93-1810	2-4	000	180	39.3	61.7	44.0	Birds, heavy equipment
	10/27/93-2240	3-6	090	180	52.9	65.5	54.5	Diesel pump operating
	10/28/93-1010	3-6	270	180	42.5	53.6	45.7	Heavy equipment
	11/30/93-1907	3-8	225	000	47.8	63.0	50.0	HPS existing unit ^a
				Average	48.5	62.6	50.5	
3	10/27/93-1730	2-4	000	180	34.0	57.1	39.4	Red-wing blackbirds
	10/27/93-2210	3-6	090	180	50.1	70.0	52.2	Insect noises
	10/28/93-1150	3-6	270	180	34.8	64.9	45.8	Jets (4) and birds
	11/30/93-1935	3-8	225	270	39.6	57.1	47.0	HPS existing unit ^a
				Average	44.7	65.5	47.6	
4	10/27/93-1650	3-5	045	000	38.4	61.6	43.3	Airplane
	10/27/93-2310	3-6	090	000	47.0	72.1	51.0	Auxiliary equipment at plant
	10/28/93-0930	1-3	—	000	42.0	72.5	46.8	Birds and airplane
	11/30/93-1745	3-10	248	180	43.1	63.4	45.3	HPS existing unit ^a
				Average	43.7	69.7	47.3	
5	10/27/93-1520	3-5	045	180	40.1	52.1	44.0	Airplane
	10/27/93-2115	0	—	180	47.7	52.5	49.8	Insect noises
	10/28/93-0850	1-2	—	180	39.4	53.8	46.3	Birds and heavy equipment
	11/30/93-1813	2-7	248	180	45.8	54.0	48.7	HPS existing unit ^a
				Average	44.6	53.2	47.7	

^a HPS existing units (two combustion turbines and the steam turbine) operating during monitoring.

Source: KBN, 1994.

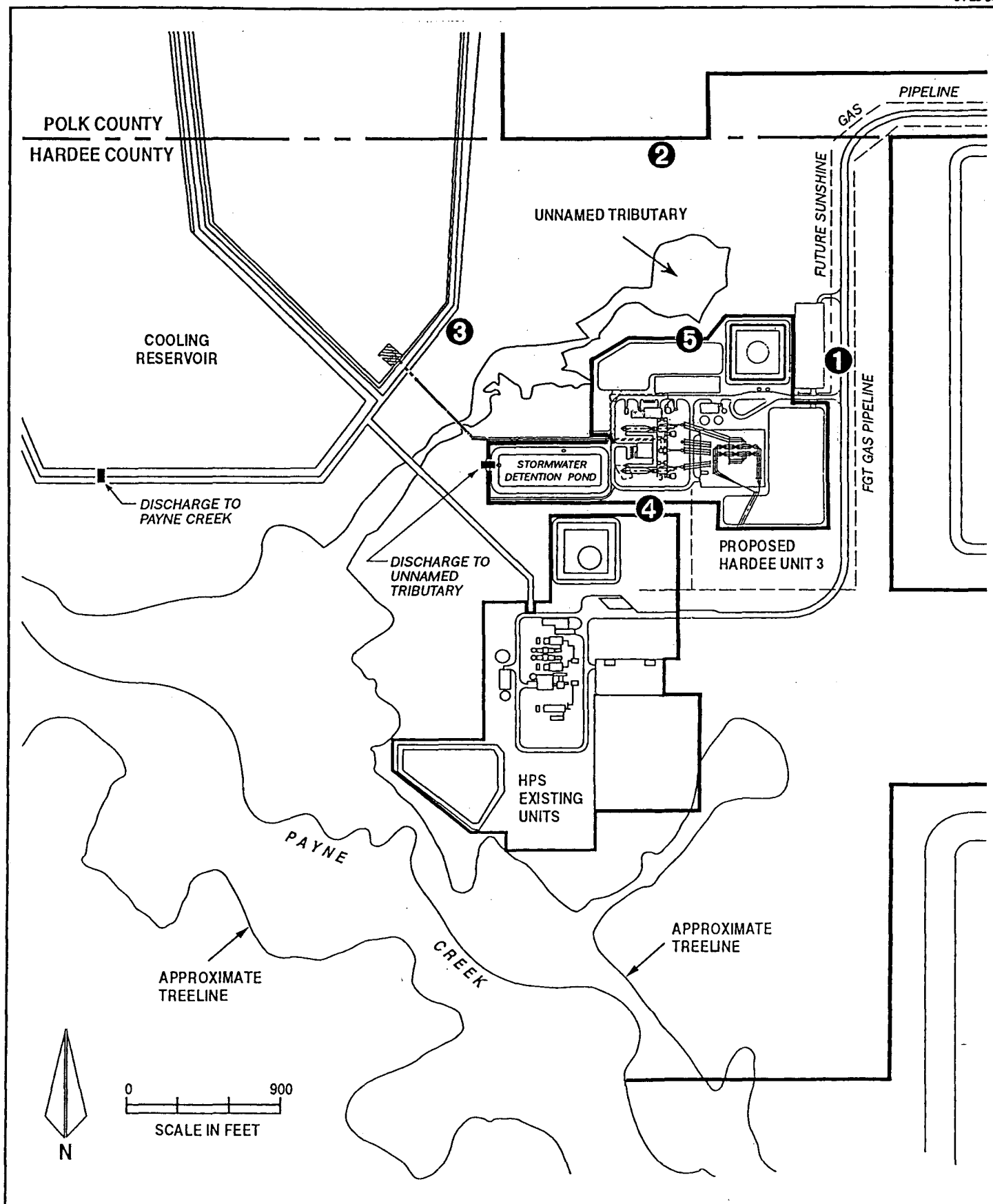


Figure 2.3.8-1
Baseline Noise Monitoring Locations

Source: KBN, 1994.



2.3.9 OTHER ENVIRONMENTAL FEATURES

The previous sections describe the environmental features of the Hardee Unit 3 site.

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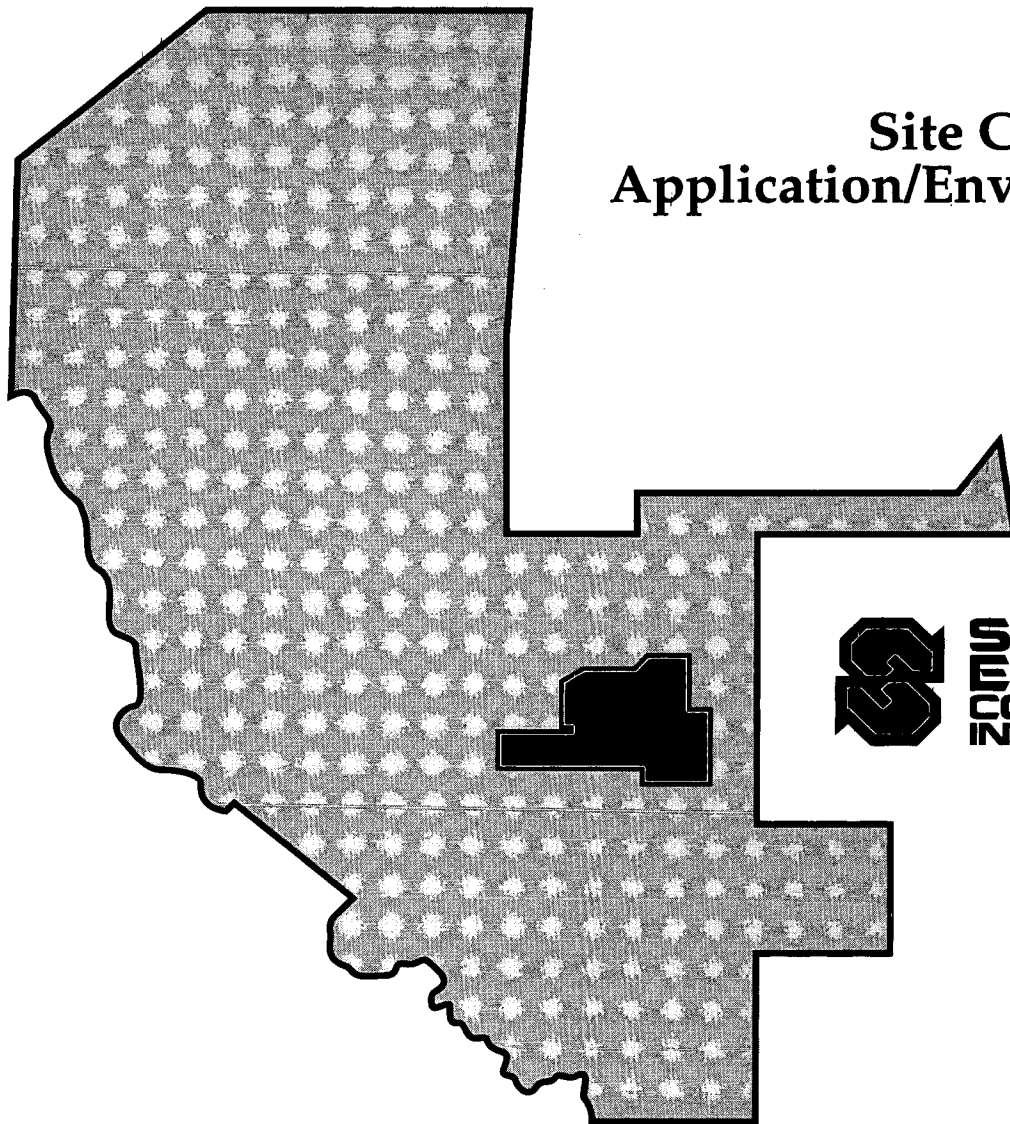
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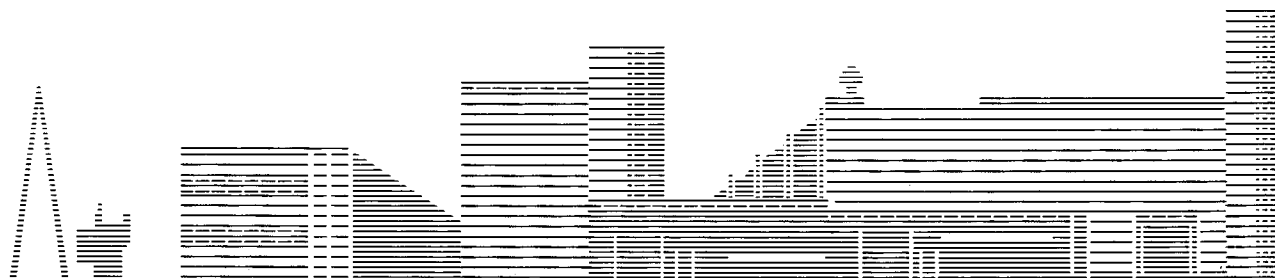
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HARDEE UNIT 3

Site Certification
Application/Environmental
Analysis



**SEMINOLE
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3.0 THE PLANT AND DIRECTLY ASSOCIATED FACILITIES

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3.1 BACKGROUND

This chapter provides a description of the proposed Hardee Unit 3 Project, including the overall site layout, key components of the facility and their operation, and proposed controls for air emissions and water discharges. Fuel specifications are provided for both natural gas and distillate fuel oil. Estimates of the expected character, quality, and quantity of discharges and emissions from the proposed facility are provided, based on the current available engineering and design information.

In 1990, the Hardee Power Station (HPS) was certified for 660 megawatts (MW) of generation in a phased construction schedule as follows:

1. TECO Power Services--295 MW (1993) (Phase 1A).
2. TECO Power Services--145 MW (future unit) (Phase 1B).
3. SECI--220 MW (date unspecified) (Phase 2).

This new certification does not change Phases 1A and 1B above but will increase the Seminole Electric Cooperative Incorporated (SECI) certified generation (Phase 2) from 220 MW to 440 MW, with a now-established inservice date of January 1999.

Location of the Hardee Unit 3 facility at the HPS site and selection of the combined cycle technology will maximize the beneficial use of the HPS site while minimizing environmental, land use, and cost impacts otherwise associated with development of a 440-MW power plant. The proposed project will utilize but not alter a number of the HPS existing facilities, including the cooling reservoir and transmission lines, and will increase the ultimate generating capacity without increasing the overall size of the HPS site.

The Hardee Unit 3 Project consists of a 440-MW combined cycle power plant and directly associated facilities. The project will consist of two 150-MW Westinghouse Model 501F advanced combustion turbines (CTs), with dry low nitrogen oxide (NO_x) combustors with a combined generating capacity of 300 MW (net). Each CT will be connected to a heat recovery steam generator (HRSG) which will utilize the waste heat from the CT to produce steam to be utilized in a single 140-MW (net) steam turbine. The proposed facility (Figure 3.1.0-1) will have a total nominal generating capacity of 440 MW (net). No duct burners are proposed for the

Hardee Unit 3 Project. By utilizing the otherwise wasted heat from the CT, the Hardee Unit 3 combined cycle facility will be more efficient than either simple cycle CTs or traditional steam cycle power plants. The dry low-NO_x combustor designed for the Model 501F CT consists of two premixed fuel zones plus a standard diffusion flame pilot burner. Low NO_x levels are achieved by introducing fuel primarily to the premix zones and reducing the amount of fuel being combusted from the pilot nozzle. Steam injection is used to increase the power output from the unit when firing natural gas. This is commonly referred to as "steam for power augmentation." This is different than using steam injection in the combustion zone for standard combustors, which is used for NO_x control. When natural gas is combusted at ambient temperatures of 27 degrees Celsius (°C) [80 degrees Fahrenheit (°F)] or higher, the turbines are not capable of generating sufficient electrical power to meet the required nominal generating capacity of 150 MW. Therefore, power output will be increased through use of steam for power augmentation when firing natural gas to achieve near full load requirements when ambient temperatures are 27°C (80°F) or higher.

The CTs are capable of both combined cycle and simple cycle operation; the latter is possible by using bypass stacks which bypass the HRSG. The CTs will use natural gas as the primary fuel and distillate fuel oil with a 0.05 percent sulfur content as the backup fuel. Use of distillate fuel oil will be equivalent to 1,500 hours per year at full load. Gas will be transported to the site via pipeline, and oil will be trucked to the site. The Hardee Unit 3 facility will connect with an onsite natural gas supply from either the existing Florida Gas Transmission (FGT) system or the proposed SunShine Natural Gas Pipeline. Fuel oil will be stored onsite in a new 16.6-million-liter (L) (4.4-million-gallon) aboveground storage tank.

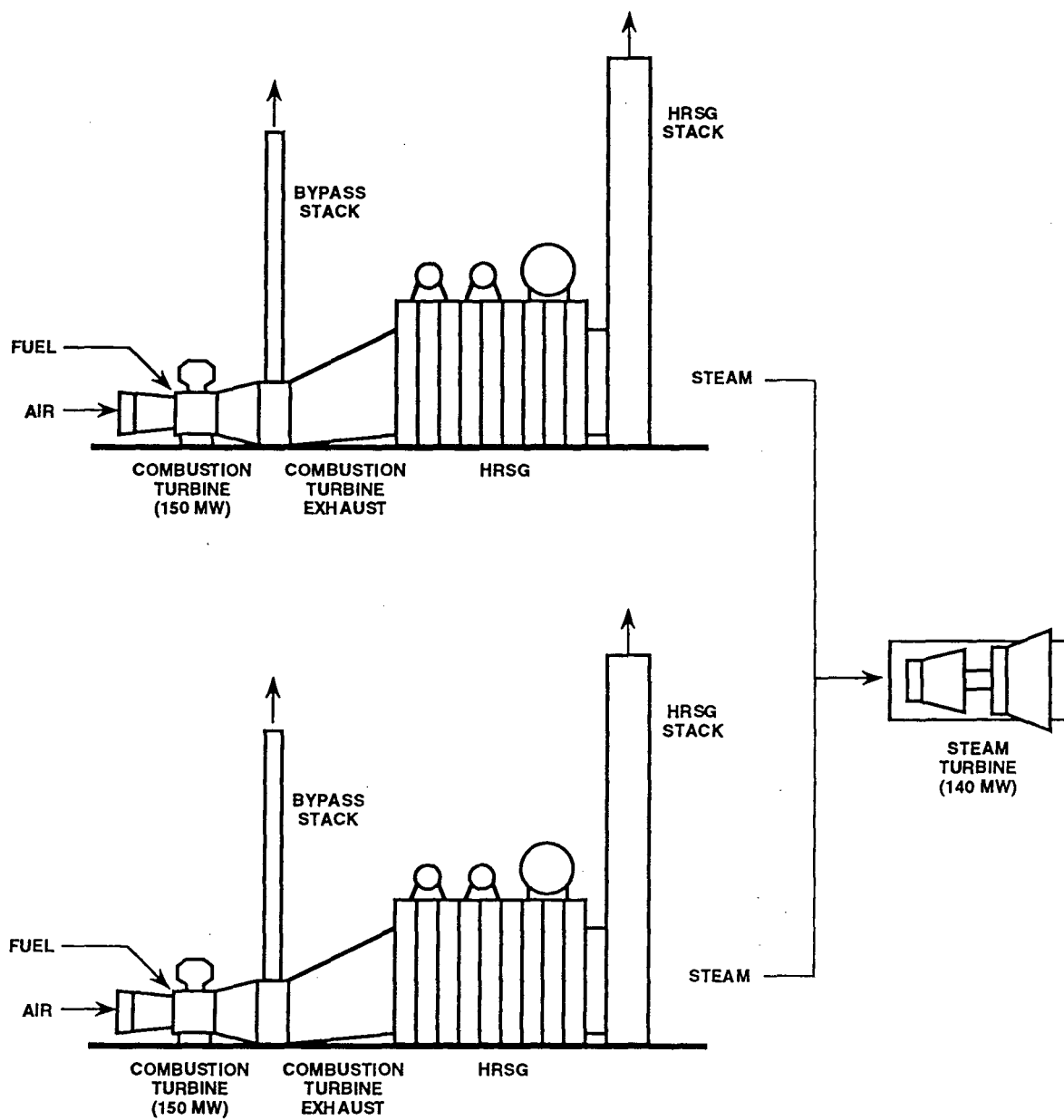
Other onsite facilities to be constructed as part of the proposed project include the switchyard, water treatment building, general services building, distillate fuel oil unloading and storage facilities, water circulating pipes, and warehouse/service buildings.

Primary water uses for the proposed project will be for condenser cooling, air emission control during oil firing, and process water. The existing 230-hectare (ha) (570-acre) cooling reservoir will be used for condenser cooling, with process water and makeup water being obtained from the lower Floridan aquifer through onsite wells under current water-use authorization.

Air emissions control will consist of state-of-the-art dry low-NO_x combustors in the CTs when firing natural gas. Water injection will be used for NO_x control when firing distillate fuel oil. SO₂ air emissions will be controlled by the use of low-sulfur fuels. These design alternatives maximize control of air emissions while minimizing economic, environmental, and energy impacts [see Section 3.4 for the analysis of best available control technology (BACT)].

The Hardee Unit 3 facility has been designed to minimize direct discharge to surface waters. Non-contact stormwater runoff will be collected and routed to a stormwater detention pond which has been designed to meet Southwest Florida Water Management District (SWFWMD) requirements (see Section 3.8 and Appendix 10.11.1). All wastewaters, including process water pretreatment backwash, sanitary treatment system wastewater, plant and equipment drains, and neutralization unit effluent, will be treated as appropriate and recycled to the existing cooling reservoir. The existing cooling reservoir will not be structurally altered, with the exception of the addition of new condenser cooling water intake and discharge structures for the proposed project. The previously certified discharge structure from the cooling reservoir to Payne Creek will not be structurally modified.

Hardee Unit 3 will connect to the Florida electric power grid within the existing HPS site; no new offsite transmission lines will be constructed.



NOTE: HRSG = Heat Recovery Steam Generator

Figure 3.1.0-1
Schematic Flow Diagram of Hardee Unit 3 Facility

Source: KBN, 1994.



3.2 SITE LAYOUT

The Hardee Unit 3 Project will be located on the 526-ha (1,300-acre) HPS site (see Figure 3.2.0-1). The proposed facility will be located adjacent to the HPS existing units and will occupy approximately 20 ha (50 acres) of the HPS site. The Hardee Unit 3 facilities and their approximate areas are:

Base Plant and Buildings	2.7 ha (6.7 acres)
Fuel Oil Storage/Handling	1.7 ha (4.2 acres)
Switchyard	1.3 ha (3.3 acres)
Switchyard Interconnect	0.3 ha (0.7 acres)
Water/Wastewater Treatment	0.4 ha (1.1 acres)
Site Runoff Detention Pond	3.0 ha (7.4 acres)
Construction Laydown	5.7 ha (14.1 acres)
Miscellaneous (e.g., site roads)	5.0 ha (12.5 acres)
 Total Land Area Requirements	 20 ha (50 acres)

A profile of the Hardee Unit 3 facilities is shown in Figure 3.2.0-2, with preliminary dimensions presented in Table 3.2.0-1.

Site non-contact stormwater runoff will be released to surface waters, i.e., the unnamed tributary to Payne Creek, from the site runoff detention pond (see Figure 3.2.0-3). Discharges from the cooling reservoir will be through the previously certified, existing discharge structure to Payne Creek; however, such discharges will still be infrequent (i.e., only during storm events greater than the 10-year, 24-hour storm). No additional point source water discharges will be associated with the Hardee Unit 3 facility.

Exhaust gases will be emitted from either a stack associated with each HRSG unit or each CT bypass stack (see Figure 3.2.0-4). The bypass stacks would be operated only when the HRSG and associated steam cycle are not in operation or when simple cycle operation is necessary.

Table 3.2.0-1. Dimensions of Major Plant Facilities for the Hardee Unit 3 Facility

Facility	Elevation ^a (ft)	Length (ft)	Width (ft)
CT Enclosure	30	110	35
Bypass Stack	75	—	23 ^b
Inlet Air Filter	60	40	40
HRSO Stack	90	—	19 ^b
HRSO	70	122	39
Steam Turbine	53	90	40
Service/Fire Water Tank	45	—	53 ^b
Demineralizer Tank	45	—	57 ^b
Fuel Oil Storage Tank	53	—	125 ^b
Service Building	36	90	90
Warehouse	20	40	80
Covered Laydown	25	25	60
Machine Shop	20	80	60
Water Treatment Building	20	75	40
Circulating Water Chemical Feed	16	50	25
Water Pump Building	16	60	20
Substation Control Building	16	30	15

Note: feet (ft) x 0.3 = meters (m).

^a Above ground surface.

^b Diameter.

Source: Black & Veatch, 1994.

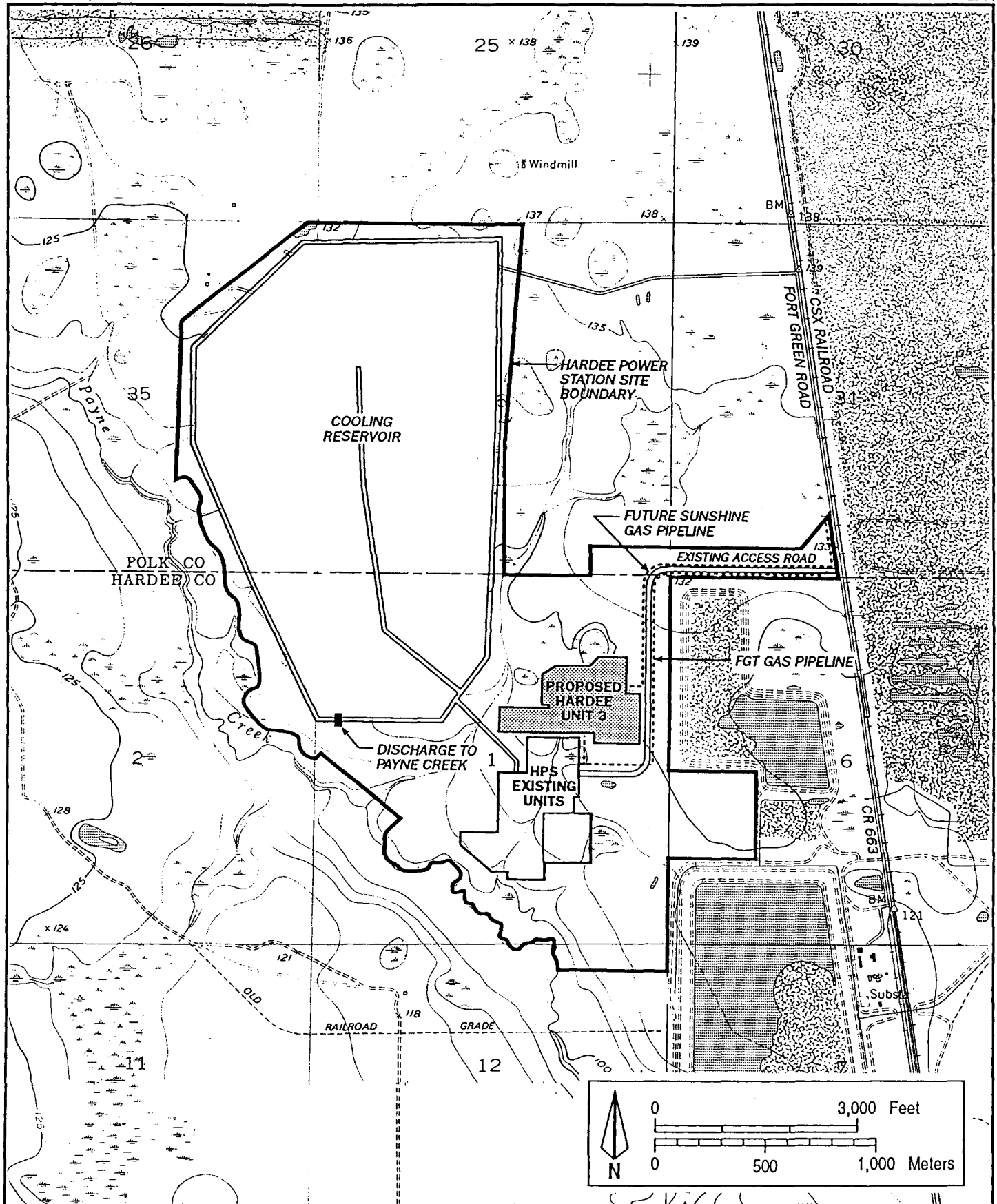
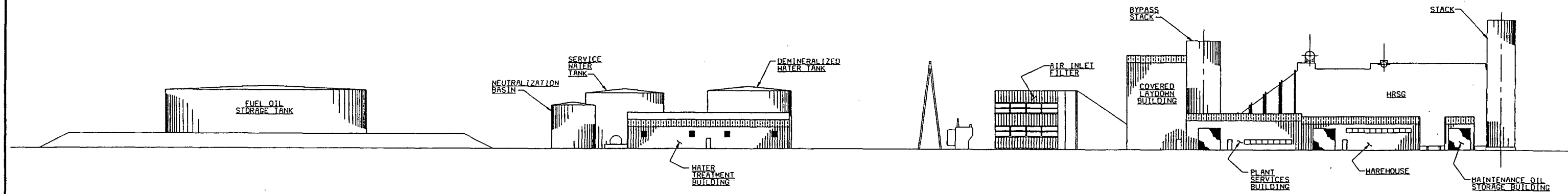


Figure 3.2.0-1
Hardee Unit 3 Site

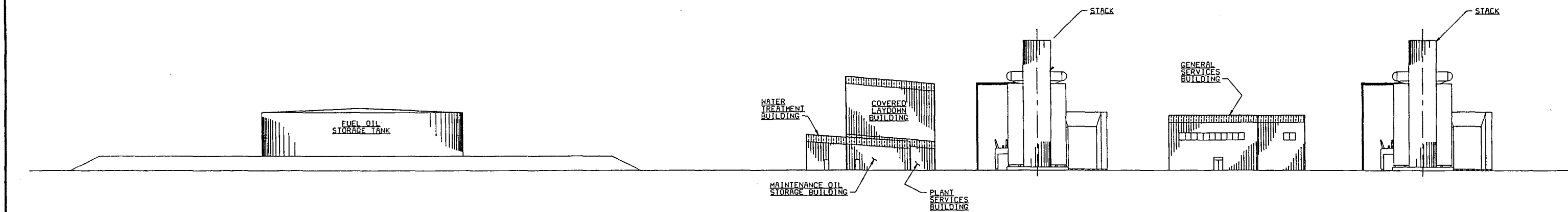
Sources: USGS, 1987; KBN, 1994.



30' 20' 10' 0' 30' 60'



ELEVATION - LOOKING SOUTH



ELEVATION - LOOKING EAST

Figure 3.2.0-2
Hardee Unit 3 Profile

Source: Black & Veatch, 1994.



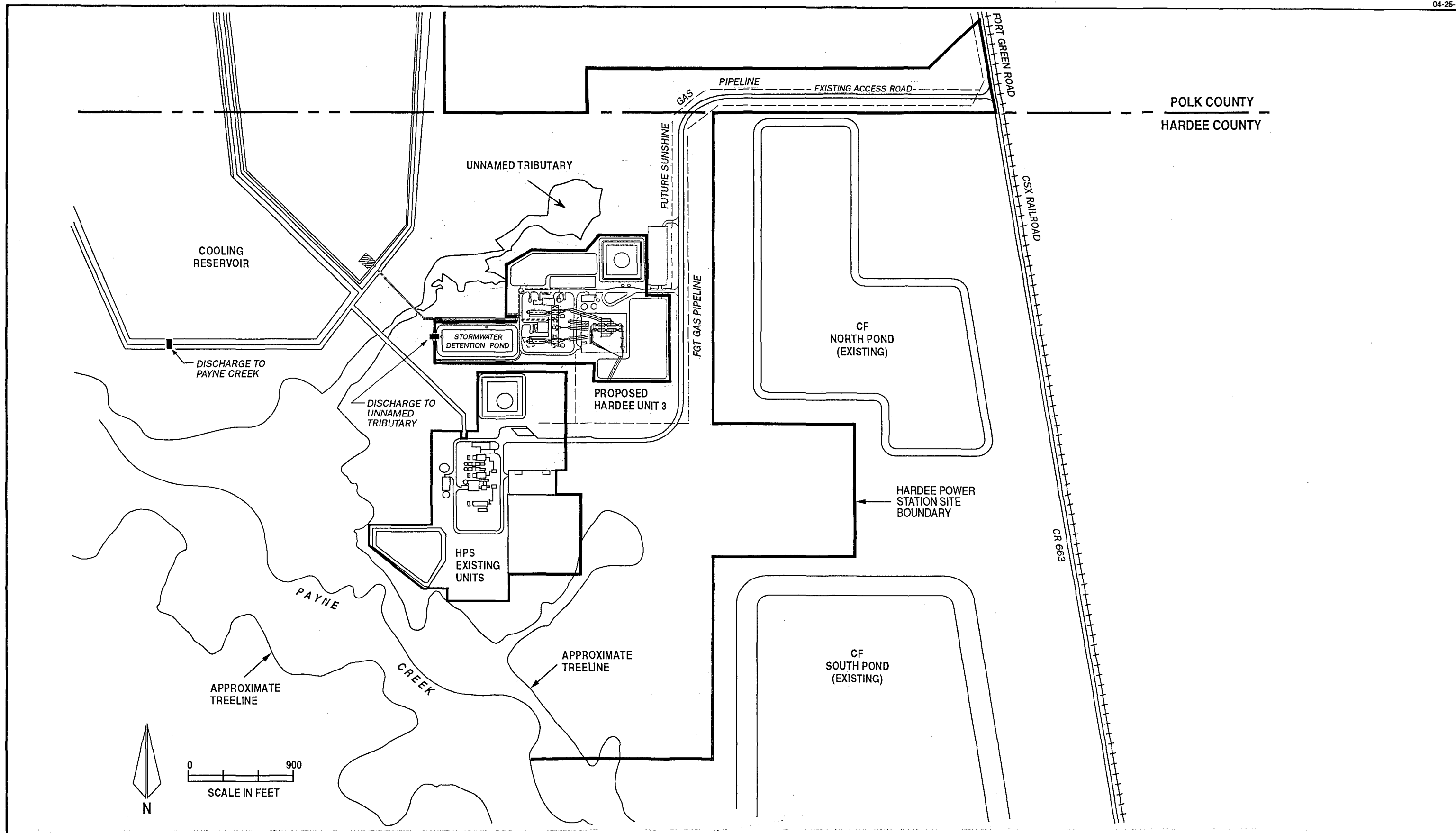


Figure 3.2.0-3
Hardee Unit 3 Proposed Site Layout

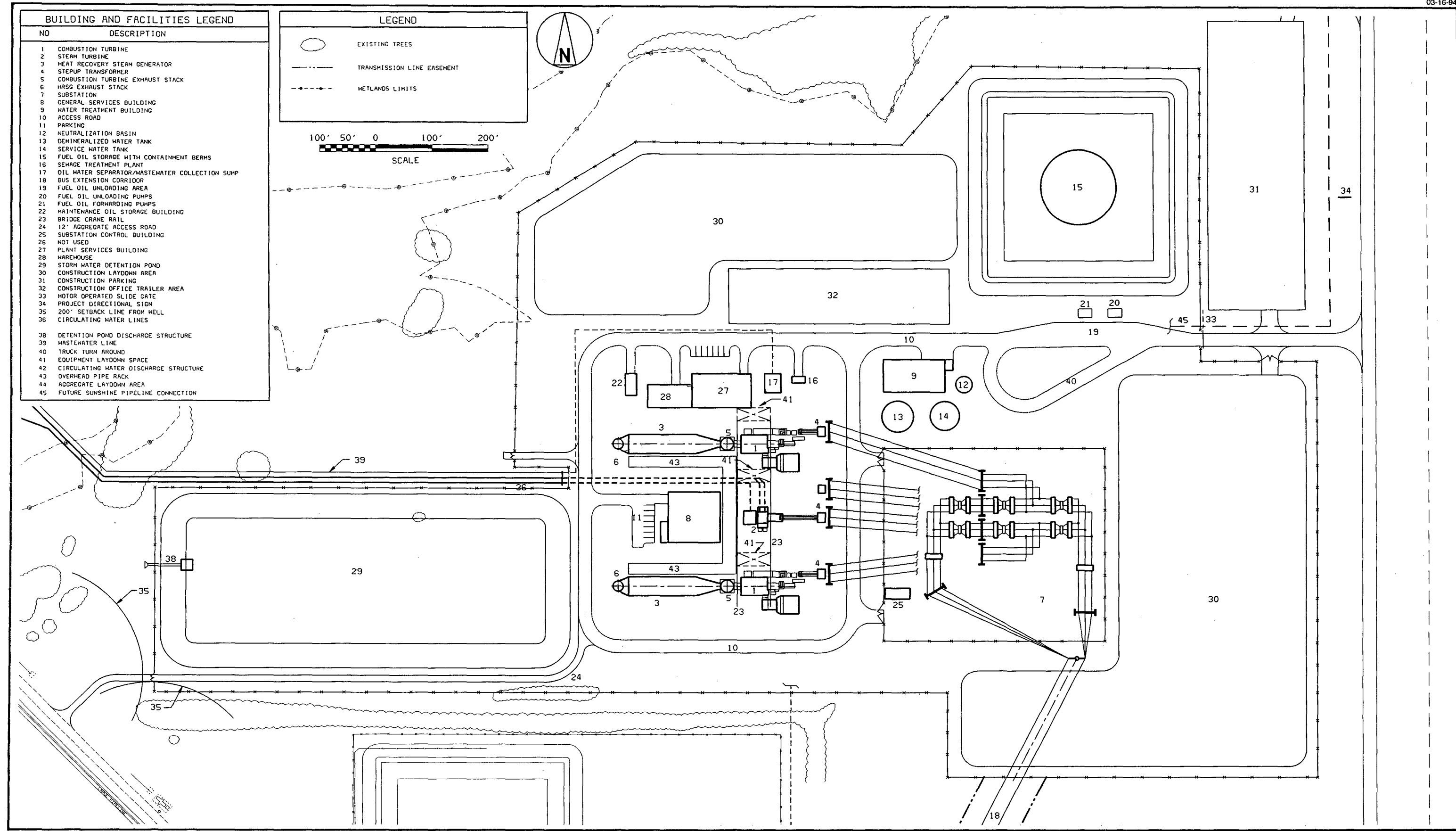


Figure 3.2.0-4
Hardee Unit 3 Plot Plan.

Source: Black & Veatch, 1994.



3.3 FUEL

The primary fuel used by the CTs will be natural gas, delivered to the plant by pipeline. Typical properties of pipeline-grade natural gas are shown in Table 3.3.0-1. The heat content is typically 48,548 Joules per gram (J/g) [20,890 British thermal units per pound (Btu/lb)] [low heating value (LHV)] with a maximum sulfur content of 1 grain per 100 standard cubic feet (gr/100 scf) of gas. The secondary fuel will be low sulfur distillate fuel oil. Typical properties of the fuel oil are shown in Table 3.3.0-2. The fuel oil will have a heat content of between 43,147 J/g (18,566 Btu/lb) (LHV) and 45,736 J/g (19,680 Btu/lb) [high heating value (HHV)] with a maximum sulfur content of 0.05 percent by weight.

No onsite storage will be provided for natural gas. Fuel oil will be stored onsite in a new 16.6-million-liter (4.4-million-gallon) aboveground steel storage tank. As part of the oil storage and delivery system, berms and special drainage will be provided. Oily wastewater will be routed to oil separation equipment for treatment and subsequent routing to the cooling reservoir. A preliminary Spill Prevention, Control, and Countermeasure (SPCC) Plan for Hardee Unit 3 is presented in Appendix 10.1.8.

The CTs will also be capable of burning synthetic gas derived from coal gasification. The plant site could accommodate the possible future addition of coal gasification facilities, which would include a gasifier, gas cleanup equipment, and coal handling and storage systems. Although a coal gasification facility is not being proposed for certification as part of the Hardee Unit 3 Project, a discussion of potential coal gasification alternatives and the site's capability to accommodate such facilities is presented in Section 8.3.

The generating capacity of a combined cycle plant is affected by ambient temperature, with increased temperature resulting in less efficient electric production. Greater overall fuel consumption will occur at lower ambient temperatures. For the purpose of calculating maximum hourly fuel use quantities, the following operating conditions for the CTs were used:

1. 0°C (32°F) dry-bulb ambient temperature,
2. 30 percent relative humidity,
3. 38 meters above mean sea level (m-msl) [125 feet above mean sea level (ft-msl)] elevation,

4. 53,847 J/g (23,170 Btu/lb) heating value (HHV) of natural gas, and
5. 45,736 J/g (19,680 Btu/lb) heating value (HHV) of distillate fuel oil.

At these conditions, the maximum heat input for the nominal 440-MW facility is $3,795 \times 10^9$ J/hr and $4,160 \times 10^9$ J/hr [$3,598$ and $3,944 \times 10^6$ Btu/hr] (HHV) when firing natural gas and distillate fuel oil, respectively [100 percent capacity, 0°C (32°F)]. The corresponding maximum fuel usage is 19,567 grams per second (g/s) [155,290 pounds per hour (lb/hr) or 3,600,000 cubic feet per hour (cf/hr)] for natural gas and 25,252 g/s (200,410 lb/hr) for fuel oil. Annual fuel usage at 15°C (59°F) ambient temperature is expected to be 575,210,000 kilograms per year (kg/yr) [1,268,100,000 pounds per year (lb/yr) or 2.94×10^{10} cubic feet per year (cf/yr)] for natural gas and 127,100,000 kg/yr (280,200,000 lb/yr) for fuel oil (assuming an equivalent of 1,500 hours per year of at full load). Hardee Unit 3 will connect onsite with either an existing 46-cm (18-inch) FGT natural gas lateral already constructed to the HPS site or the proposed SunShine Pipeline Company's natural gas pipeline.

Table 3.3.0-1. Expected Natural Gas Analysis

Constituents, Percent by Volume

Hydrogen (H ₂)	—
Methane (CH ₄)	83.40%
Ethylene (C ₂ H ₄)	—
Ethane (C ₂ H ₆)	15.80%
Carbon Monoxide (CO)	—
Carbon Dioxide (CO ₂), max	2.0%
Nitrogen (N ₂)	0.80%
Oxygen (O ₂), max	0.40%
Hydrogen Sulfide (H ₂ S), max	1 grain/100 scf
Sulfur (S), max.	1 grain/100 scf
Water (H ₂ O) Vapor, max.	4 lb/10 ⁶ scf
Synthetic Lubricants (Phosphate-Ester Based)	Trace
Specific Gravity (relative to air)	0.636

Ultimate, Percent by Weight

Hydrogen (H ₂)	23.53%
Carbon (C)	75.25%
Nitrogen (N ₂)	1.22%
Oxygen (O ₂)	—
Btu/ft ³ @60°F and 30 inches HgA (HHV)	950 (min)-1129
Heating Value Btu/lb	23,170 (HHV) 20,890 (LHV)

Sources: TPS/SECI, 1989.
 KBN, 1994.

Table 3.3.0-2. Expected Fuel Oil Analysis^a

Specific gravity, 60°F (16°C)	0.82-0.86
Viscosity, cST, 100°F (38°C), min	0.5
Pour point, max	
°F	0
°C	17.8
Heating value, LHV	
Btu/lb	18,566
J/g	43,147
Heating value, HHV	
Btu/lb	19,680
J/g	45,736
Filterable dirt, mg/100 ml	4
Carbon residue (10% Bottoms), %, max.	0.25
Carbon residue (100% Sample), %, max.	1.0
Sulfur, % wgt., maximum	0.05
Nitrogen, % wgt.	<0.015 - 0.03
Hydrogen, % wgt.	12.2 - 13.2
Ash (fuel as delivered), ppm wgt, max.	50
Trace metal contaminants (untreated)	
Sodium plus potassium, ppm, max.	1
Vanadium, ppm, max.	0.5
Lead, ppm, max.	1
Calcium, ppm, max.	2

^a Specification is typical of American Society of Testing and Materials (ASTM) Grade distillate fuel oil (ASTM D-398).

Sources: TPS/SECI, 1989.
 KBN, 1994.

3.4 AIR EMISSIONS CONTROLS

3.4.1 AIR EMISSIONS TYPES AND SOURCES

The Hardee Unit 3 Project consists of a 440-MW combined cycle power plant and directly associated facilities. The project will consist of two 150-MW Westinghouse Model 501F advanced combustion turbines, with dry low-NO_x burners, with a combined generating capacity of 300 MW (net). Each combustion turbine will be connected to a HRSG which will use the waste heat to produce steam to be used in a single 140-MW (net) steam turbine. The facility will have a nominal generating capacity of 440 MW (net). No duct burners are proposed for the Hardee Unit 3 Project.

The dry low-NO_x combustor designed for the 501F combustion turbine consists of two premixed fuel zones plus a standard diffusion flame pilot burner. Low NO_x levels are achieved by introducing fuel primarily to the premix zones and reducing the amount of fuel being combusted from the pilot nozzle. Steam injection is used to increase the power output from the unit when firing natural gas. This is commonly referred to as "steam for power augmentation." This is different than using steam injection in the combustion zone for standard combustors, which is used for NO_x control. When natural gas is combusted at ambient temperatures of 27°C (80°F) or higher, the turbines are not capable of generating sufficient electrical power to meet the required nominal generating capacity of 440 MW. As a result, power output will be increased through use of steam for power augmentation when firing natural gas to achieve near full load requirements when ambient temperatures are 27°C (80°F) or higher. Steam for power augmentation is expected to be required for a maximum of 2,000 hours per year based on ambient temperatures and unit demand.

Power augmentation with dry low-NO_x combustors increases dynamic pressure activity in the overall combustion process. To minimize this activity, the pilot flame percentage is increased from its normal "low NO_x" level to a slightly higher percentage. As the pilot flame increases, there is a resulting increase in NO_x and carbon monoxide (CO) levels.

Air pollutant emissions will be emitted from the CTs when firing either natural gas or fuel oil. Emissions will emanate from either the bypass or HRSG stacks depending upon the mode of operation.

Air emissions result from either the combustion process itself or impurities in the fuel. Table 3.4.1-1 presents the maximum estimated emission rates for regulated pollutants. The maximum estimated emission rates were determined using the manufacturer's information for the equipment proposed for the project. The design parameters were provided for operating loads of 100 percent (base load), 75 percent, and 50 percent capacity and for ambient temperatures of 0°C (32°F), 15°C (59°F), 22°C (72°F), and 36°C (95°F). Annual emissions were based on emissions expected for base load and ambient temperatures of 15°C (59°F). The prevention of significant deterioration (PSD) application (see Appendix 10.1.5) presents the basis for the emission rates and maximum annual emissions of regulated and nonregulated pollutants.

During combustion, two types of NO_x are formed: fuel NO_x and thermal NO_x. Fuel NO_x emissions are formed through the oxidation of a portion of the nitrogen contained in the fuel. Thermal NO_x emissions are generated through the oxidation of a portion of the nitrogen contained in the combustion air. NO_x formation can be limited by lowering combustion temperatures (through water or steam injection) and/or staging combustion (a reducing atmosphere followed by an oxidizing atmosphere, known as dry NO_x control).

Carbon monoxide is formed by incomplete combustion of fuel. High combustion temperatures, adequate excess air, and good fuel/air mixing during combustion will minimize CO formation. Carbon monoxide formation is limited by ensuring complete efficient combustion of the fuel in the turbines. Recent improvements in CT combustor technology allow for both reduced NO_x emissions and low CO emissions.

Emissions of NO_x for the Hardee Unit 3 facility are proposed at concentrations of 15 parts per million (ppm) and 42 ppm, corrected to ISO conditions and 15 percent oxygen (O₂) dry conditions (ppmvd) for natural gas and distillate fuel oil firing, respectively. When firing natural gas during power augmentation, the NO_x emissions are proposed at 25 ppmvd corrected to ISO conditions and 15 percent O₂. Maximum estimated NO_x emissions for distillate fuel oil firing are 42 ppm at ISO conditions based on a maximum concentration of fuel-bound nitrogen of 0.015 percent; higher fuel-bound nitrogen concentrations would also increase NO_x emissions. At a fuel-bound nitrogen concentration of 0.03 percent, NO_x would increase by about 12 ppm (corrected conditions) in accordance with the NSPS adjustment found in 40 Code of Federal Regulations (CFR) 60, Subpart GG, Section 60.332(a)(3).

Emission rates for CO were established by the level of NO_x control, since dry low NO_x combustors will be used. Maximum CO emission rates for the project would be 20 part per million by volume dry (ppmvd) and 25 ppmvd at base load operation for natural gas and distillate fuel oil, respectively. When firing natural gas during power augmentation, the CO emissions would be 50 ppmvd.

Maximum SO₂ emission rates are dictated by the amount of sulfur in the fuels.

Table 3.4.1-1. Summary of the Maximum Potential Annual Emissions for the Proposed CTs for Combined Cycle Operations at the Hardee Unit 3 Facility

Emissions (TPY)				
Pollutant	Fuel Oil	Natural Gas	Natural Gas- Steam for Power Augmentation	Total
<u>Potential Emissions (Without Power Augmentation)^a</u>				
SO ₂	140.1	34.8	NA	174.9
PM/PM10	94.1	50.4	NA	144.5
NO _x	466.2	673.2	NA	1,139.4
CO	127.9	486.1	NA	614.0
VOC	29.2	69.5	NA	98.7
Lead	0.16	NA	NA	0.16
Arsenic	0.014	NA	NA	0.014
Beryllium	0.0069	NA	NA	0.0069
Fluoride	0.090	NA	NA	0.090
Mercury	0.024	0.0003	NA	0.025
Sulfuric Acid Mist	31.1	6.86	NA	38.0
<u>Potential Emissions (With Power Augmentation)^b</u>				
SO ₂	140.1	25.2	9.32	174.6
PM/PM10	94.1	36.5	14.4	145.1
NO _x	466.2	487.7	251.5	1,205.4
CO	127.9	352.2	313.4	793.5
VOC	29.2	50.3	17.9	97.5
Lead	0.16	NA	NA	0.16
Arsenic	0.014	NA	NA	0.014
Beryllium	0.0069	NA	NA	0.0069
Fluoride	0.090	NA	NA	0.090
Mercury	0.024	0.0002	0.00009	0.025
Sulfuric Acid Mist	31.1	4.97	1.84	37.9

Note: NA = not applicable.

^a Emission rates are based on two CTs firing fuel oil for 1,500 hours and natural gas for 7,260 hours at ambient temperature of 59°F (without power augmentation) and relative humidity of 60 percent.

^b Emission rates are based on two CTs firing fuel oil for 1,500 hours and natural gas for 7,260 hours at ambient temperature of 59°F and relative humidity of 60 percent. Natural gas combustion includes 2,000 hours of steam for power augmentation at ambient temperature of 80°F and relative humidity of 80 percent.

Source: KBN, 1994.

3.4.2 AIR EMISSION CONTROLS

The use of clean fuels, i.e. natural gas and low-sulfur distillate fuel oil, and combustion controls will minimize air emissions and enable compliance with applicable emission-limiting standards. Using clean fuels will minimize emissions of sulfur dioxide (SO₂), particulate matter (PM)/particulate matter with an aerodynamic diameter of 10 micrometers or less (PM₁₀), and other fuel-bound contaminants. Combustion controls will minimize the formation of NO_x (by water injection for fuel oil firing) and the formation of CO and volatile organic compounds (VOCs) by combustor design. These techniques are proposed as BACT for this project based on an evaluation of economic, energy, and environmental impacts. The following subsection presents a summary of the BACT analysis which is presented in full in the PSD permit application in Appendix 10.1.5.

3.4.3 BEST AVAILABLE CONTROL TECHNOLOGY (BACT)

BACT review is required under the State of Florida and U.S. Environmental Protection Agency (EPA) regulations pertaining to PSD. Federal regulations are codified in 40 CFR Part 52.21, and the State of Florida has adopted PSD regulations essentially the same as the federal rules (Rule 17-212.400 F.A.C.). The BACT review (Rule 17-212.410, F.A.C.) is part of the evaluation of control technology under PSD rules. BACT is applicable to all pollutants for which PSD review is required and is pollutant-specific. It is an emission limitation that is based on the maximum degree of reduction for each regulated pollutant which is determined to be appropriate after taking into account energy, environmental, and economic impacts and other costs. BACT cannot be any less stringent than the federal New Source Performance Standards (NSPS) applicable to the source under evaluation.

The State of Florida and EPA have established a policy for BACT review in which the most stringent control alternatives are evaluated first. The alternatives are either rejected based on technological, environmental, energy, or economic reasons or are proposed as BACT. This procedure is referred as the "top-down" approach. For the Hardee Unit 3 Project, BACT is applicable for emissions of nitrogen oxides, carbon monoxide, sulfur dioxide, volatile organic compounds, PM and PM10, and trace contaminants.

The applicable NSPS for the Hardee Unit 3 Project is that promulgated by EPA for stationary gas turbines. These NSPS (40 CFR Part 60, Subpart GG) establish emission-limiting standards for NO_x and SO₂. The applicable NSPS are:

NO_x--75 ppmvd corrected to 15 percent oxygen and heat rate plus adjustment to fuel-bound nitrogen

SO₂--no more than 0.8 percent sulfur in the fuel

Appendix 10.1.5 of this Site Certification Application/Environmental Assessment (SCA/EA) contains a complete PSD application. Section 4.0 of that application contains the BACT evaluation for this project and addresses those pollutants for which BACT is applicable, i.e., nitrogen oxides, carbon monoxide, sulfur dioxide, particulates, beryllium, sulfuric acid mist, and inorganic arsenic. It includes a discussion of the environmental, economic, and energy aspects of alternative control techniques and methods. The remainder of this section briefly describes those

control technologies that were considered in the analysis and the conclusions reached. For details, refer to Section 4.0 and Attachment B in the PSD application, Appendix 10.1.5.

3.4.3.1 NITROGEN OXIDES

Dry low-NO_x combustor technology has recently been offered and installed by CT 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 of 15 ppmvd (corrected to 15 percent O₂) have been offered by manufacturers for advanced CTs. Advanced in this context is the larger (over 150 MW) and more efficient (higher initial firing temperatures and lower heat rate) CTs. This technology truly represents pollution prevention since NO_x emissions are inhibited from forming.

Selective catalytic reduction (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. The reaction occurs typically between 316 and 399°C (600 and 750°F) which limits SCR application to combined cycle units where such temperatures occur in the HRSG. Exhausts from simple cycle operation are in the range of 538°C (1,000°F), thus limiting SCR application for this mode of operation. SCR has been installed and operated on combined cycle facilities generally achieving 9 ppmvd (corrected to 15 percent O₂) while burning natural gas. Applications with oil firing are limited. Where oil firing has been attempted, catalyst poisoning and ammonium salt formation have occurred. 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 that does not react with NO_x is emitted directly and referred to as ammonia slip. In general, SCR manufacturers guarantee ammonia slip to be no more than 10 ppmvd; however, permitted limits in some applications have exceeded 25 ppmvd. While SCR is technically capable of reducing NO_x emissions to 9 ppmvd at 15 percent O₂ when firing natural gas and 15 ppmvd at 15 percent O₂ when firing fuel oil, SCR has not been applied to an advanced CT of the size proposed for this project or to the amount of oil firing that may occur with Hardee Unit 3.

The recent permitting trend for advanced CTs is the use of dry low-NO_x combustors. Indeed, all of the recent combined cycle projects using advanced CTs have been permitted with this

technology including three projects in Florida (FPL Martin Units 3 and 4, FPC Polk Power Park, and Central Florida Cogeneration Project) and one in Maryland [Baltimore Gas and Electric Company (BG&E) Perryman Project].

Based on an analysis of the economic, environmental, and energy impacts, dry low-NO_x combustion technology was selected as the proposed BACT for NO_x.

The total capital and annual costs for SCR are estimated to be \$8,647,400 and \$4,462,200, respectively. The cost effectiveness was estimated to be \$6,802 per ton of NO_x removed from 15 ppm to 9 ppm (natural gas). This cost effectiveness is above that considered reasonable for this technology in recent Florida Department of Environmental Protection (FDEP) permitting actions. In addition, this cost effectiveness accounts for only the reduction of NO_x with SCR use and not the potential increased emissions of ammonia or other criteria pollutants (particulate, SO₂, CO, and VOC) that may result. The net removal cost effectiveness (\$/ton) will be much higher. Indeed, it could be over \$15,000 per ton [\$4,462,200 divided by the net reduction of 276 tons per year (TPY)]. Although NO_x emissions will decrease with SCR, the ammonia and other criteria pollutants will increase due to the electrical energy required to run the SCR system and the backpressure from the turbines will reduce the electrical power output from the project. This power, which would otherwise be available to the electrical system, will have to be replaced by other less efficient units.

The cost effectiveness of \$6,802 per ton of NO_x removed is estimated by assuming that the proposed project would run at full load all year at the maximum emission rates for natural gas and fuel oil. Such conditions are generally unrealistic but provide a conservative basis for calculating cost effectiveness. In reality, the actual capacity factor will be lower than 100 percent, and fuel oil would only be used as a backup supply. The actual cost effectiveness would likely be in the range of \$9,000 to \$13,000 per ton of NO_x removed. Presented below is the calculated cost effectiveness for a range of Hardee Unit 3 operating scenarios (i.e., capacity factor and fuel oil usage).

<u>Cost Effectiveness (per ton NO_x removed)</u>	<u>Total Capacity Factor (%)</u>	<u>Fuel Operation (hours per year)</u>
\$9,108	100	500 oil; 2,000 gas with power augmentation; 6,260 gas
\$9,732	70	1,000 oil; 1,600 gas with power augmentation; 3,532 gas
\$12,906	70	350 oil; 1,400 gas with power augmentation; 4,382 gas

Although NO_x emissions would be reduced by about 656 TPY with SCR as compared to dry low-NO_x combustors alone, the net emissions reduction would not be as great. There are three additional factors that must be considered. First, ammonia slip would occur which may be as high as 193 TPY. Second, additional particulate matter may be formed through the reaction of ammonia and sulfur oxides forming ammonium salts. As much as 51 TPY additional particulate matter may be formed. Third, SCR would require energy for system operation and reduce the efficiency of the CT. This lost energy would have to be replaced since the proposed project would be an efficient plant while operating. Any power plants replacing this lost energy would be lower on the dispatch list and inevitably more polluting. Conservatively, this lost energy would result in the emissions of an additional 135 TPY of criteria pollutants. Additional emissions of carbon dioxide would also result.

Energy impacts with SCR would also not be insignificant. The energy penalty from SCR equipment and backpressure on the turbine would result in lost energy of about 15×10^6 kWh per year. This amount of energy is sufficient to provide the annual electrical needs of 1,250 residential customers.

As noted from this analysis, the application of SCR is economically unreasonable and should be rejected as BACT.

3.4.3.2 CARBON MONOXIDE

The proposed BACT emission rates for CO are 20 ppmvd and 25 ppmvd at base load operation for natural gas and distillate fuel oil, respectively. When firing natural gas during power

augmentation, the CO emission rate would be 50 ppmvd. The CTs would utilize advanced combustion technology and are consistent with those established as BACT by FDEP.

The only other feasible control measure available to reduce CO emissions from the combined cycle units other than good combustion practice is an oxidation catalyst. Exhaust gases from the CT and duct burner are passed over a catalyst bed where excess air oxidizes the CO. The temperature range for this process is approximately 316 to 649°C (600 to 1,200°F), with the highest removal efficiencies occurring in the upper temperature range.

An oxidation catalyst will experience the same operating problems as those discussed for the SCR catalyst especially when using fuel oil. The cost of removal of CO by oxidation catalyst will be significant and is estimated to be approximately \$4,000 per ton.

Combustion controls were selected as the proposed BACT control technology for CO based on economic, environmental, and energy considerations.

3.4.3.3 SULFUR OXIDES (SO₂ AND H₂SO₄ MIST)

Postcombustion controls comprise various wet and dry flue gas desulfurization (FGD) processes. However, FGD alternatives are not feasible for use on CT facilities due to high pressure drops across the control device. The only feasible control is clean fuels, i.e., natural gas and distillate fuel oil with a maximum sulfur content of 0.05 percent. Additionally, sulfuric acid mist production will be limited by fuel selection as previously described.

3.4.3.4 PARTICULATE MATTER AND OTHER REGULATED POLLUTANTS

Postcombustion alternatives such as baghouses, scrubbers, and electrostatic precipitators are not feasible due to the high pressure drops associated with the units and the small amount of PM reduction which would occur since the CT PM emissions are minimal (i.e., these emissions are already lower than most baghouses emit). Clean-burning fuels that have low PM and trace contaminant contents are being proposed as BACT.

Emissions of other pollutants are expected to be minimal and require no additional control technology. Concentrations of beryllium are not expected to be measurable because of the lack of their presence in the natural gas or light oil to be used as fuel. Although arsenic may be present

in trace quantities, these quantities are not expected to be large enough to be removable through the use of special controls. Therefore, no alternative emission controls for these other pollutants are proposed.

3.4.4 DESIGN DATA FOR CONTROL EQUIPMENT

Fuel properties have been presented in Section 3.3. Flue gas data are presented in the PSD application for natural gas and for fuel oil firing. These data are estimates based on the most recent information available.

The control equipment for minimizing air pollutant emissions from the Hardee Unit 3 Project are integral to the design of the combustors associated with each Westinghouse 501F CT. When firing natural gas, emissions are controlled with the application of dry low-NO_x combustors which consist of two premixed fuel zones and a standard diffusion pilot flame. Low NO_x levels, and corresponding low levels of CO, particulate matter, and VOCs, are achieved by introducing a majority of the fuel into the premix zones that allow the combustion air to mix with the fuel prior to combustion. This reduces the flame temperatures and the NO_x formed in the combustion process. The NO_x emissions will be limited to no more than 15 ppmvd corrected to 15 percent oxygen at ISO conditions. This is equivalent to about 0.06 lb NO_x/MMBtu heat input.

When firing fuel oil, water will be injected into the combustion zone to reduce flame temperatures and NO_x formation. The amount of water injected will depend on the ambient temperature and will range from 883 Lpm at 0°C to 708 Lpm at 35°C (220 gpm at 32°F to 187 gpm at 95°F). The amount of water is controlled as a function of ambient temperature to ensure that NO_x emissions are limited to 42 ppmvd corrected to 15 percent oxygen at ISO conditions as well as limit the formation of CO and VOCs at base load to 25 ppmvd and 10 ppmvd, respectively.

The power augmentation mode will only be used when firing natural gas and at ambient temperatures of 27°C (80°F) or above. Power augmentation will involve injection of steam which will vary from 14,610 kg/hr at 27°C to 25,442 kg/hr at 35°C (32,210 lb/hr at 80°F to 56,090 lb/hr at 95°F). Dry low-NO_x combustors will still limit NO_x emissions, but the emissions will be slightly higher than under normal gas firing mode, i.e., 25 ppmvd corrected to 15 percent oxygen at ISO conditions. NO_x emissions are slightly higher during power augmentation due to an increase in pilot flame fuel which is required to limit combustion instability.

The design parameters when firing natural gas and fuel oil and under power augmentation are presented in Appendix 10.1.5, Prevention of Significant Deterioration (Attachment A). These

data provide detailed design information, including fuel usage, water and steam injection, exhaust parameters, and emission calculations.

3.4.5 DESIGN PHILOSOPHY

The design philosophy for the Hardee Unit 3 Project minimizes air pollutant emissions by using the most efficient and pollutant-preventing generating technology. Initially, this concept has been incorporated with the selection of a combined cycle process utilizing advanced CTs. Combined cycle plants can be expected to achieve fuel conversion rates on the order of 7,550 Btu/kWh, as opposed to values in the 9,000 to 10,000 Btu/kWh range for more conventional generating plants. This is an improvement of about 25 percent. Thus, by maximizing the megawatt output per unit of fuel consumed, the air pollutant emissions per megawatt output are minimized. The selection of the most efficient CTs (the advanced type) also minimizes emissions with respect to power output. Pollution prevention is incorporated in the design by the use of clean fuels and combustion technology. Natural gas and very low sulfur content distillate oil will be used. Moreover, advanced dry low-NO_x combustion technology will be used to minimize NO_x emissions while ensuring that CO and VOC emissions are within accepted limits. Taken together, the design of Hardee Unit 3 will incorporate features that will make the project one of the most efficient and pollution-free power plants in the State of Florida.

3.5 PLANT WATER USE

The water demands and uses at the Hardee Unit 3 facility include condenser cooling, potable water, general plant service water, emergency (fire control) water, NO_x injection water (when firing distillate fuel oil for up to 1,500 hours per year), water for power augmentation, evaporative cooler makeup water, and steam cycle makeup water.

Condenser cooling demands for the Hardee Unit 3 Project will be satisfied by the existing cooling reservoir. Other water demands will be satisfied through direct withdrawal and use of lower Floridan aquifer water from onsite wells. All water demands for the Hardee Unit 3 Project will be met through the previously certified consumptive use allocation for the original HPS; no additional groundwater withdrawals will be requested for the Hardee Unit 3 Project.

Overall water balances for the entire 880-MW HPS (TPS 440-MW Units 1A and 1B and SECI 440-MW Hardee Unit 3) for average annual and maximum daily makeup conditions are presented in Figures 3.5.0-1 and 3.5.0-2. These figures show the overall groundwater withdrawal rate from the lower Floridan aquifer and the overall water budget for the cooling reservoir and the individual service water systems. These rates are within the existing allocation for the HPS site. Individual components of the water budgets for the average annual and maximum conditions are shown in Tables 3.5.0-1 and 3.5.0-2; methodologies used to calculate the water budgets are presented in the Water Alternatives Study (see Appendix 10.10).

Detailed plant water balances for Hardee Unit 3 alone for the average annual makeup, maximum daily makeup, and maximum daily discharge conditions for the Hardee Unit 3 Project are presented in Figures 3.5.0-3, 3.5.0-4, and 3.5.0-5, respectively. Average annual makeup is based on average annual climatological data and average annual operating conditions which are defined:

- 70 percent plant load
- Power augmentation (steam injection) for 12 hours/day between June and October, when ambient temperature exceeds 27°C (80°F)
- Relative humidity of 80 percent
- 95 percent natural gas firing and 5 percent distillate fuel oil firing, and
- No oil firing during peak unit loading.

Maximum daily makeup was based on the worst-case monthly climatological data and the following operational conditions:

- 100 percent plant load
- -1.1°C (30°F) ambient temperature
- 50 percent relative humidity
- Fuel oil firing of the CTs
- NO_x injection water

The various components of the Hardee Unit 3 water balances (i.e., Figures 3.5.0-3 through 3.5.0-5) are discussed in Sections 3.5.2 through 3.5.4. Section 3.5.5 presents a discussion of plant size and water use; e.g., a 440-MW configuration.

The makeup water requirements for the cooling reservoir with the proposed 880-MW configuration and existing supply sources (i.e., Floridan aquifer wells, rainfall, surface water runoff, and recycled treated wastewater from the plant) were estimated using a water balance methodology. This water balance approach considers all the water inflows to and outflows from the cooling reservoir in order to calculate monthly water makeup and discharge requirements.

The water balance of the cooling reservoir can be summarized as the following:

$$\Delta Q = Q_P + Q_R + Q_{SA} + Q_D + Q_{DW} - Q_E - Q_L - Q_{BS} - Q_{SD}$$

where:

ΔQ = gain or loss in reservoir volume over a specified unit of time

Q_P = precipitation on the reservoir

Q_R = upland runoff into reservoir

Q_{SA} = surficial aquifer seepage into the reservoir

Q_D = effluents discharged the reservoir

Q_{DW} = deep-well makeup to the reservoir

Q_E = evaporation

Q_L = leakance

Q_{BS} = berm seepage out of the reservoir

Q_{SD} = surface discharge to Payne Creek

Given monthly variations in rainfall and runoff into the reservoir, monthly variations in reservoir levels are calculated. If the reservoir level exceeds the control elevation [37.8 m-msl (124 ft-msl)], the required discharge quantity is calculated and mathematically subtracted from the reservoir. If the reservoir level drops below the minimum allowable elevation [37.2 m-msl (122 ft-msl)], the required deep-well makeup quantity is calculated and mathematically added to the reservoir in order to maintain it at the minimum elevation. By tracking and maintaining this monthly balance in reservoir water levels, the long-term water makeup and discharge requirements are calculated for various operational (load) scenarios.

Based on this methodology, the reservoir makeup requirements are shown in Table 3.5.0-1 and Figure 3.5.0-1 for average conditions and in Table 3.5.0-2 and Figure 3.5.0-2 for maximum conditions. As seen in these tables, the average monthly makeup requirement is estimated to range from 12.0 million Lpd (3.17 mgd) under average load conditions to a monthly maximum water demand of 32.4 million Lpd (8.57 mgd) under maximum load conditions.

The estimated average monthly makeup requirement of 11.7 million Lpd (3.17 mgd) does not consider the variability of climatic conditions (e.g., a succession of dry or wet months) that will determine actual groundwater withdrawals. To estimate these types of scenarios, a probabilistic frequency analysis (i.e., Log-Pearson Type III) was conducted as follows:

1. Average annual monthly water requirements under average load conditions were computed for each of the 37 years modeled via the heat and water budget models;
2. The Log-Pearson Type III probability distribution was calculated for the 37 years of average annual monthly water requirements; and
3. Using the probability density function; water withdrawals for various recurrence intervals (e.g. once in 10 years) were computed.

The results of this frequency analysis are presented in Table 3.5.0-3. As seen in the table, the 10 percent (e.g., one month in 10 years) water withdrawal is approximately 14.4 million Lpd (3.8 mgd). This analysis shows that the groundwater withdrawal rate may slightly exceed the average annual monthly allocation a maximum of three times throughout the projected economic life of the Hardee Unit 3 facility. However, at no time will the groundwater withdrawal exceed the existing 32.7 million Lpd (8.64 mgd) maximum monthly allocation. Given the projected load scenarios for HPS, this value was selected as the design average makeup water requirement.

The average annual groundwater makeup for the entire 880-MW HPS (TPS 440-MW Units 1A and 1B, and SECI 440-MW Hardee Unit 3) is 3.8 mgd. The maximum daily makeup for the entire 880-MW HPS is 8.64 mgd. A detailed discussion of the derivation of the average annual and daily maximum makeup volumes is presented in the Water Alternatives Study (see Appendix 10.10).

Design water quality characteristics for the existing cooling reservoir, surface runoff, and lower Floridan aquifer are presented in Table 3.5.0-4. The existing cooling reservoir will continue to serve as the water source for condenser cooling, and the lower Floridan aquifer will be the source of plant service water and makeup to the cooling reservoir, when needed. Water from the lower Floridan aquifer will be obtained from onsite wells.

Table 3.5.0-1. Summary of Cooling Reservoir Water Balance for Annual Average Conditions for 880-MW Buildout

	Flow ^a (gpd)
Total Groundwater Withdrawal	
Reservoir Makeup	2,602,000
Units 1A and 1B Service Water	408,000
Unit 3 Service Water	<u>164,000</u>
TOTAL	3,174,000
Reservoir Water Inflows	
Direct Rainfall	2,224,900
Surface Runoff	311,500
Surficial Aquifer Seepage	0
Units 1A and 1B Water Discharge	86,300
Unit 3 Wastewater Discharge	93,700
Deep Well Makeup	2,602,000
Total Reservoir Inflow	5,318,400
Reservoir Water Outflows	
Leakance Losses	336,000
Dike Seepage Losses	920,000
Evaporation From Reservoir	4,062,400
Discharges to Payne Creek	0
Total Reservoir Outflow	5,318,400

^a Assumes average load conditions.

Source: KBN, 1994.

Table 3.5.0-2. Summary of Cooling Reservoir Water Balance for Worst-Case Monthly Conditions for 880-MW Buildout

	Flow ^a (gpd)
Total Groundwater Withdrawal	
Reservoir Makeup	6,685,400
Units 1A and 1B Service Water	945,000
Unit 3 Service Water	<u>937,000</u>
TOTAL	8,567,400
Reservoir Water Inflows	
Direct Rainfall	2,034,600
Surface Runoff	0
Surficial Aquifer Seepage	0
Units 1A and 1B Water Discharge	200,000
Unit 3 Wastewater Discharge	285,000
Deep Well Makeup	6,685,400
Total Reservoir Inflow	9,205,000
Reservoir Water Outflows	
Leakance Losses	336,000
Dike Seepage Losses	920,000
Evaporation From Reservoir	7,949,000
Discharges to Payne Creek	0
Total Reservoir Outflow	9,205,000

^a Assumes 100 percent load.

Source: KBN, 1994.

Table 3.5.0-3. Estimation of Monthly Average Water Demand Under Average Load Conditions Using the Log-Pearson Type III Distribution

Interval (yrs)	Recurrence		Flow (gpd)
		Percent	
1.01		99	1,905,023
2		50	3,208,315
5		20	3,619,754
10		10	3,807,750
25		4	3,984,341
50		2	4,085,172
100		1	4,166,616
200		0	4,233,623

Note: Results of the Log-Pearson Type III distribution based on average annual monthly water requirements under average load conditions (for 880 MW) computed for each of 37 years show that an average monthly water withdrawal rate of 3.8 mgd will be required once every 10 years. The withdrawal rate of 3.8 mgd is consistent with the currently existing groundwater allocation for HPS.

Data Statistics:

Average	3,173,000 gpd
Minimum	2,101,000 gpd
Maximum	4,131,000 gpd
Standard Deviation	487,600 gpd
Number of Observations	37 years ^a

^a based on 444 months of historical data.

Source: KBN, 1994.

Table 3.5.0-4. Design and Existing Water Quality Characteristics for HPS (Page 1 of 2)

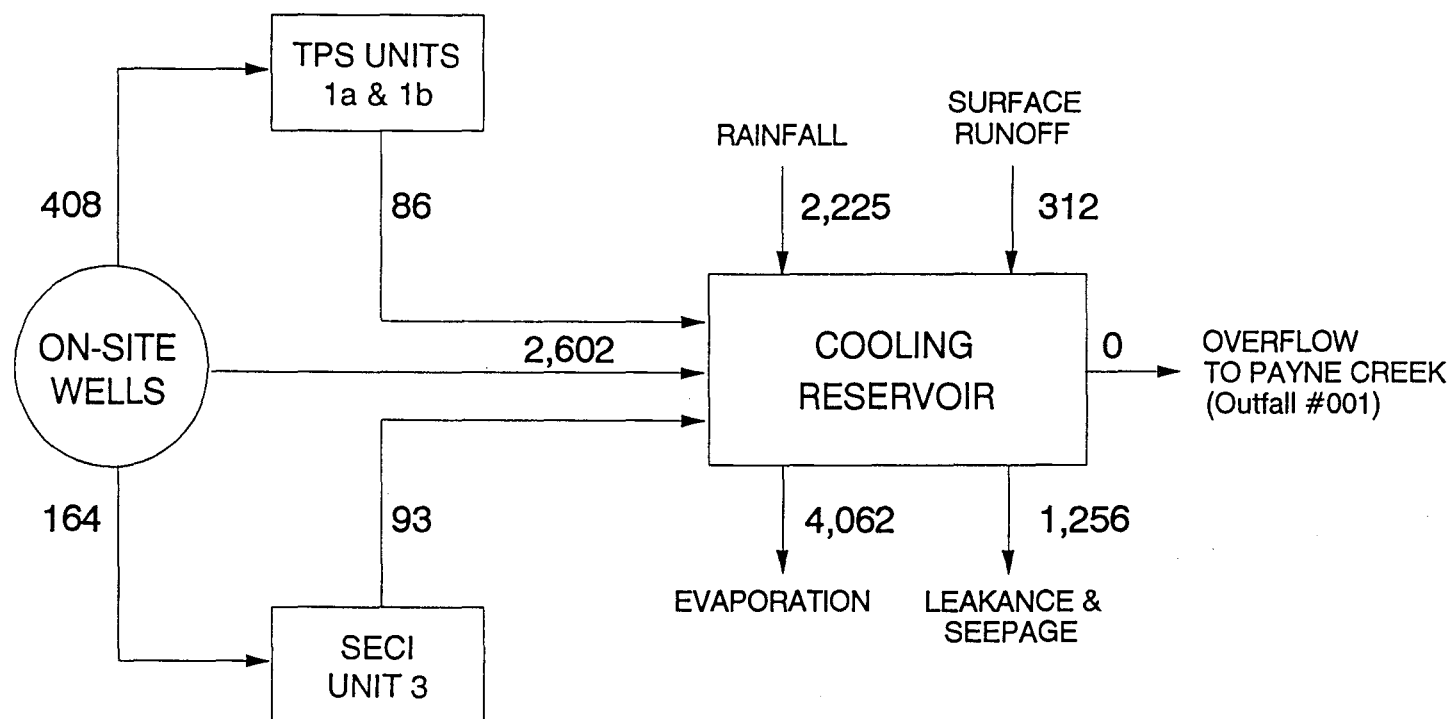
Parameter	Existing Cooling Reservoir	Design	
		Surface Runoff	Lower Floridan Aquifer Makeup
Calcium, mg/L as CaCO ₃	50.9	63	113
Magnesium, mg/L as CaCO ₃	52.4	39	49
Sodium, mg/L as CaCO ₃	108	17	37
Potassium, mg/L as CaCO ₃	1.5	0	8
Total Hardness, mg/L as CaCO ₃	101	102	162
Alkalinity, mg/L as CaCO ₃	96	61	160
Sulfate, mg/L as CaCO ₃	36.8	37	26
Chloride, mg/L	185	21	21
Silica, mg/L	< 1	5.4	27
Fluoride, mg/L	1.81	1.0	2.0
Cyanide, mg/L	< 0.005	< 0.004	< 0.005
MBAS, mg/L	NA	0.040	< 0.180
Oil and Grease, mg/L	< 5	< 5	< 5
Turbidity, NTU	10	1.7	14
pH, units	7.8	7	7.5
Total Dissolved Solids, mg/L	427	190	342
Specific Conductivity, μ mho/cm	349	173	320
Total Kjeldahl Nitrogen, mg/L	1.57	0.74	0.39
Ammonia Nitrogen, mg/L	0.046	0.11	0.20
Organic Nitrogen, mg/L	NA	0.65	0.19
Nitrate+Nitrite-Nitrogen, mg/L	0.009	0.50	0.031

Table 3.5.0-4. Design and Existing Water Quality Characteristics for HPS (Page 2 of 2)

Parameter	Existing Cooling Reservoir	Design	
		Surface Runoff	Lower Floridan Aquifer Makeup
Total Nitrogen, mg/L	1.58	1.24	0.421
Orthophosphorus, mg/L	0.347	0.41	0.20
Total Phosphorus, mg/L	0.816	0.44	0.20
Arsenic, $\mu\text{g/L}$	<5	<5	<10
Barium, $\mu\text{g/L}$	12	<10	75
Beryllium, $\mu\text{g/L}$	<0.1	<3	<0.1
Cadmium, $\mu\text{g/L}$	<5	<0.4	<0.7
Chromium, $\mu\text{g/L}$	<5	<10	13
Copper, $\mu\text{g/L}$	<10	7	7
Iron, $\mu\text{g/L}$	162	293	420
Lead, $\mu\text{g/L}$	<5	6.1	1
Manganese, $\mu\text{g/L}$	<5	7.9	28
Mercury, $\mu\text{g/L}$	<0.2	0.24	<0.2
Nickel, $\mu\text{g/L}$	<30	16	23
Selenium, $\mu\text{g/L}$	<5	<5	16
Silver, $\mu\text{g/L}$	<0.07	<0.08	<0.07
Strontium, $\mu\text{g/L}$	88	100	300
Zinc, $\mu\text{g/L}$	73	7.4	143
Alpha, Gross (pC/L)	12.5	1.7	8.4
Radium 226 (pC/L)	1.0	0.7	3.0

Note: NA = not analyzed.

Sources: TPS/SECI, 1989.
KBN, 1994.



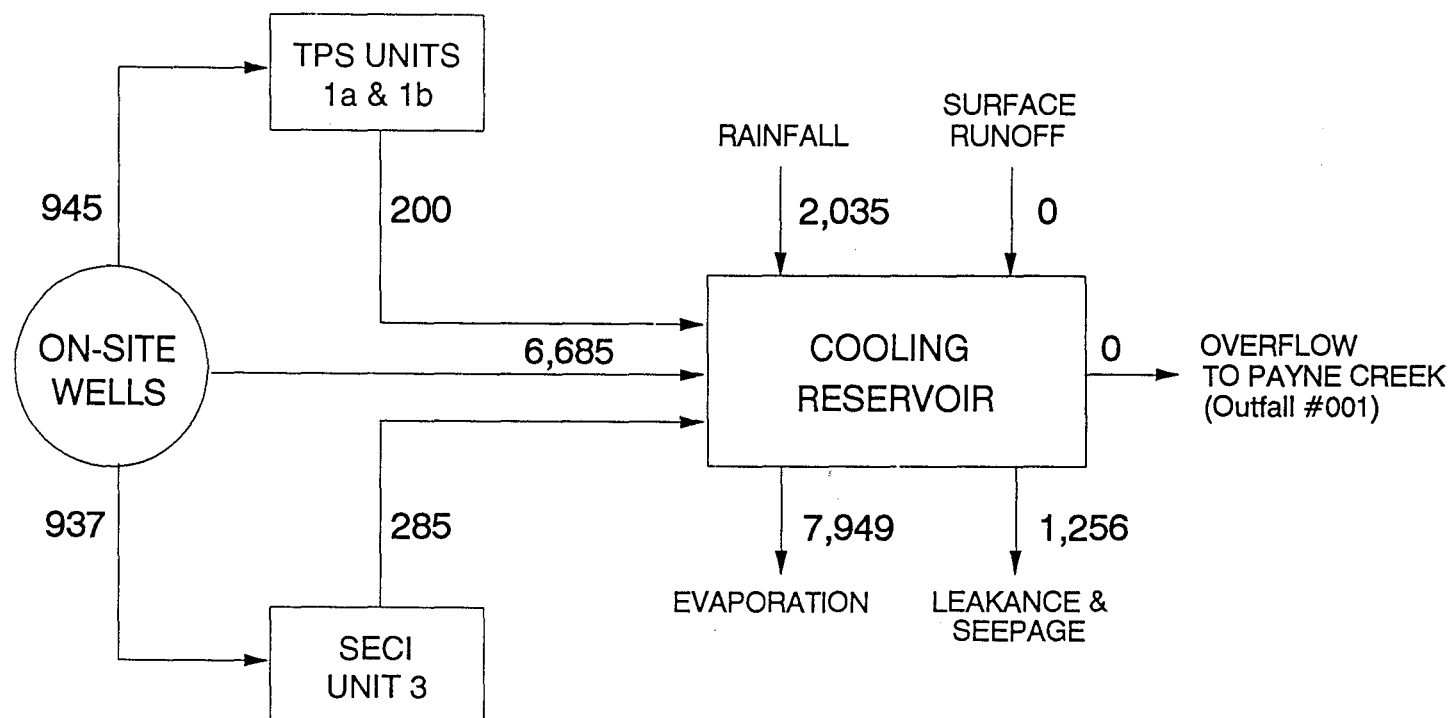
NOTES:

1. FLOWS ARE EXPRESSED AS 1,000 GALLONS PER DAY
2. FLOWS ARE FOR 880 MW PLANT

Figure 3.5.0-1
Cooling Reservoir Water Balance — Annual Average Conditions for 880-MW Buildout

Source: KBN, 1994.





NOTES:

1. FLOWS ARE EXPRESSED AS 1,000 GALLONS PER DAY
2. FLOWS ARE FOR 880 MW PLANT

Figure 3.5.0-2
Cooling Reservoir Water Balance — Worst-Case Monthly Conditions for 880-MW Buildout

Source: KBN, 1994.



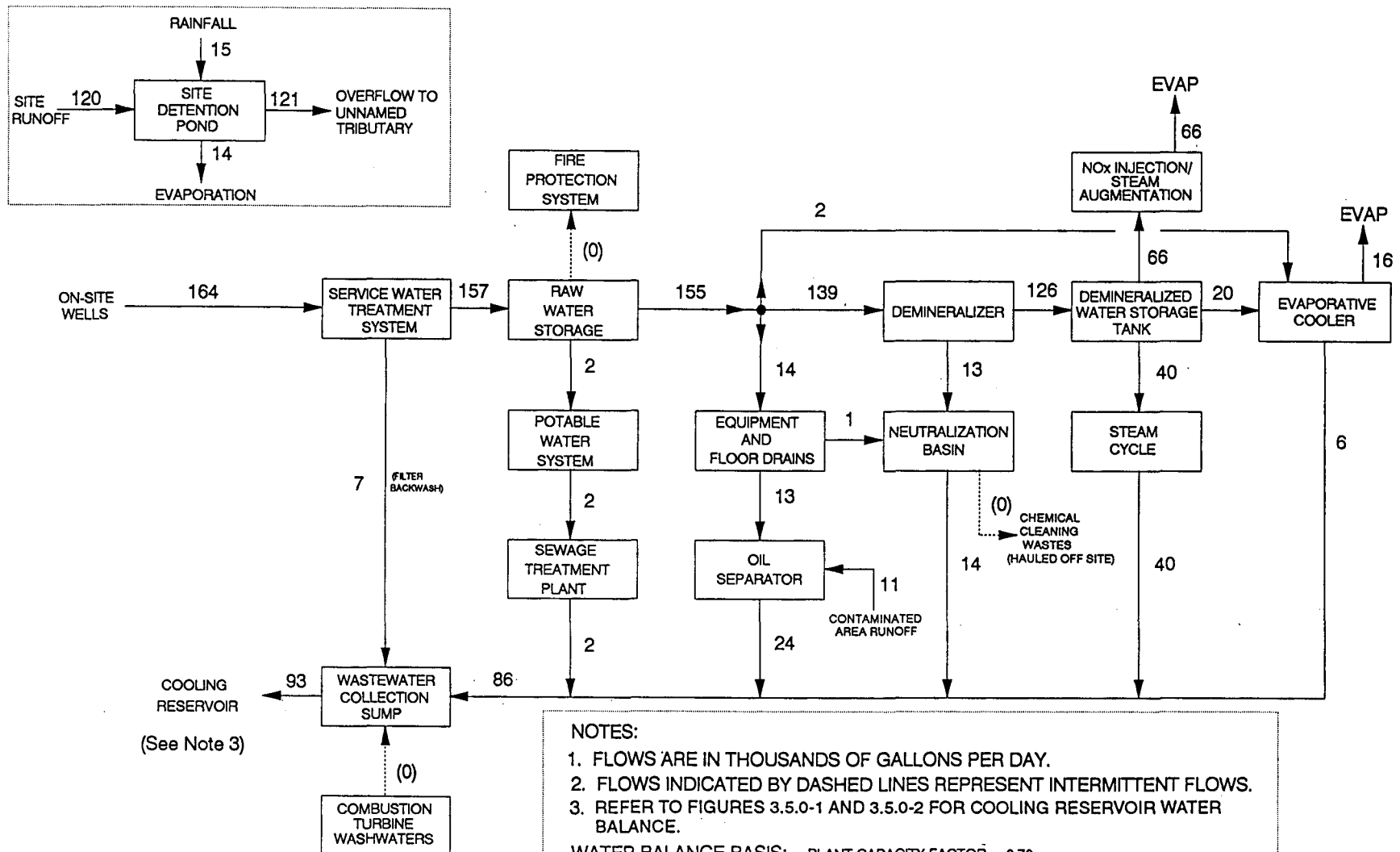


Figure 3.5.0-3
Plant Water Balance — Annual Average Makeup for the 440-MW Hardee Unit 3

Source: Black & Veatch, 1994.



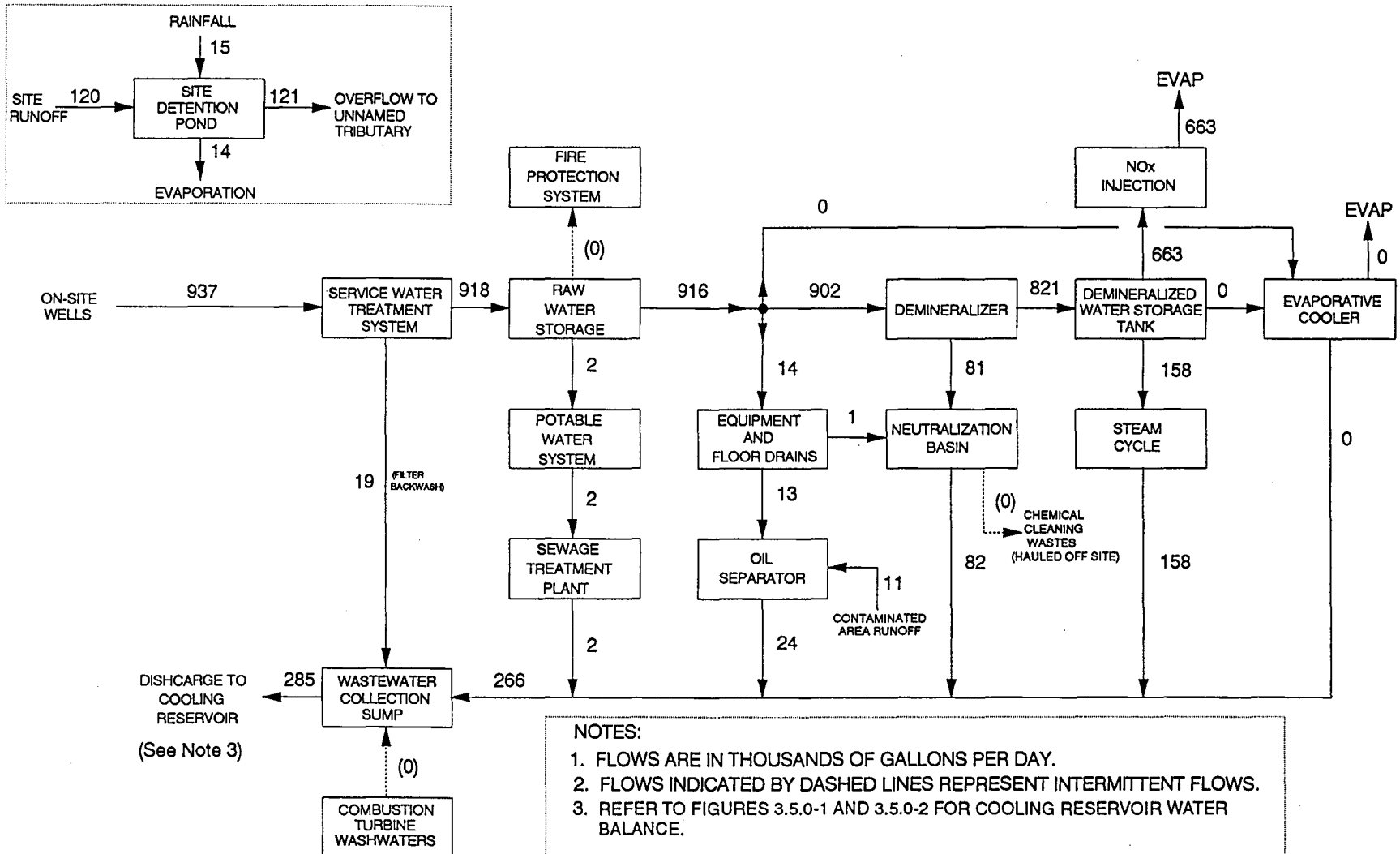
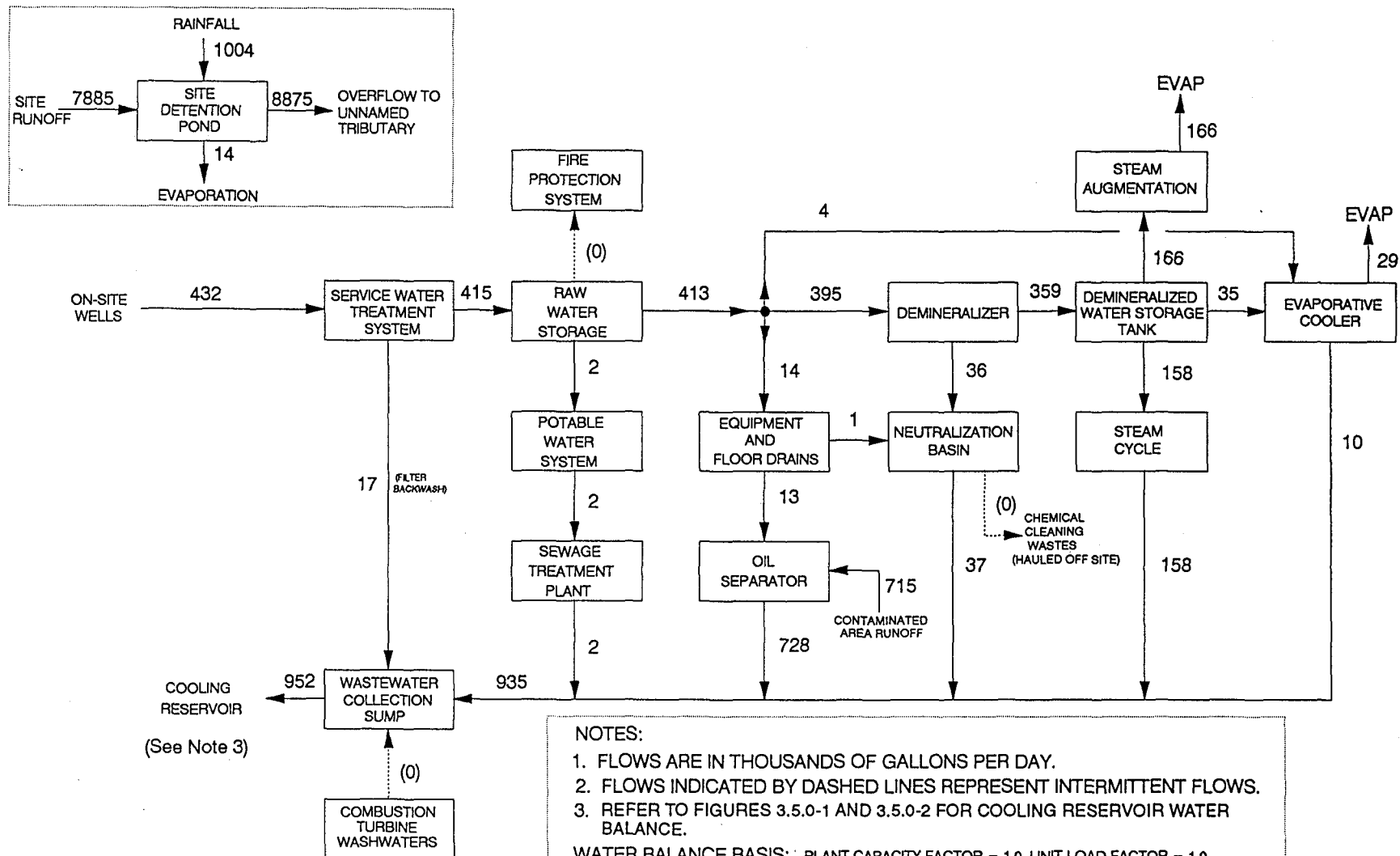


Figure 3.5.0-4
 Plant Water Balance — Maximum Daily Makeup for the 440-MW Hardee Unit 3

Source: Black & Veatch, 1994.





NOTES:

1. FLOWS ARE IN THOUSANDS OF GALLONS PER DAY.
2. FLOWS INDICATED BY DASHED LINES REPRESENT INTERMITTENT FLOWS.
3. REFER TO FIGURES 3.5.0-1 AND 3.5.0-2 FOR COOLING RESERVOIR WATER BALANCE.

WATER BALANCE BASIS: PLANT CAPACITY FACTOR = 1.0, UNIT LOAD FACTOR = 1.0
 25 YEAR, 24 HOUR RAINFALL EVENT
 STEAM AUGMENTATION 12 HR/DAY
 BURNING NATURAL GAS, 95 DEG-F, 80% R.H.

Figure 3.5.0-5
 Plant Water Balance — Maximum Daily Discharge for the 440-MW Hardee Unit 3

Source: Black & Veatch, 1994.



3.5.1 CIRCULATING WATER HEAT REJECTION SYSTEM

3.5.1.1 SYSTEM DESIGN

Based on the plant design for Hardee Unit 3, the following cooling system engineering design criteria were used:

1. The cooling system shall be capable of rejecting 1.24×10^{12} joules/hr (1.18×10^9 Btu/hr) at 35°C (95°F) ambient temperature and 1.37×10^{12} joules/hr (1.30×10^9 Btu/hr) at 0°C (32°F).
2. The cooling system shall be optimized for the expected ambient conditions and performance characteristics and requirements of the various heat rejection systems.
3. The cooling system shall be capable of supplying a daily average water temperature of 35°C (95°F) or cooler to the condenser under design ambient conditions and 100 percent load. Additionally, the condenser back-pressure shall not exceed 3.5 inches of mercury (in. Hg).
4. Cooling system water quality shall be maintained at satisfactory quality to allow continuous condenser cooling operation.

Condenser cooling will be achieved by once-through cooling using water from the existing cooling reservoir. Thermal modeling conducted as part of the Water Alternatives Study (see Section 5.1 and Appendix 10.10) indicated that the existing cooling reservoir has the capacity to accommodate the heat rejection requirements of the full 880-MW Hardee Power Station (440-MW Hardee Unit 3 Project and previously certified 295-MW Phase 1A and the future 145-MW Phase 1B).

The cooling reservoir will function as the fundamental component of the heat dissipation/rejection system. In this system, cooling water from the reservoir is pumped through the condenser to condense the turbine exhaust steam. This heated cooling water is returned to the cooling reservoir, where it is cooled through evaporative and radiant mechanisms.

The plant circulating water system consists of a single-pressure surface condenser, circulating water pumps, and supply and return circulating water piping to withdraw and return circulating water to the cooling reservoir. In addition to the surface condenser, an auxiliary cooling water system for equipment cooling will be installed. This system will consist of water-to-water heat exchangers and will receive cooling water from the circulating water system.

3.5.1.2 SOURCES OF COOLING WATER

As stated in the preceding section, the existing cooling reservoir will be used for condenser cooling for the Hardee Unit 3 Project. Currently, water makeup sources for the existing cooling reservoir include direct rainfall, runoff and seepage from the surrounding upland watershed, plant discharges to the reservoir, and, as necessary to maintain the reservoir water level, water from the lower Floridan aquifer. Proposed Hardee Unit 3 plant water inflows to the reservoir will include treated sanitary wastewater, plant and equipment drains, boiler blowdown, and demineralizer regeneration wastes; these will be treated as shown in the water mass balance (see Figures 3.5.0-3 through 3.5.0-5). The lower Floridan aquifer well water will not be treated before use as direct makeup to the cooling reservoir.

As part of the Water Alternatives Study conducted for Hardee Unit 3 (Appendix 10.10), refinements to the cooling reservoir water balance were developed. Based on these inputs and modeling results from the Water Alternatives Study, it was determined that the existing consumptive use allocation for the HPS is adequate to supply all water needs for the ultimate HPS generating capacity of 880 MW (440-MW Hardee Unit 3 Project and 440-MW Phase 1A and 1B previously certified) based on the 90 percent probability distribution of worst-case climatological data. Therefore, additional groundwater withdrawals will not be requested for the Hardee Unit 3 Project.

A maximum withdrawal rate of 32.7 million Lpd (8.64 mgd) is proposed for the 880-MW plant at the site with an average monthly withdrawal of 14.4 million Lpd (3.8 mgd). Small quantities of water will be used for drinking water, plant maintenance (cleaning) water, and miscellaneous water use at the plant.

The parameters listed in Table 3.5.1-1 were used to evaluate drawdown at the well and site boundary. These parameters were used with the modified Theis equation and the law of superposition to determine the drawdown at various distances from the pumping wells.

Figure 3.5.1-1 shows a worst-case groundwater withdrawal scenario of 58.3 million Lpd (15.4 mgd) (i.e., 1.8 times the permitted amount). Even when pumping at this unrealistically high rate for 120 days continuously, drawdown at the property boundary is estimated to be

<0.12 m (<0.4 ft.) Actual drawdowns will be considerably less given a pumping rate of 14.4 million Lpd (3.8 mgd).

Estimated long-term circulating water quality after 30 years of operation is shown in Table 3.5.1-2. These estimates are based on (1) existing water quality in the reservoir, (2) influent water quality from surface runoff and the lower Floridan aquifer, and (3) annual average climatological data and average load conditions for the entire 880-MW facility.

3.5.1.3 COOLING RESERVOIR WATER RELEASES

Water losses from the cooling reservoir include evaporation, seepage through the berm, leakage into the lower aquifers, and infrequent releases into Payne Creek (i.e., releases resulting from rainfalls greater than the 10-year, 24-hour storm).

Seepage from the cooling reservoir will serve as a continuous blowdown from the recirculating water system and will reduce the accumulation of adverse levels of dissolved solids within the reservoir.

To accommodate the infrequent releases which may occur during extreme (wet) meteorological conditions (> 10-year, 24-hour rainfall event), a reservoir overflow to Payne Creek was certified and constructed as part of the original HPS certification (TPS/SECI, 1989). The cooling reservoir overflow/discharge is currently directed from the reservoir surface to the edge of the Payne Creek floodplain/wetlands by a large wide swale. At the upland edge of the Payne Creek floodplain/wetlands, the swale widens to an area of sheet flow prior to entering Payne Creek. No modifications to the existing discharge structure are proposed as part of the Hardee Unit 3 Project.

Table 3.5.1-1. Deep-Well Aquifer Characteristics for Hardee Unit 3

Parameter	Value
Aquifer	Floridan
Transmissivity	1,000,000 gpd/ft
Storativity	0.005
Depth to Static Water	85 ft

Source: Dames & Moore, 1979.

Table 3.5.1-2. Estimated Long-Term Cooling Reservoir Water Quality After 30 Years of Operation at Average Load Conditions

Parameter	Units	Concentration
Calcium	mg/L as CaCO ₃	310
Magnesium	mg/L as CaCO ₃	140
Sodium	mg/L as CaCO ₃	210
Potassium	mg/L as CaCO ₃	20
Total Hardness	mg/L as CaCO ₃	440
Alkalinity	mg/L as CaCO ₃	360
Sulfate	mg/L as CaCO ₃	250
Chloride	mg/L as CaCO ₃	60
Silica	mg/L	70
Fluoride	mg/L	5.4
Cyanide	mg/L	0.01
MBAS	mg/L	0.48
Oil and Grease	mg/L	5
Turbidity	mg/L	31
pH, units	std. units	7.5
Total Dissolved Solids	mg/L	1080
Specific Conductivity	μmho/cm	1240
Total Kjeldahl Nitrogen	mg/L	1.2
Ammonia Nitrogen	mg/L	0.5
Unionized Ammonia	mg/L	0.017
Organic Nitrogen	mg/L	0.7
Nitrate+Nitrite-Nitrogen	mg/L	0.2
Total Nitrogen	mg/L	1.4
Orthophosphorus	mg/L	0.6
Total Phosphorus	mg/L	0.6
Arsenic	μg/L	30
Barium	μg/L	200
Beryllium	μg/L	1.6
Cadmium	μg/L	1.00
Chromium	μg/L	40
Copper	μg/L	9.95
Iron	μg/L	990
Lead	μg/L	6.8
Manganese	μg/L	63
Mercury	μg/L	0.097
Nickel	μg/L	60
Selenium	μg/L	40
Silver	μg/L	0.14
Strontium	μg/L	800
Zinc	μg/L	370
Alpha, Gross	pC/L	22.2
Radium 226	pC/L	7.9

Source: KBN, 1994.

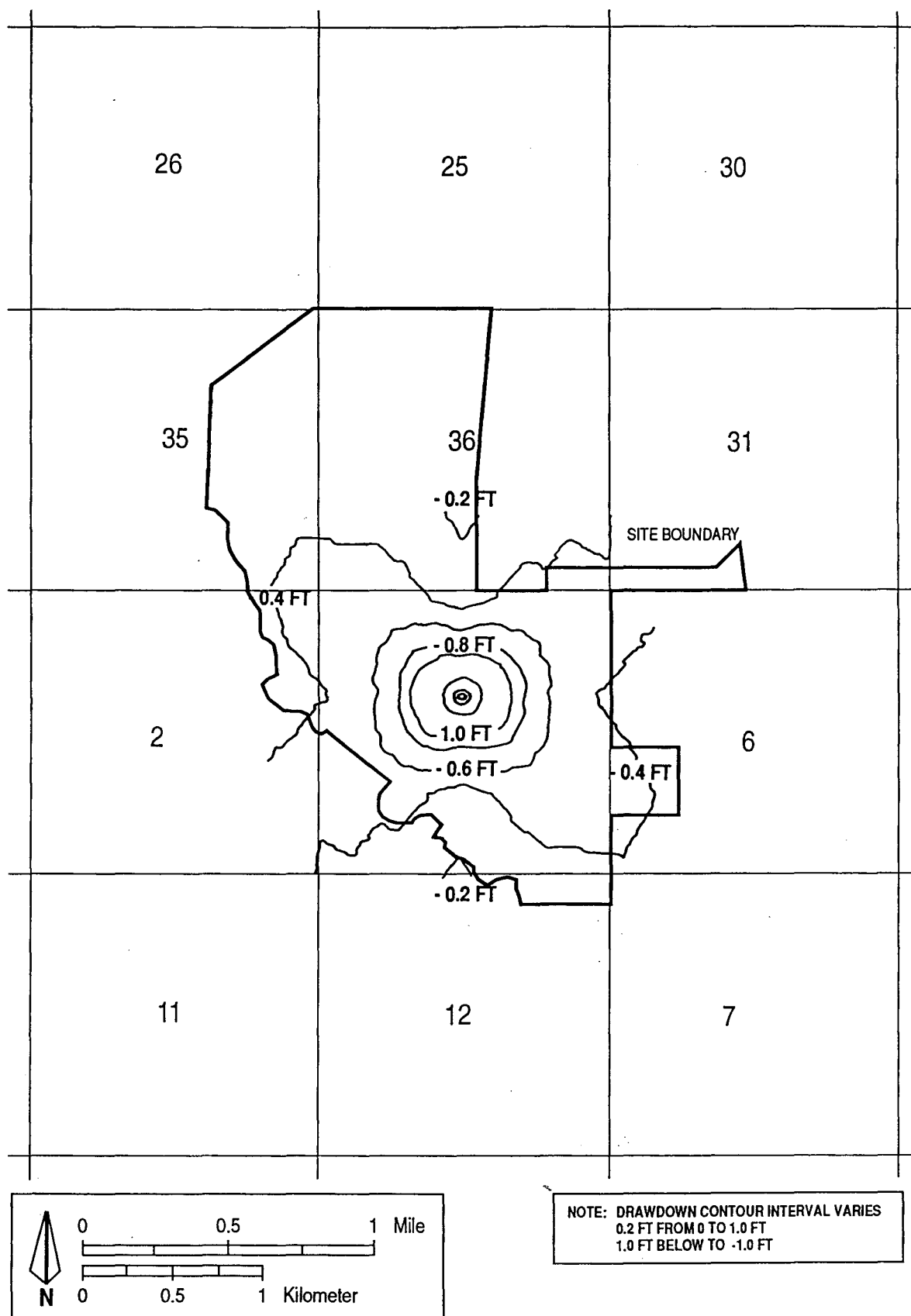


Figure 3.5.1-1
Predicted Worst-Case Groundwater
Drawdown Scenario

Source: TPS/SECI, 1989.



3.5.2 DOMESTIC/SANITARY WASTEWATER

Domestic/sanitary wastewater generated within the Hardee Unit 3 plant will be treated in a new package sewage treatment plant. This plant will be constructed and operated in compliance with F.A.C. 17-600. Final design information will be submitted to FDEP pursuant to conditions of certification. Sanitary facilities using potable water will be sized for 40 administrative, maintenance, operating, and other personnel. Discharges from showers, wash basins, bathrooms, drinking fountains, and other facilities are expected to result in an estimated 2,000 gpd (50 gallons per person per day) of combined sanitary wastewater flow. The BOD of the sanitary wastewater influent is anticipated to be 160 mg/L, or 2.7 pounds per day BOD loading to the system. The sludge per pound of BOD ratio is 0.6, or 1.6 pounds per day of sludge.

The proposed sanitary waste treatment system will be an extended aeration type package unit capable of handling a daily load of at least 2,000 gallons. The sanitary wastewater treatment system will include a covered, vented lift station and an activated sludge package unit. The components of the package unit include equalization, biological treatment, clarification, sludge digestion, filtration, and disinfection units. Effluent from the sanitary wastewater treatment system will be routed to the wastewater collection sump and then routed to the cooling reservoir for reuse in the heat dissipation system. Periodically, sludge will be removed from the sludge digester by vacuum truck for offsite disposal in an appropriately licensed sanitary landfill. Approximately 1,022 L (270 gallons) of sewage sludge is expected to be produced each month, based on a maximum of 40 persons at full buildout and assuming a sludge concentration of 1.5 percent.

The treatment system will be designed to ensure compliance with the following effluent limitations: BOD, 20 mg/L; TSS, 20 mg/L; and pH between 6 and 8.5. Disinfection will be designed to result in not more than 200 fecal coliform values per 100 mL of effluent sample [Chapter 17-600.440(4), F.A.C.].

Figure 3.5.2-1 presents a flow diagram of the sanitary wastewater treatment system. Wastewater from the sanitary lift station will flow to an activated sludge package treatment unit. Aeration air will be supplied by blowers to provide oxygen and mixing to the activated sludge for biological metabolism of organic material. Activated sludge will flow by gravity from the aeration basin to the clarifier for solids separation. A portion of the settled solids will be recycled to the aeration

basin to sustain the microorganism population. Excess activated sludge will be drawn off and sent to the sludge digester, providing the correct water-to-recycle ratio.

Effluent from the clarifier will flow by gravity to the chlorine contact chamber for disinfection. Effluent will be given at least 15 minutes contact time in the disinfectant chamber. A residual concentration of 0.5 mg/L total chlorine will be maintained in the effluent prior to discharge to the cooling reservoir.

3.5.2-3

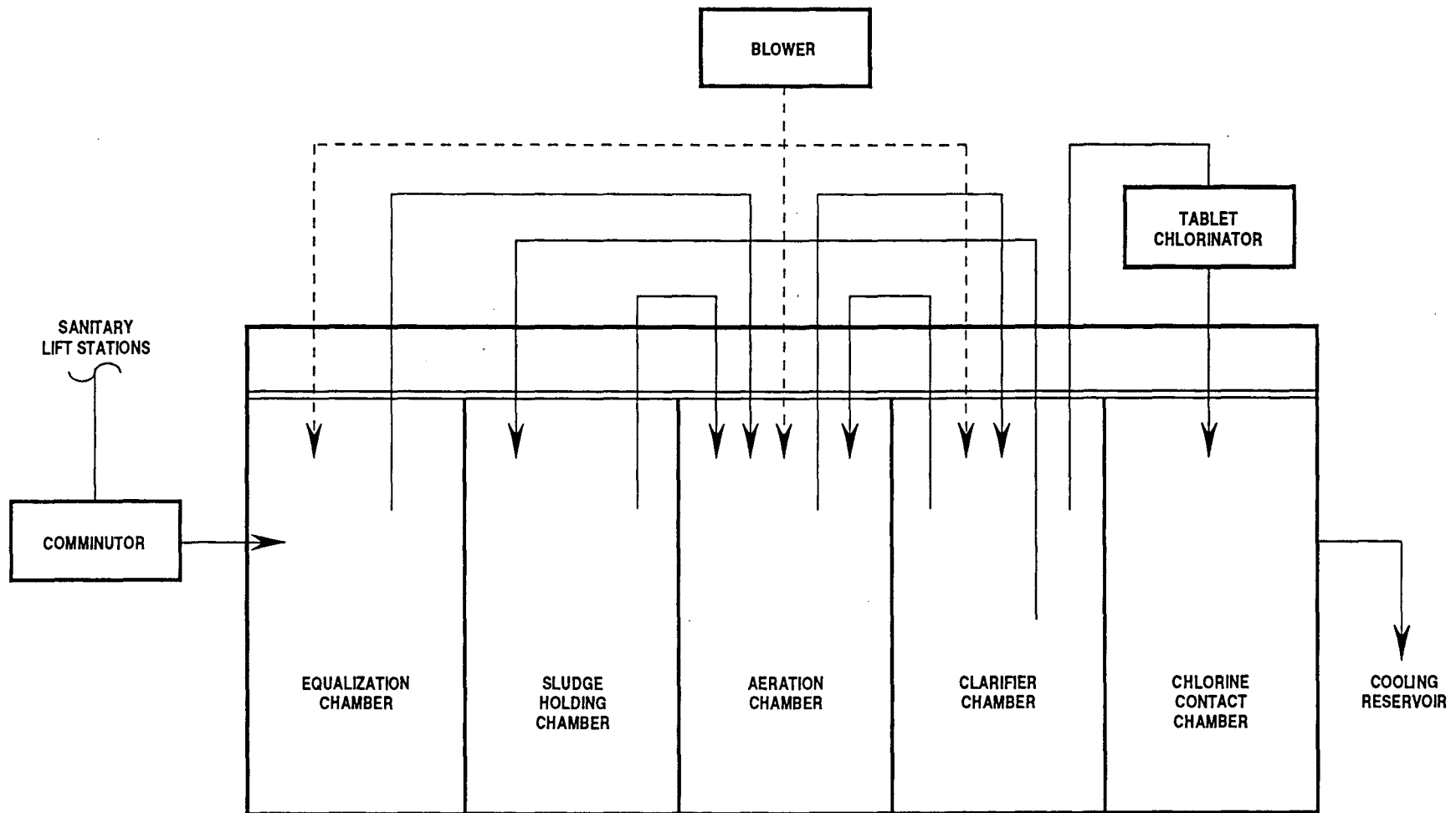


Figure 3.5.2-1
Sanitary Wastewater Treatment System

Source: Black & Veatch, 1994.

3.5.3 POTABLE WATER

Potable water uses at the Hardee Unit 3 facility will include water for drinking, washing, and toilets. Potable water for the plant will be obtained from the service water system, which will be supplied by lower Floridan aquifer well water following treatment and chlorination by the service water treatment system. The average expected potable water usage is approximately 7,570 Lpd (2,000 gpd) based on 40 administrative, maintenance, operating, and other personnel.

The system will be classified as nontransient noncommunity water system and will be operated in accordance with Chapters 17-550 and 17-555, F.A.C., the Safe Drinking Water Act, the Florida State Drinking Water Act, and other relevant standards. Final design information will be submitted to FDEP pursuant to conditions of certification.

3.5.4 PROCESS WATER

3.5.4.1 DEMINERALIZED WATER

The second largest water use in the new facility will be for demineralized water. Demineralized water is required for:

1. Injection into the CTs to reduce NO_x emissions when firing distillate fuel oil;
2. Makeup to replace blowdown from the HRSG (necessary to maintain a low dissolved solids content in the HRSG);
3. Injection into CTs for power augmentation to meet load demand in summer months;
4. Makeup to replace miscellaneous steam losses in the heat recovery cycles; and
5. Makeup to replace losses in the evaporative cooler.

Service water (i.e., filtered lower Floridan aquifer well water) will be demineralized in the ion exchange demineralizer train. The demineralizer train will consist of primary and secondary cation and anion exchangers. A forced-draft type degasifier will be located between the primary and secondary exchange vessels for reduction of carbon dioxide (CO₂). The demineralizer ion exchange vessels will be regenerated with solutions of sulfuric acid and sodium hydroxide (NaOH). The resulting regenerant wastestreams will be collected in a neutralization unit and treated as described in Section 3.6.7. The treated regenerant wastewater will be collected in a wastewater collection sump and recycled to the existing cooling reservoir.

3.5.4.2 GENERAL SERVICE WATER

General usage water, including seal water, cleaning and flushing water, and emergency (fire control) water, will be provided by the service water system. Water requirements are expected to average 57 liters per minute (Lpm) [15 gallons per minute (gpm)] for the Hardee Unit 3 facility and will be supplied from the service water treatment system.

Service water will be lower Floridan aquifer water which has been filtered using pressure filters. The filter units will be used to remove suspended solids from the water supply stream. The filters will be backwashed periodically with an average of 26,500 L (7,000 gallons) of unfiltered water. The filter backwash will be routed to the wastewater collection sump and then directed to the cooling reservoir.

Following filtration, chlorine will be added to the water for disinfection. A residual chlorine concentration of 0.2 ppm will be maintained in the raw water storage tank.

3.5.5 WATER USE VARIATIONS

Maximum daily water requirements for Hardee Unit 3 discussed in the preceding sections are based on a 440-MW facility operating at 100 percent load and when ambient meteorological conditions would necessitate the greatest overall consumption of water. For the major plant water uses (i.e., demineralized water for NO_x injection water, power augmentation, evaporative cooler, and steam cycle makeup), water use is proportional to operating load. Thus, reduction in load would result in a proportional reduction in water demand. The balance of plant water uses (potable and general service uses) is less dependent on operating load.

Variations in ambient meteorological conditions will also result in variations in water demand for evaporative cooling and cooling reservoir makeup. Given that a large portion (approximately 50 percent) of the total cooling reservoir makeup comes from precipitation, an increase in precipitation will cause an equivalent decrease in cooling reservoir makeup from lower Floridan aquifer wells. Similarly, periods of low temperature and/or high humidity will cause the evaporation in the cooling reservoir to decrease, and will allow the cooling reservoir makeup from lower Floridan aquifer wells to decrease proportionally.

Given its size and volume, the cooling reservoir substantially dampens short-term variations in cooling water makeup. Whereas actual evaporative losses may vary significantly based on plant load or daily meteorological conditions, the relative fluctuation in reservoir level or reservoir volume is small. Cooling reservoir makeup is independent of the short-term variations in plant and meteorological conditions. The cooling reservoir functions as a surface water reservoir designed to manage all water inflows and outflows, thereby maximizing water reuse, minimizing water withdrawals, and minimizing water demand and use variations. Makeup to the cooling reservoir is untreated.

3.6 CHEMICAL AND BIOCIDES WASTE

The overall water/wastewater flow schemes for Hardee Unit 3 are shown in Figures 3.5.0-3 through 3.5.0-5. All wastewaters generated within the proposed facility will be recycled to the existing cooling reservoir, after appropriate treatment (as described below), for reuse as cooling reservoir makeup. A similar wastewater treatment and recycling scheme is currently in use at the existing HPS units. The principal water/wastewater discharges to the cooling reservoir include:

1. Circulating cooling water return flow,
2. Service water treatment system backwash water,
3. Sanitary treatment system wastewater,
4. Equipment and floor drains,
5. Neutralization unit effluent,
6. Contact stormwater plant runoff,
7. Steam cycle blowdown, and
8. Evaporative cooler blowdown.

The principal uses of chemicals and biocides at the Hardee Unit 3 facility will be for cooling reservoir circulating water quality control, steam cycle water quality control, sanitary wastewater treatment, makeup water demineralization, chemical cleaning of the boiler and preboiler piping systems, and miscellaneous chemical drains.

3.6.1 COOLING RESERVOIR CIRCULATING WATER CHEMICAL TREATMENT

Intermittent shock chlorination or other oxidizing or nonoxidizing biocides will be used to prevent biofouling of the circulating water system. A chlorine solution will be fed into the intake structure at the circulating water pump intake.

A scale inhibitor may be fed to the circulating water system to control the formation of calcium carbonate scales, which adhere to heat transfer surfaces and reduce cooling condenser performance.

3.6.2 STEAM CYCLE WATER TREATMENT

The steam-condensate-feedwater cycle will be chemically treated to prevent corrosion or scaling of the condensate piping and the HRSG preboiler piping and boiler drums. The steam cycle water will be treated with an oxygen scavenger, such as hydrazine, for dissolved oxygen control and with ammonia or an amine for pH control. Sodium phosphate will be fed to the boiler for control of pH and hardness. Residual phosphate in the boiler will react with hardness to form a nonadherent precipitate.

3.6.3 SANITARY WASTEWATER TREATMENT

Sanitary wastewater produced during normal plant operation will be routed to an extended aeration sewage treatment plant. The average expected flow of sanitary wastewater is 7,570 Lpd (2,000 gpd). The sanitary wastewater treatment plant will be operated in accordance with Chapters 17-600 and 17-601, F.A.C. Effluent from the sanitary wastewater treatment system will be routed to the wastewater collection sump and then recycled to the existing cooling reservoir.

During construction and prior to completion of the sewage treatment plant, construction-related sanitary wastes will be managed by the installation, use, and maintenance of portable chemical toilets. As necessary, sanitary wastes will be pumped from these individual toilets and disposed of offsite in an approved facility by a licensed contractor.

3.6.4 MAKEUP WATER DEMINERALIZATION

As discussed in Section 3.5.4, the makeup water to the steam cycle will be demineralized using an ion exchange type demineralizer train. The demineralization system will use sulfuric acid for cation resin regeneration and sodium hydroxide for anion resin regeneration. The sulfuric acid and sodium hydroxide will be stored in bulk storage tanks with secondary containment located in, or adjacent to, the water treatment building. The use of these chemicals will be on an intermittent and as-needed basis, dependent on duration of the demineralizer service run and regeneration requirements.

Cation resin regeneration will produce regenerant wastewater containing unreacted sulfuric acid and dissolved sulfate salts of the cations removed from the resins during regeneration. Anion resin regeneration will produce regenerant wastewater containing unreacted sodium hydroxide and dissolved sodium salts of the anions removed from the resins during regeneration.

The estimated regenerant wastewater flow will average approximately 49,000 Lpd (13,000 gpd) based on the average makeup requirement conditions. The regenerant wastewaters will be drained by gravity to the neutralization unit for pH adjustment prior to discharge to the wastewater collection sump and ultimately recycled to the cooling reservoir. The neutralization unit is described in Section 3.6.7.

3.6.5 CHEMICAL CLEANING

The HRSG boiler and preboiler piping will be chemically cleaned initially during commissioning and also periodically during the life of the plant. The chemicals used will not be permanently stored onsite but will be delivered to the site by a licensed contractor at the time of the scheduled periodic cleanings. The chemical cleaning solutions to be used for acid and alkaline cleaning of the HRSG will be dependent on the HRSG manufacturer selected. The actual cleaning solutions used must be consistent with the HRSG manufacturer's recommendations. Chemicals typically used in HRSG and feedwater pipe cleaning include the following:

1. Inhibited hydrochloric acid,
2. Ammonium bifluoride,
3. Hydroxyacetic acid,
4. Formic acid,
5. Disodium phosphate,
6. Trisodium phosphate,
7. Soda ash,
8. Nonfoaming wetting agents, and
9. Foam inhibitors.

Wastewaters will consist of the cleaning solutions and material removed during the cleaning process. The chemical cleaning contractor will dispose of the chemical cleaning wastes offsite.

Since chemical cleaning is an infrequent maintenance operation, it does not contribute to the liquid wastes produced by the normal operation of the plant.

3.6.6 MISCELLANEOUS CHEMICAL DRAINS

Chemical wastewater can result from draining a chemical storage tank or from cleaning and maintenance operations such as washdown of chemical storage areas. A dedicated chemical waste drainage system will be provided to route miscellaneous chemical wastes to the neutralization unit for treatment. Flows from the miscellaneous chemical drains will be intermittent and will not normally contribute to the wastewater flows.

3.6.7 NEUTRALIZATION UNIT

A neutralization unit will be provided for pH adjustment of chemical wastes on a batch basis. The unit will be of sufficient volume to accommodate the wastewaters produced during regeneration of the demineralizer system. The neutralization unit will be a reinforced concrete basin lined with a chemical-resistant membrane and acid-resistant brick and mortar. A chemical waste mixer will be provided to mix the acid and alkaline wastewaters to enhance their self-neutralizing tendencies. Sulfuric acid and sodium hydroxide, as required for neutralization, will be available from the demineralizer regeneration equipment. The pH-adjusted chemical wastewaters will be routed to the wastewater collection sump. The estimated discharge from the neutralization unit under maximum daily conditions is 140,045 Lpd (37,000 gpd). Table 3.6.7-1 presents the estimated water quality of the neutralization unit effluent.

Table 3.6.7-1. Estimated Characteristics of the Neutralization Unit Effluent for the Hardee Unit 3 Facility (Page 1 of 2)

Parameter	Concentration
Calcium, mg/L as CaCO ₃	1,130
Magnesium, mg/L as CaCO ₃	490
Sodium, mg/L as CaCO ₃	3,050
Potassium, mg/L as CaCO ₃	80
Total Hardness, mg/L as CaCO ₃	1,620
Alkalinity, mg/L as CaCO ₃	0
Sulfate, mg/L as CaCO ₃	4,540
Chloride, mg/L as CaCO ₃	210
Silica, mg/L	270
Fluoride, mg/L	20
Cyanide, mg/L	0.05
MBAS, mg/L	1.8
Oil and Grease, mg/L	0
Turbidity, NTU	10
pH, units	6-9
Total Dissolved Solids, mg/L	6,860
Specific Conductivity, umhos/cm	12,100
Total Kjeldahl Nitrogen, mg/L	3.9
Ammonia Nitrogen, mg/L	2.0
Organic Nitrogen, mg/L	1.9
Nitrate+Nitrite-Nitrogen, mg/L	0.3
Total Nitrogen, mg/L	4.2
Orthophosphorus, mg/L	2.0
Total Phosphorus, mg/L	2.0

Table 3.6.7-1. Estimated Characteristics of the Neutralization Unit Effluent for the Hardee Unit 3 Facility (Page 2 of 2)

Parameter	Concentration
Arsenic, $\mu\text{g/L}$	100
Barium, $\mu\text{g/L}$	750
Beryllium, $\mu\text{g/L}$	4.5
Cadmium, $\mu\text{g/L}$	3.5
Chromium, $\mu\text{g/L}$	130
Copper, $\mu\text{g/L}$	30
Iron, $\mu\text{g/L}$	0
Lead, $\mu\text{g/L}$	15
Manganese, $\mu\text{g/L}$	0
Mercury, $\mu\text{g/L}$	0.06
Nickel, $\mu\text{g/L}$	230
Selenium, $\mu\text{g/L}$	160
Silver, $\mu\text{g/L}$	0.35
Strontium, $\mu\text{g/L}$	3,000
Zinc, $\mu\text{g/L}$	1,400
Alpha, Gross (pC/L)	84
Radium 226 (pC/L)	30

Source: Black & Veatch, 1994.

3.6.8 MISCELLANEOUS EQUIPMENT AND FLOOR DRAINS

Separate collection systems will be used to collect chemical drain wastewater and miscellaneous equipment and floor drain wastewater. Chemical drain wastewaters are addressed in Section 3.6.6. Miscellaneous equipment and floor drain wastewater can result from maintenance drains of equipment, seal water drains, and drains from general cleaning and maintenance, such as washdown of general plant (i.e., non-chemical) areas. Miscellaneous equipment and floor drains will be directed to an oil/water separator and then routed to the wastewater collection sump for recycling to the cooling reservoir. The estimated discharge from equipment and floor drains under maximum daily conditions is 49,210 Lpd (13,000 gpd).

3.7 SOLID AND HAZARDOUS WASTE

3.7.1 SOLID WASTE

Only small quantities of solid wastes will be generated by the Hardee Unit 3 Project since there will be no ash or flue gas desulfurization (FGD) waste generated. Solid wastes will be limited to municipal solid waste, sanitary waste treatment sludge, and infrequent replacement of demineralizer resins. The sanitary waste sludge will be disposed of by a licensed contractor who will remove sludge from the sludge-holding compartment once or twice per year. The sanitary waste sludge will be hauled offsite for disposal by a licensed contractor. All municipal solid wastes will be disposed of in an offsite sanitary landfill by a trash disposal contractor. Spent demineralizer resins will be removed from the site by a vendor and taken to an approved offsite disposal facility.

3.7.2 HAZARDOUS WASTE

Generation of hazardous waste at the Hardee Unit 3 facility will be limited to small quantities (less than 100 kg/month) of spent solvents and other chemicals. These wastes will be collected onsite and disposed of by a licensed hazardous waste contractor. No hazardous waste will be stored onsite for more than 90 days before removal. The demineralizer regenerant wastewaters can contain up to 10 percent sulfuric acid or up to 5 percent sodium hydroxide along with the minerals removed from the ion exchange resins. Spent acidic and basic solutions used to treat the demineralizer resin bed ion exchangers will be treated to eliminate corrosivity. Since these solutions will be treated in "an enclosed neutralization unit" or "elementary neutralization unit," they will not be classified as hazardous wastes according to Florida Hazardous Waste Rules (F.A.C. 17-730.270) or Federal Hazardous Waste Rule [40 CFR 264.1(g)(6) and 40 CFR 265.1(c)(10)]. The neutralized wastewater will not be accumulated and will be routed from the neutralization unit to the wastewater collection sump and ultimately to the cooling reservoir as a nonhazardous waste. Acid-cleaning wastes are addressed in Section 3.6.5.

3.8 ONSITE DRAINAGE SYSTEM

The site drainage facilities for Hardee Unit 3 will be constructed and operated separately from the HPS existing units. No changes in design or operation of the site drainage system for the HPS existing units are proposed as part of the current certification application.

Site drainage facilities for the Hardee Unit 3 will be designed in accordance with SWFWMD criteria (Chapter 40D-4, F.A.C.) for water quality and water quantity control. A plant site drainage system of pipes, channels, and culverts will convey runoff to a stormwater detention pond. Discharge from this stormwater detention pond will flow to the unnamed tributary to Payne Creek. A conceptual stormwater management plan for Hardee Unit 3 is presented in Appendix 10.12.1.

3.8.1 STORMWATER DETENTION POND

Non-contact surface runoff from the area disturbed for new facility construction and plant operation will be collected and routed to the stormwater detention pond. This pond will be located in the southwestern portion of the Hardee Unit 3 Project site and will receive non-contact surface drainage from the entire Hardee Unit 3 facility.

The stormwater detention pond has been sized to address both the water quality and water quantity control criteria of SWFWMD. For water quality control, the stormwater detention pond will provide "on-line" wet detention for runoff from the first 2.5 cm (1 inch) of runoff. Treated stormwater from the pond will be discharged to the adjacent unnamed tributary to Payne Creek.

For water quantity control, the stormwater detention pond will provide sufficient volume for peak attenuation to limit the peak pond discharge rate to the pre-development site peak discharge rate for a 25-year, 24-hour rainfall event. The overflow weir structure will pass any flows that exceed the flow resulting from the 25-year, 24-hour rainfall event. Design calculations are presented in Appendix 10.12.1.

3.8.2 STORMWATER RUNOFF CONTROL DURING CONSTRUCTION

The stormwater detention pond will be built during initial construction to serve as a construction stormwater detention pond. A system of temporary construction ditches and piping will direct the stormwater runoff and dewatering water flow to the pond. The construction drainage system will follow the layout of the permanent ditch system where possible.

Site development will not significantly alter the grades or drainage patterns of the site. Existing vegetation will be removed as required during initial site preparation operations. Final grading will include seeding all disturbed areas not occupied by plant facilities or not surfaced with asphalt or crushed aggregate.

Existing natural and mine reclamation drainage patterns will be altered so that all runoff from the main plant site will be directed to the runoff detention pond.

The temporary erosion and sedimentation control measures will be designed to prevent sediment from being displaced and carried offsite by construction runoff. The primary destination of construction runoff will be the runoff detention pond.

Prior to beginning excavation activities, a silt fence or straw bales will be installed along the perimeter of the project where runoff to offsite areas is expected. This silt fence will filter sediments from construction runoff. During construction, the extent of earth disturbances will be minimized as much as practical. Areas outside of cut and fill operations will be protected against unnecessary equipment traffic. Aggregate-surfaced areas will be provided for construction parking and roads.

Erosion control during construction will also include periodic spraying of water to minimize fugitive dust from the project area. A sediment filter or small sediment trap will be provided at the culverts and ditches to reduce the sediment load carried into the drainage system and pond.

Diversion ditches and/or berms will be constructed as necessary to divert runoff from offsite areas around the construction site. Temporary control measures will be maintained as necessary throughout the construction period and removed at the end of construction.

Runoff from areas of the site not disturbed by construction activities or plant operations will be directed to the natural drainage systems within the area. Runoff from areas of the site disturbed by construction activities will be collected in the stormwater drainage system and routed to the stormwater detention pond. A sedimentation and erosion control plan for Hardee Unit 3 is included in Appendix 10.10.

As necessary, sediment collected during the construction phase will be removed to ensure adequate pond volume and disposed of onsite.

3.8.3 SITE DRAINAGE

Generally, the drainage in the area of the new facility will be directed away from the structures and routed to the stormwater detention pond. The main plant complex area will be graded with moderate slopes for effective drainage.

Site runoff will be conveyed to the stormwater detention pond through a drainage system of pipes, channels, and culverts (see Appendix 10.11.1).

3.8.4 FLOOD ELEVATIONS

The Hardee Unit 3 site is not located in a 100-year floodplain. The 100-year flood elevation of the nearby unnamed tributary is approximately 36.3 m-msl (119 ft-msl). The elevation of the site facilities will be approximately 39.0 to 39.3 m-msl (128 to 129 ft-msl), which is about 3 m (10 ft) above the flood elevation.

3.9 MATERIALS HANDLING

3.9.1 CONSTRUCTION MATERIALS AND EQUIPMENT

Construction materials and equipment will be delivered to the site by existing roads and railroads. As shown in Figure 3.2-1, the existing access road from CR 663 will be used during construction and operation of the Hardee Unit 3 Project. Figure 3.2-1 also shows the existing CSX rail line located east of the project site. Rail deliveries of equipment will be made at an existing siding near the site and transported to the site by truck.

Construction laydown areas for materials will be located as shown in Figure 3.2-3. Materials will be unloaded and moved around the site using portable cranes and trucks. Some of the heaviest items such as the CTs, generators, HRSGs, and transformers may require rail delivery as discussed in Section 3.9.3. Pollution control measures for the laydown areas will include runoff collection as described in Section 3.8. Main roads in the laydown areas will be surfaced with aggregate and treated with dust palliative to reduce dust. Water sprays will also be used, as required, to control dust due to traffic.

3.9.2 ROADS

Construction trucks will travel to the site via Fort Green Road and CR 663 and the existing site access road shown on Figure 3.2.0-1. This route was used during construction of the HPS existing units.

3.9.3 RAILROAD

A CSX Railroad branch-line currently runs north-south approximately 0.8 km (0.5 mile) east of the proposed power block location on the site. All rail deliveries of construction materials and equipment for the facility will be off-loaded at a rail siding near the CFI plant and transported by truck to the site. The branch-line is primarily used for phosphate rock shipments from local mines. This line can accommodate the shipments required for the project.

3.10 REFERENCES

The following references are cited in Chapter 3.

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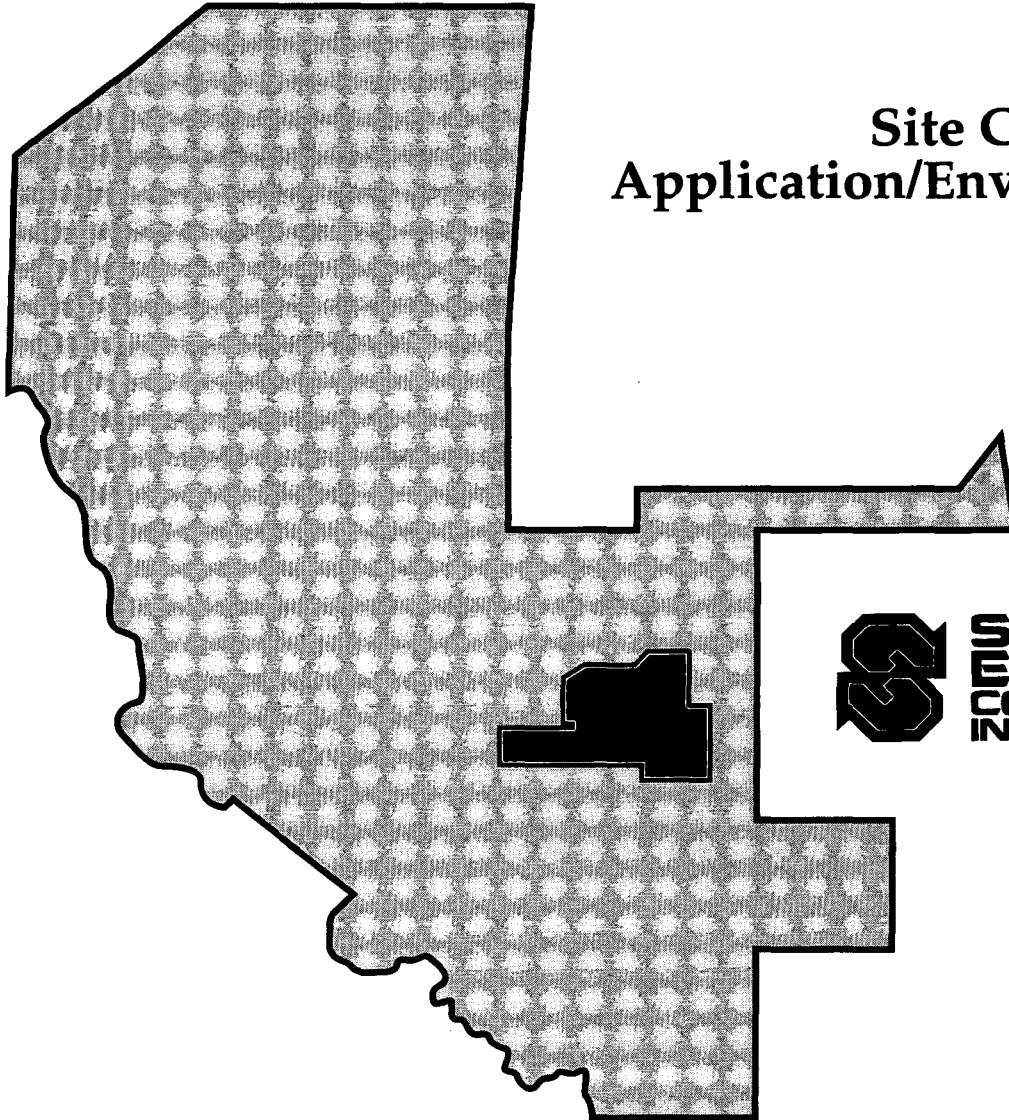
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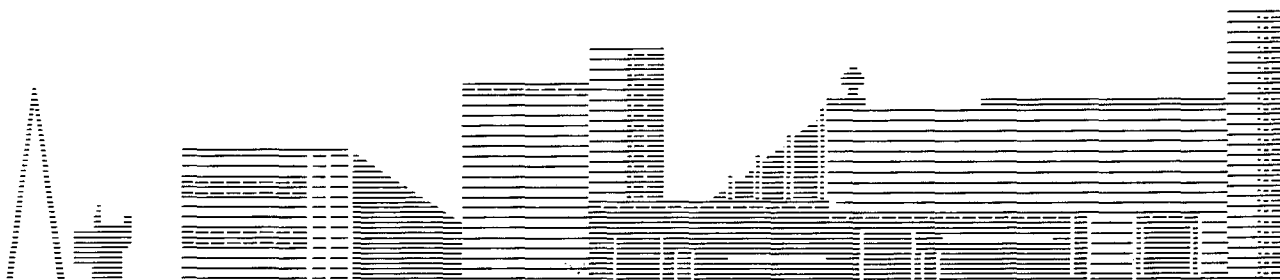
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HARDEE UNIT 3

Site Certification
Application/Environmental
Analysis



 **SEMINOLE
ELECTRIC
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4.0 EFFECTS OF SITE PREPARATION AND PLANT AND ASSOCIATED FACILITIES CONSTRUCTION

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4.1 LAND IMPACTS

4.1.1 GENERAL CONSTRUCTION IMPACTS

As discussed in Section 2.3.5, the land in the immediate vicinity of the proposed Hardee Unit 3 site currently is either being used for phosphate mining or is in the process of post-mining reclamation. Most of the land in the general area has already been disturbed by mining activities. The proposed facility will be located on a 20-hectare (ha) (50-acre) parcel adjacent to the HPS existing units and existing cooling reservoir within the existing Hardee Power Station (HPS) site. Therefore, general site preparation and construction will have minimal land impacts.

The Hardee Unit 3 power block will be constructed primarily on land that has been disturbed by mining and reclamation activities; other facility structures will be located on both unmined and mined land. The 230-ha (570-acre) existing cooling reservoir was constructed during the first phase of the HPS buildout entirely on mined lands. The cooling reservoir will not be expanded in size to accommodate Hardee Unit 3. The existing access road, which is 8 meters (m) [26 feet (ft)] wide with a 6 m (20 ft) wide paved center section and a 1 m (3 ft) shoulder on either side will provide access to the Hardee Unit 3 facility from Fort Green Road in Polk County which becomes County Road (CR) 663 at the Hardee County line. No new access roads will be constructed for Hardee Unit 3. Although the Hardee Unit 3 site is relatively flat, local site grading and leveling will be necessary for construction. Impacts to terrain will be minor. No blasting is anticipated for construction of the Hardee Unit 3 Project.

Laydown areas for equipment and supplies will be graded and surfaced with aggregate where needed. These areas will be used for the storage of construction materials and will be located as shown in Figure 4.1.1-1.

No impacts from disposal of construction wastes are anticipated. Combustible construction wastes (e.g., paper, wood, etc.) will be burned onsite in accordance with applicable regulations. Other construction wastes will be removed from the site for disposal at a facility approved by the Florida Department of Environmental Protection (FDEP). Any garbage (food containers, papers, etc.) will be collected in appropriate waste collection containers and disposed in accordance with FDEP and local regulations. Any waste oils or other chemical wastes generated during construction will be removed from the site and disposed of by a licensed contractor.

During construction, the construction labor force will utilize portable chemical toilets. All sanitary sewage will be frequently pumped from the individual toilets for transportation to an approved disposal facility by a licensed contractor.

Potable water for consumption during construction will be obtained from the existing wells or from offsite sources.

Fugitive dust and impacts on the human population are addressed in Sections 4.5 and 4.6, respectively.

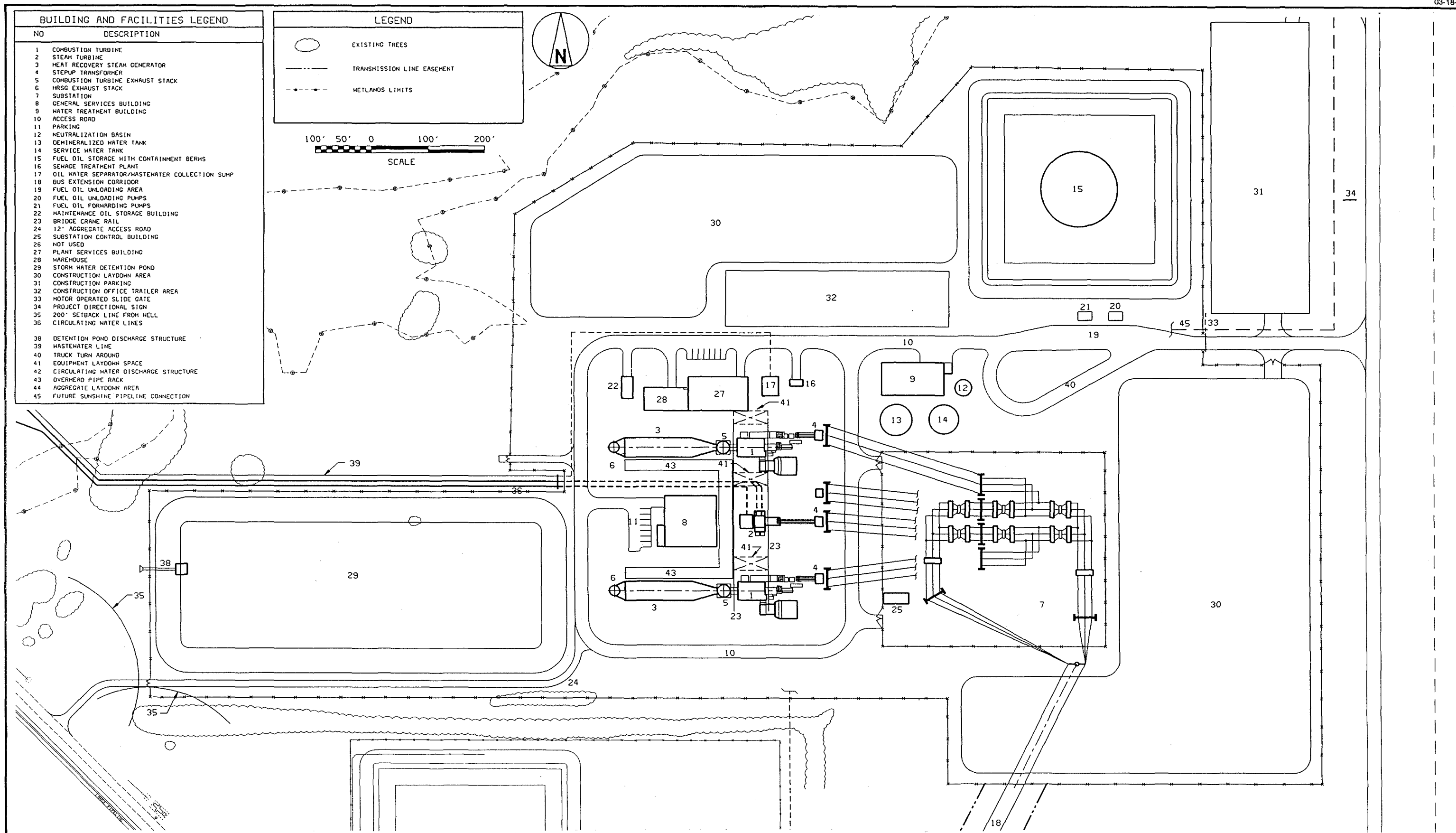


Figure 4.1.1-1
Hardee Unit 3 Plot Plan

Source: Black & Veatch, 1994.



4.1.2 ROADS

The Hardee Unit 3 Project will use the existing access road that connects the HPS facility with Fort Green Road in Polk County, just north of the Polk/Hardee County border. Fort Green Road becomes CR 663 in Hardee County. Therefore, no new access roads to either county- or state-maintained roads will be required. Short road connections will be required to access the Hardee Unit 3 site within the existing HPS site.

4.1.3 FLOOD ZONES

As part of its mining/reclamation permit approval program, Agrico conducted a 100-year flood elevation study for Payne Creek. Based on this study, the 100-year flood elevation in the vicinity of the HPS site generally corresponds with the limits of the forested floodplain and related wetland vegetation associated with Payne Creek, and does not extend to the project area. The flood study indicated that the floodplain elevation was generally about elevation 33.5 meters above mean sea level (m-msl) [110 feet above mean sea level (ft-msl)], while the HPS site is generally higher than 37.2 m-msl (122 ft-msl). These flood elevation study results were submitted to regulatory agencies as part of the approval process for Agrico's mining and reclamation plan.

All Hardee Unit 3 facilities have been designed to comply with all applicable Southwest Florida Water Management District (SWFWMD), Hardee County, and FDEP requirements regarding flood protection and control. No structures or fill will be placed in the Payne Creek floodplain; therefore, no reduction in cross-section flow-way or flood storage will occur. No adverse impact on the 100-year flood elevations or flood flows in Payne Creek are anticipated, because stormwater design will comply with SWFWMD regulations that restrict postdevelopment peak flow rates to predevelopment flow rates.

With the exception of the water circulating pipes, all structures associated with the Hardee Unit 3 Project will be outside of the unnamed tributary to Payne Creek; the circulating water pipes will cross the unnamed tributary in a manner that will not affect water flow and will minimize impacts to associated wetlands.

4.1.4 TOPOGRAPHY AND SOILS

Current topographic features at the HPS site reflect past mining and reclamation activities.

The site location for the Hardee Unit 3 facility consists of unmined and reclaimed land. This area of the HPS site is gently sloping, bordered by the access road to the east and south and a wetland area to the north and west. General site grading for the Hardee Unit 3 facility will take place by matching of cuts and fills, as needed. It is anticipated that a net import of soil materials will be required. Major structures in the power block area will be constructed on land previously disturbed during reclamation activities.

Bearing strengths of the fine sands are sufficient, and shearing failures of the foundations will not occur. Auger cast pilings, if required to support heavily loaded major equipment foundations, may be used. Where compaction is necessary for construction, a densification program will be instituted. Structures will not be constructed on unstable soils; adequate support and retaining structures will be utilized.

Construction runoff from the site will be collected in the detention pond upgradient of the unnamed tributary wetland. Areas not covered by structures and roads will be left in a natural state so that rainfall will percolate into the surficial aquifer.

During construction, an erosion control and sedimentation plan (see Appendix 10.10) will be implemented to prevent discharge of sediment from the site. This plan will include a detention pond, silt nets, straw baling, and other techniques to retain sediments onsite. As each area is final graded, vegetation will be established. Areas near switchyards and permanent ditches will be protected with coarse stone to prevent erosion and to promote infiltration of stormwater.

Construction-related changes in site topography or soils should have no adverse effect on aesthetics or viewshed based on elevations and relative distance from roads.

4.2 IMPACT ON SURFACE WATER BODIES AND USES

4.2.1 IMPACT ASSESSMENT

4.2.1.1 SURFACE HYDROLOGY - PHYSICAL AND CHEMICAL

Payne Creek and its unnamed tributary are the only natural surface water bodies in the immediate vicinity of the HPS site. The primary potential impacts to Payne Creek and its unnamed tributary from site preparation and plant construction are erosion and sedimentation due to earthmoving and material placement associated with the plant. Discharges associated with construction dewatering may also be considered a potential impact to the surface waters of Payne Creek and its unnamed tributary. These impacts will be controlled and minimized through proper design and placement of runoff control features (see Erosion Control and Sedimentation Plan, Appendix 10.10).

Runoff from areas of the site disturbed by construction activities, including material laydown areas, and dewatering flows, will be collected in pipes, an open channel system, and/or catch basin and directed to the permanent site stormwater detention pond. This pond will be located adjacent to the power block area and will be built early during construction to serve as a construction runoff detention pond. Sediments which are trapped by and accumulate in the stormwater detention pond will be removed as necessary. The construction drainage system will follow the layout of the permanent ditch system where possible. The treated runoff will be discharged into the unnamed wetland tributary.

With the exception of new cooling water intake and return structures, no changes to the existing cooling reservoir structure will be made as part of the Hardee Unit 3 Project. The design of the cooling water intake and return structures will be similar to those constructed for HPS existing units.

4.2.1.2 ECOLOGICAL SYSTEMS

No direct impacts to the aquatic systems of Payne Creek or its associated floodplain will occur from construction activities associated with Hardee Unit 3 because no structures will be placed in the flowing creek or in the floodplain.

Construction of the circulating water pipes will result in minor impacts to IMC/Agrico's reclaimed wetland (Area No. 1 in Figure 4.2.1-1). Impacts associated with the reclaimed wetland

include clearing 0.02 ha (0.06 acre) of wetland, permanently filling 0.006 ha (0.015 acre) of wetland within the 0.024 ha (0.06 acre) clearing for pipe support structures, and temporarily filling 0.002 ha (0.006 acre) of wetland within the 0.024 ha (0.06 acre) clearing to construct two temporary pads for equipment work area (Table 4.2.1-1).

Clearing 0.024 ha (0.06 acre) of reclaimed wetland will consist of removing fewer than 32 planted trees. A total of 32 trees were slated to be removed when the impact area was 21 m (70 ft) wide. However, the impact area has been reduced to 12 m (40 ft) wide, so the number of trees to be removed has also been reduced. These trees are approximately 0.9 to 1.5 m (3 to 5 ft) tall and were planted 2 years ago by IMC/Agrico. Additionally, a few large oak trees located along the upland/wetland boundary will also be removed for constructing the circulating water pipes. The only fill to remain in the reclaimed wetland upon construction of the circulating water pipes will be two concrete support structures each 0.9 m by 5.5 m (3 ft by 18 ft) in size. After the circulating water pipes are constructed, the original 0.024 ha (0.06 acre) cleared area will be returned to original grade, planted with native herbaceous species, and maintained as a herbaceous wetland.

Wetland impacts associated with a highly disturbed portion of the unnamed tributary wetland will occur southwest of the proposed construction laydown area (Area No. 2 in Figure 4.2.1-1). A total of only 0.004 ha (0.01 acre) will be filled and 0.001 ha (0.003 acre) will be excavated to construct a retainment berm. This proposed impact area is herbaceous in nature and has been extensively disturbed by feral hog activity.

An access road is proposed to be constructed in the southwest corner of the site and will cross an existing FDEP and USACE jurisdictional drainage ditch wetland (Area No. 5 in Figure 4.2.1-1). Two culverts will be placed in the drainage ditch to ensure passage of the 25-year storm peak. A second drainage ditch which forms the eastern boundary of the project site will be crossed by two culverts (Areas Nos. 6 and 7 in Figure 4.2.1-1). These crossings will provide access to the power plant from the existing access road. A total of 0.004 ha (0.01 acre) will be excavated and 0.09 ha (0.22 acre) will be filled to install these two culverts. These roadside drainage ditches will continue to be mowed and maintained. Therefore, ecological impacts to these ditches will be minor.

A detailed description of the mitigation plan, which compensates for these wetland impacts, is provided in the dredge and fill application (see Appendix 10.1.4).

Construction of the power block area and the stormwater detention basin will impact 2.12 ha (5.24 acres) of wetlands which are jurisdictional only by USACE (Areas No. 3 and 4 in Figure 4.2.1-1). These wetlands were inadvertently created during post-mining reclamation. They provide low ecological value and are colonized by weedy species such as cattail, primrose willow, and Carolina willow. Impacts to these wetlands are not expected to result in a loss of significant wildlife habitat.

Table 4.2.1-1. Summary of Wetland Impacts for Each Jurisdictional Agency

Regulatory Jurisdiction	Permanent Clearing	Permanent Filling	Temporary Filling	Excavation
SWFWMD	0.06 acre across tributary wetland	0.015 acre for pipe support structures in tributary wetland 0.07 acre for culverts across west drainage ditch	0.006 acre for temporary pads in the tributary wetland	0.015 acre for installation of support structure 0.015 acre for culverts across west drainage ditch
FDEP	0.06 acre across tributary wetland	0.015 acre for pipe support structures in tributary wetland 0.01 acre for retainment berm 0.07 acre for culverts across west drainage ditch 0.22 acre for culverts across east drainage ditch	0.006 acre for temporary pads in the tributary wetland	0.015 acre for installation of support structure 0.003 acre for retainment berm 0.015 acre for culverts across west drainage ditch 0.010 acre for culverts across east drainage ditch
USACE	0.22 acre across tributary wetland	0.085 acre for pipe support structures in tributary wetland 4.69 acre in power block area 0.01 acre for retainment berm 0.17 acre for stormwater detention basin 0.07 acre for culverts across drainage ditch	0.006 acre for temporary pads in the tributary wetland	0.30 acre in stormwater detention basin 0.85 acre for installation of support structures 0.003 acre for retainment berm 0.01 acre for culverts across drainage ditch

Note: acres x 0.4047 = hectares.

Source: KBN, 1994.

4.2.1-5

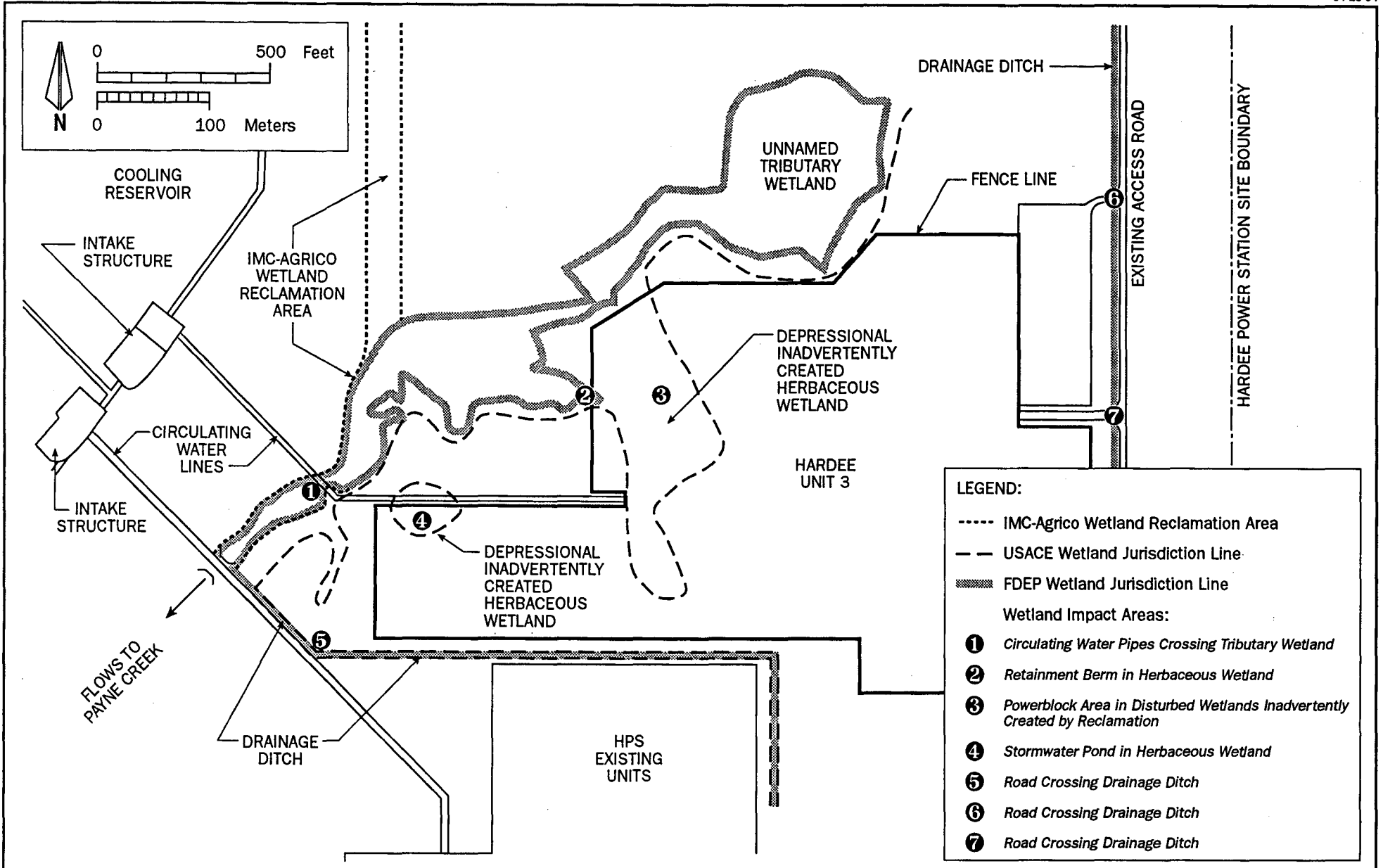


Figure 4.2.1-1
Location of Jurisdictional Wetlands in Relation to Hardee Unit 3 Site Plan

Source: KBN, 1994.



4.2.2 MEASURING AND MONITORING PROGRAMS

Because of the proposed erosion control measures, no anticipated water quality impacts to Payne Creek or the unnamed tributary are expected. However, turbidity will be monitored in the unnamed tributary wetland during construction.

4.3 GROUNDWATER IMPACTS

4.3.1 PHYSICAL AND CHEMICAL EFFECTS OF DEWATERING

Some dewatering will be required during excavation for construction of plant structures. The site facilities requiring dewatering include:

- Foundations,
- Circulating water piping,
- Intake structure, and
- Miscellaneous underground utilities.

The circulating water piping system will require the most extensive dewatering. The dewatering flow is estimated to be 315 liters per minute (Lpm) [83 gallons per minute (gpm)] per 30 meters (m) [100 linear feet (ft)] of pipe, regardless of pipe size. Assuming 152 m (500 linear ft) of pipe is excavated and dewatered at a time [maximum depth = 0.9 m (3 ft)], a dewatering flow of 1,575 Lpm (332 gpm) would be anticipated, with a radius of influence of approximately 91.4 m (300 ft). These flows would exist during the construction period, which will last approximately 1 month for each 152-m (500-ft) section. The total period for dewatering will be 6 months. After construction, granular backfill will be used in the circulating water trench so that natural groundwater flow is not disrupted.

The intake structure located in the southeast reservoir berm will be constructed within a sheetpile enclosure which will minimize dewatering. The dewatering flow for the system is estimated to be approximately 828 Lpm (218 gpm) for a 1-month period.

The underground utilities will be installed in shallow trenches. The shallow groundwater table will require open trench sumping to control groundwater. Based on the anticipated length of open trench, the quantity of dewatering is estimated to be on the order of 380 Lpm (100 gpm).

The primary impact of dewatering is that groundwater from the surficial aquifer will be withdrawn and the aquifer phreatic line will be depressed locally. To minimize the impact of dewatering, the pumpage from wellpoints in the power block area will be directed to the detention pond, which provides for natural infiltration and replenishment of the surficial aquifer. Thus, the

dewatering flows removing groundwater are balanced a short distance away by recharge from the detention pond.

Dewatering can cause increases in vertical stresses. In this case, the increase will not be significant enough to cause settlement or depressions. Foundations in the power block area will not be at risk because they will be constructed following the completion of dewatering activities.

Chemical effects of dewatering will result primarily from oxidation of the groundwaters. The sands of the surficial aquifer are predominantly quartzitic, although soluble calcite will liberate calcium ions and bicarbonate anions, which will increase the hardness of the water.

No impacts to the intermediate aquifer are predicted since the excavation/dewatering will be limited to the surficial aquifer groundwater regime.

4.3.2 MEASURING AND MONITORING PROGRAM

No monitoring is proposed for dewatering activities.

4.4 ECOLOGICAL IMPACTS

4.4.1 IMPACT ASSESSMENT

4.4.1.1 AQUATIC SYSTEMS

As discussed in Section 4.2.1.2, no structures will be placed in Payne Creek. During construction, surface runoff, including water from construction dewatering, will be routed into a detention pond, and erosion prevention measures will be used. Treated runoff, if discharged, will flow into the adjacent unnamed tributary. No adverse ecological impacts to the Payne Creek aquatic system are anticipated.

4.4.1.2 TERRESTRIAL SYSTEMS

The power plant and related onsite facilities such as parking lots, detention ponds, and roads will occupy approximately 20 ha (50 acres) of land. Nearly all of this area will be located on recently mined land that has been reclaimed to upland pasture.

The reclaimed wetland will be crossed by the circulating water pipes. The pipes will be supported on permanent concrete structures, thus filling 0.006 ha (0.015 acre) within the reclaimed wetland. In order to construct the circulating water pipes, 0.024 ha (0.06 acre) within the reclaimed wetland will be cleared. Temporary pads will be built on both sides of the reclaimed wetland to construct the circulating water pipes. After construction of the pipes is complete, the pads will be removed, and the impacted area will be revegetated with native herbaceous wetland species. The impacted area will then be maintained as a herbaceous wetland. Ecological impacts to the reclaimed wetland are expected to be minor because the only permanent impacts will be concrete support structures and because the area will be maintained as a herbaceous wetland.

Approximately 2.12 ha (5.24 acres) of USACE-jurisdictional wetlands will be impacted by construction of the power block area and stormwater detention basin (Figure 4.2.1-1). These impacted areas are characterized by weedy wetland species that colonized low pockets which were inadvertently created after reclamation occurred. Due to the low ecological value of these areas, ecological impacts are expected to be minor. Construction of a retainment berm will impact 0.01 ha (0.03 acre) of highly disturbed herbaceous wetlands, and installing two culverts across a

drainage ditch will impact 0.03 ha (0.08 acre) of the ditch. Both of these impacts are considered minor given the disturbed condition of both the herbaceous wetland and drainage ditch.

The potential impacts to the vegetation communities onsite due to construction activities include the following:

1. Sedimentation due to stormwater runoff into the tributary from laydown areas, roads, and areas under construction;
2. Damage to wetlands due to construction dewatering; and
3. Tree clearing [approximately 21 m (70 ft) wide] for intake and discharge pipes to cross the reclamation wetland.

Uncontrolled stormwater runoff into Payne Creek and onsite wetlands will be prevented by the implementation of temporary and permanent water collection and detention measures (see Section 4.2.1.1). Erosion and sediment control measures employed during construction will include seeding and mulching exposed areas, minimizing unnecessary clearing of vegetation, and redirecting stormwater runoff by using dikes, basins, and sediment curtains. The detention basin will be constructed for control and treatment of stormwater.

Dewatering activities will occur onsite (see Section 4.3.1). The maximum predicted drawdown is 2.4 m (8 ft). The zone of drawdown influence is predicted to extend 152 m (500 ft). The duration of the dewatering will last for 30 days at any given location. This means that saturated water conditions will not occur in the dewatering zone during this period. The unnamed tributary wetland occurs within the predicted zone of dewatering. No significant effects to wetland vegetation are anticipated because of the short duration of dewatering and the fact these wetlands are currently receiving surface water from upgradient areas offsite.

Potential impacts to wildlife communities due to construction activities include the following:

1. Vegetation removal and loss of habitat,
2. Noise, and
3. Road traffic and road kills.

Most of the wildlife habitat area has been previously altered by mining operations. Some wildlife habitats, i.e., floodplain forest of Payne Creek, do exist on the HPS site. Since these habitats

will not be impacted by construction of the Hardee Unit 3 Project, no significant impacts on local or regional wildlife habitats will occur.

The increased noise from construction equipment may cause temporary avoidance behavior in area wildlife. This behavior is expected to be minimal since existing wildlife are acclimated to the noise generated by existing mining and power plant operations.

Wildlife habitats such as wetlands, water bodies, etc., are currently accessible by existing roads. Any additional traffic to these areas will not affect wildlife conditions in these habitats.

A temporary increase in road kills may be expected from construction traffic. Some small mammals (e.g., opossums) and reptiles (e.g., snakes) may be killed. No important wildlife species are expected to be affected.

The wildlife species present on the site are considered typical of the region. No unique species or habitats or significant populations of recreationally and commercially important species will be affected during construction.

4.4.2 MEASURING AND MONITORING PROGRAMS

Because of the absence of anticipated ecological impacts, no biological monitoring is proposed during the construction period. Proposed wetland mitigation monitoring is described in the wetland mitigation plan (Appendix 10.1.4).

4.5 AIR IMPACT

4.5.1 ESTIMATED EMISSIONS

The air quality impacts during the construction phase of the project will be associated primarily with the land clearing and site preparation activities. These activities will result in the generation of fugitive particulate matter (PM) and an increase in the level of exhaust emissions from construction equipment. Air emissions will be temporary and will vary substantially from day to day during each phase of construction depending on the level of activity, the specific operations, and prevailing weather conditions.

Activities that may produce fugitive PM emissions include building and road construction. These emissions will be associated with land clearing, ground excavation, cut and fill operations, and actual construction of the facility when approximately 20 ha (50 acres) of the facility site will be exposed. A large portion of the fugitive emissions will result from vehicular traffic over roads at the construction site (e.g., heavy-equipment traffic and traffic due to construction workers entering and leaving the site). The plant site arrangements are shown in Figure 3.2.0-4, and specific acreage requirements are discussed in Section 3.2.

Wind erosion from the exposed land areas may also be a source of fugitive dust. Because of the variable nature of such emissions, emissions of fugitive PM are extremely difficult to quantify. The emissions are dependent upon a number of factors, including specific activities conducted, level of activity, and meteorological conditions.

The maximum impacts from vehicular exhaust emissions will occur during the construction phase when equipment will be onsite for concrete placement and major equipment installation. Vehicle exhausts include primarily nitrogen oxide (NO_x) and carbon monoxide (CO) emissions as well as particulate matter (PM), sulfur dioxide (SO₂), and volatile organic compounds (VOCs). However, air quality impacts from construction-related vehicle exhaust emissions are expected to be negligible.

4.5.2 CONTROL MEASURES

For the emissions described in Section 4.5.1, the local air quality impact from fugitive PM will be minimized by the use of appropriate dust suppression control methods, such as spraying or paving roads. The impacts will cease when construction activities are terminated and the facilities are ready for operation.

The site will be revegetated after completion of construction. The construction process will disturb the site only temporarily.

The major roads surrounding and leading to the plant site are paved, and new roads on the plant site will be paved at the end of the construction period. Dust suppressors, water and water-based sprays will be applied to the roads as required to control fugitive dust emissions during construction. Spilled or tracked dirt or other materials will be removed promptly.

4.5.3 POTENTIAL IMPACTS

As discussed in Section 4.5.1, the air quality impacts due to the construction activities will vary substantially from day to day depending on the level of activity, the specific operations, and prevailing weather conditions. Because of the type and nature of potential emission sources at the facility site, the maximum impacts are expected to occur near the construction activities in areas on or near plant property because such dusts settle quickly. Based on the proposed controls presented in Section 4.5.2, the air quality impacts are expected to be minimized by the control measures implemented during construction.

Most of the construction activities will be conducted during daylight hours. As a result, the scheduling of the construction activities will act to reduce impacts since better atmospheric dispersion conditions exist during the daytime as opposed to nighttime. Also, many of the construction operations, such as land clearing, site filling and grading, and foundation work, will be intermittent and of short duration.

No significant air quality impacts are expected off plant property locations due to construction activities, based upon the intermittent nature of construction activities and the control measures, such as water spraying, implemented to reduce emissions.

4.6 IMPACT ON HUMAN POPULATIONS

4.6.1 NOISE IMPACTS

Construction of Hardee Unit 3 is expected to occur in four phases:

1. Site preparation,
2. Foundations,
3. Erection of structures and equipment, and
4. Facility startup.

Typically, construction equipment associated with site preparation includes heavy earth-moving equipment necessary to excavate and grade the site. Construction of foundation structures includes pouring of concrete and the placement of supporting piles, whereas erection of equipment typically includes the use of cranes and heavy equipment to move and secure power plant equipment and structures. Startup activities include site finishing and cleanup, plant startup, and system blow-out (i.e., steam blows).

Based on the types and numbers of equipment to be used for each construction phase, it is expected that activities associated with the erection of structures and equipment will most likely produce the highest noise impacts in the vicinity of the site. This is because the numbers and types of high noise level equipment to be used for this phase are more extensive than for other phases of construction. The exception may be the use of a pile driver for placement of sheet piling, which will be used during construction of the circulating water intake and return structures. This equipment has a very high noise level, i.e., 101 A-weighted decibels (dBA) at 50 ft (15 m); however, the noise is intermittent in nature. It is expected that the level of continuous noise may be greater during the erection phase of the construction project and would therefore represent a worst-case construction noise scenario.

A list of equipment to be used for erecting structures and equipment, along with the quantity, usage factor, and average sound pressure level (SPL) at a distance of 50 ft (15 m) from the source, is presented in Table 4.6.1-1. The usage factor is based on the fraction of daylight hours that the equipment will be operating. As shown, it is estimated that 28 pieces of construction equipment will be used for this construction phase of the project, with the air compressor being used most often. Average equipment SPLs range from 78 to 88 dBA [at 50 ft (15 m)].

Predicted noise levels were developed using the NOISECALC model. NOISECALC was developed by the New York State Department of Public Service (NYSDPS) to assist with noise calculations for major power projects. Noise sources can be entered as octave-band sound power levels or as octave-band SPLs at a given reference distance. If SPLs are entered, NOISECALC will back-calculate the sound power level based on the reference distance provided. Coordinates, either polar or rectangular, can be specified by the user for source and receiver locations. All noise sources are assumed to be point sources; line sources can be simulated by several point sources. Sound propagation is calculated by accounting for hemispherical spreading and three other user-identified attenuation options: atmospheric attenuation, path-specific attenuation, and barrier attenuation.

Atmospheric attenuation is calculated using the data specified by the American National Standard Institute (ANSI) Method for Calculation of the Absorption of Sound by the Atmosphere (ANSI, 1978). Path-specific attenuation can be specified to account for the effects of vegetation, foliage, and wind shadow. Directional source characteristics and reflection can be simulated using path-specific attenuation. Attenuation due to barriers can be specified by giving the coordinates and height of the barrier. Barrier attenuation is calculated by assuming an infinitely long barrier perpendicular to the source-receptor path.

Total and A-weighted SPLs were calculated by the model. Background noise levels were incorporated into the program and were used to calculate overall SPLs. For the purposes of this analysis, only atmospheric attenuation was included in the analysis in order to present worst-case construction noise impacts.

Worst-case noise impacts were predicted for the construction equipment proposed for use during the equipment and structures erection phase of the project. Construction activities for Hardee Unit 3 are expected to occur during daytime hours only. For the purpose of this analysis, equipment was assumed to operate continuously, simultaneously, and at peak load conditions. For the modeling analysis, construction equipment was placed at various locations around the plant site to most adequately simulate an area of typical operation for that equipment type. Because NOISECALC assumes that all of the construction equipment will be operating continuously and at peak levels, the noise level impacts predicted by the model are conservative in nature. In reality, not all of the construction equipment will be operating simultaneously nor at

peak load conditions. Therefore, actual noise level impacts due to construction activities are anticipated to be lower than predicted by the modeling analyses.

Octave band data for each equipment type were developed using U.S. Environmental Protection Agency's (EPA) *Noise From Construction Equipment and Operations, Building Equipment, and Home Appliances* (EPA, 1971). These octave bands were developed based on sound levels measured at 50 ft (15 m) from the equipment type. Octave band data were available for all equipment types projected for use for the project except the trencher. Because no octave band data were available, the use of the trencher was excluded from the modeling analysis.

Noise levels were predicted at six receiver sites: at the north property boundary, at two sites along the east property boundary, at the south property boundary, along the west property boundary, and at the nearest residence located south of the site along Roberts Road. These sites are depicted in Figure 4.6.1-1.

Predicted construction noise impacts are presented in Table 4.6.1-2. Predicted noise levels for each receiver site are presented and take into account representative background levels at each site. These background levels include the operation of a portion of the existing combined cycle units at the HPS facility. The background level at the residential area was determined based on a previous noise study for the Hardee Power Station.

As presented, predicted construction noise impacts at the property boundary range from 54.9 dBA at Receiver Site D to 68.9 dBA at Receiver Site B. Predicted construction noise impacts in the vicinity of the plant are below the EPA guideline value of 70 dBA. Again, the predicted impacts assume simultaneous and peak load operation of all projected construction equipment. In reality, construction noise will be more intermittent in nature, with equipment not always operating at peak load. Therefore, projected noise levels will most likely be lower during the construction phase of the project.

Predicted construction noise levels at the nearest residence are expected to be approximately 46.6 and 50.8 dBA for the daytime L_{eq} and L_{dn} values, respectively. Therefore, potential construction noise levels at the residential area are below the EPA guideline value of 55 dBA (L_{dn}).

Table 4.6.1-1. Summary of Noise Data for the Erection of Equipment and Structures Phase of the Construction Project

Equipment Type	Average Noise Level at 50 ft (dBA) ^a	Quantity	Usage Factor	Sound Power Level (dB) for Octave Band Center Frequency									Overall Sound Power Level (dBA)
				31.5	63	125	250	500	1K	2K	4K	8K	
Mobile Crane	83	1	0.12	0.0	111.6	118.6	116.6	114.6	109.6	104.6	98.6	92.6	115.6
Tractor Trailer	88	4	0.13	0.0	0.0	118.6	116.1	113.1	109.6	106.1	102.1	0.0	115.3
Backhoe	85	1	0.02	0.0	111.6	118.6	116.6	114.6	109.6	104.6	98.6	92.6	115.6
Front End Loader	84	1	0.02	0.0	111.6	118.6	116.6	114.6	109.6	104.6	98.6	92.6	115.6
Truck	88	4	0.02	0.0	0.0	118.6	116.1	113.1	109.6	106.1	102.1	0.0	115.3
Trencher	82	1	0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Stationary Crane	88	3	0.08	0.0	115.6	122.6	120.6	118.6	113.6	108.6	102.6	96.6	119.6
Drill	85	1	0.02	0.0	100.6	105.6	106.6	107.6	110.6	111.6	107.6	107.6	116.6
Saw	78	2	0.10	0.0	91.6	86.6	84.6	84.6	96.6	91.6	93.6	96.6	101.2
Torque Wrench	85	10	0.10	0.0	94.6	97.6	98.6	100.6	106.6	110.6	110.6	108.6	116.1
Air Compressor	81	1	0.40	0.0	109.6	101.6	98.6	94.6	102.6	96.6	88.6	79.6	104.5

Note: NA = not available.

^a For operation of a single unit.

Sources: Black & Veatch, 1994; KBN, 1994.

Table 4.6.1-2. Summary of Predicted Construction Noise Impacts for Hardee Unit 3

Receiver Site	Predicted Background Noise Level ^a (dBA)	Construction Equipment Noise Level (dBA)	Total Noise Level ^b (dBA)	EPA Guideline Value (dBA)
A	47.2 ^c	66.2	66.2	70
B	48.7 ^d	68.8	68.9	70
C	48.7 ^d	57.6	58.1	70
D	42.0 ^e	54.7	54.9	70
E	42.0 ^e	56.9	57.0	70
F	43.9 ^f	43.2	46.6/50.8 ^g	55 ^h

Note: Receiver sites are shown in Figure 4.6.1-1, and monitoring sites are shown in Figure 2.3.8-1.

- ^a Based on L_{eq} value from monitoring data. Background includes operation of existing HPS Unit 1 and steam turbine (except for Site F).
- ^b Background plus construction noise levels.
- ^c Ambient monitoring data collected for Monitoring Site 2 used as background.
- ^d Ambient monitoring data collected for Monitoring Site 1 used as background.
- ^e Ambient monitoring data collected for Monitoring Site 4 used as background.
- ^f Background value based on a previous analysis for predicted noise levels due to the existing Hardee Power Station.
- ^g L_{eq}/L_{dn} . For L_{dn} determination, assume daytime impacts include background and predicted construction noise levels and nighttime impacts include background only since construction activities will occur only during daytime hours.
- ^h L_{dn} measurement.

Source: KBN, 1994.

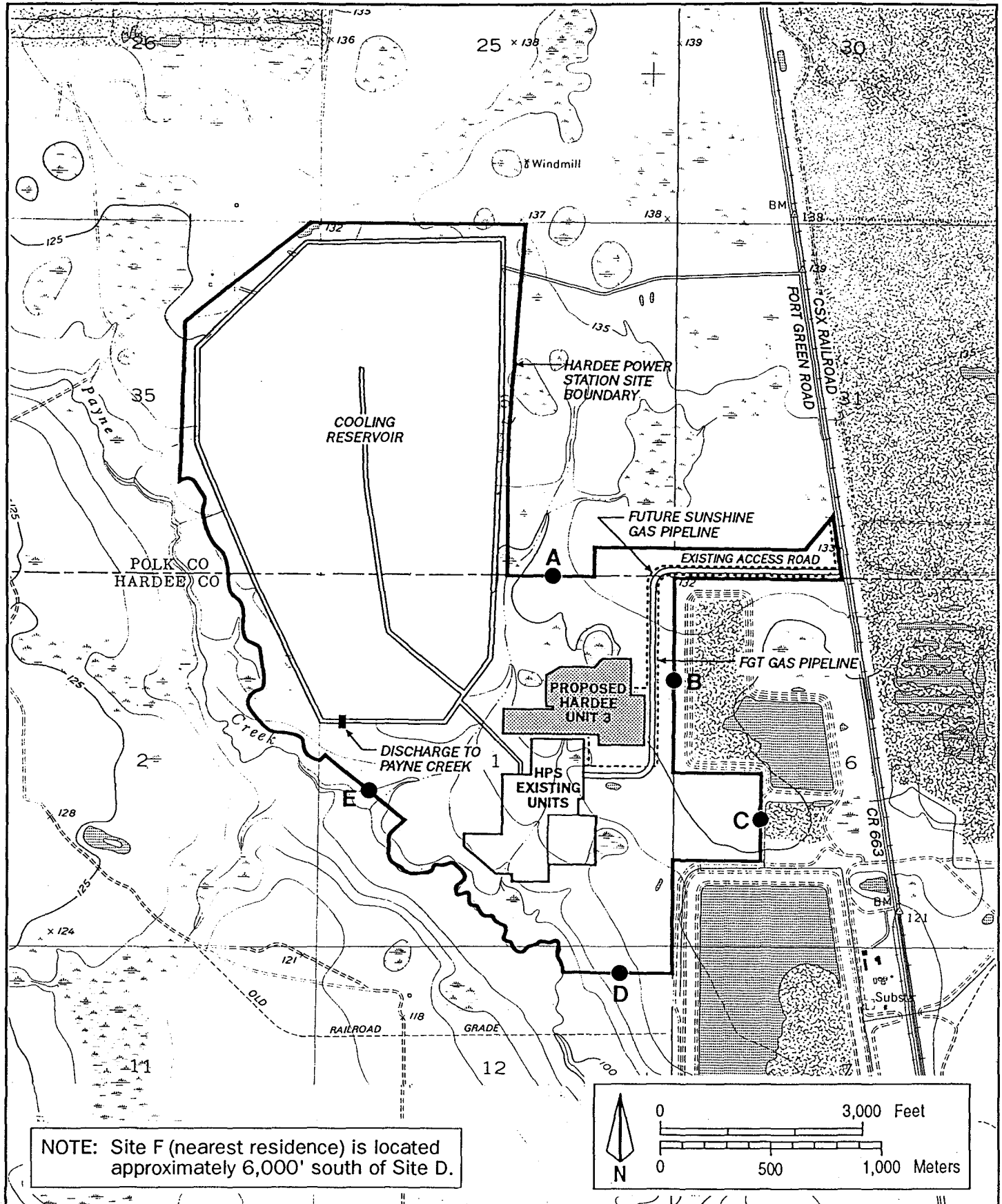


Figure 4.6.1-1
Receiver Sites Used for the Construction Noise Impact Analysis

Sources: USGS, 1987; KBN, 1994.

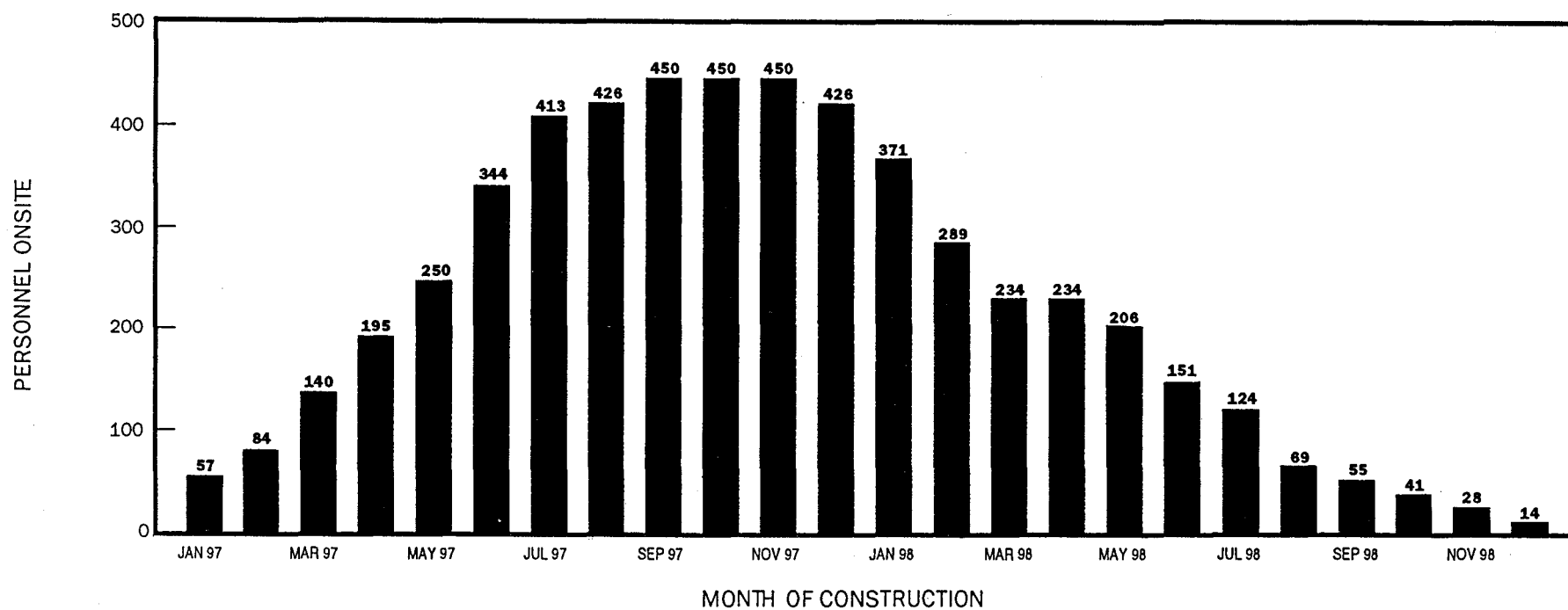


4.6.2 CONSTRUCTION EMPLOYMENT

Employment opportunities created by the construction of the Hardee Unit 3 Project will begin in January 1997 and conclude in December 1998. Figure 4.6.2-1 shows the estimated construction employment requirements for the Hardee Unit 3 Project. The average construction workforce is 229 employees per month over the 2-year period. The peak employment period will last approximately 3 months in late 1997 and total approximately 450 workers per month. Sixty-seven percent of the employment demand is expected to occur during the first year of construction.

Based on regional population distribution and workforce availability, it is anticipated that approximately 85 percent of the workforce will come from Polk and Hillsborough counties. The remaining 15 percent will likely originate from Hardee, DeSoto, Manatee, and Sarasota counties.

4.6.2-2



AVERAGE MANPOWER = 229

PEAK MANPOWER = 450

Figure 4.6.2-1
Estimated Average Monthly Personnel Onsite During Construction

Sources: Black & Veatch, 1994; KBN, 1994.



4.6.3 TRANSPORTATION IMPACTS

This section analyzes the estimated vehicular traffic impacts to the local roadway network associated with the construction of the Hardee Unit 3 Project. In addition to this project, two new power plants have recently been approved for construction and operation in southwest Polk County. The TECO Polk Power Station is located south of Bradley in Polk County and has received site certification approval to construct and operate 260 MW, with an ultimate site capacity of 1,150 MW. The TECO facility site is located approximately 9.7 km (6 miles) north of the existing HPS site (see Figure 4.6.3-1). FPC received site certification approval to construct and operate a 470-MW power plant facility located west of Homeland in Polk County. The FPC Polk County site has an ultimate capacity of 3,000 MW and is located approximately 21 km (13 miles) northeast of the existing HPS site (see Figure 4.6.3-1). To determine the cumulative impacts associated from all three facilities, the transportation sections in TECO's and FPC's Site Certification Applications were incorporated into this analysis. The projected trips generated by each project were then added in the transportation network to be utilized by construction workers associated with the Hardee Unit 3 Project. Since both FPC and TECO projects are anticipated to begin construction in 1994, the 1997 background analysis includes project traffic from both of the new power plant facilities.

The primary mode of transportation to the Hardee Unit 3 plant site during the construction phase is expected to be workers driving their own vehicles over the rural highway network of Polk and Hardee counties (see Section 2.2.7.2). The location of the plant site on the northwest Hardee County/southwest Polk County border limits the number of potential access routes to the site from nearby population centers and the available construction labor supply.

It is anticipated that a majority of the workers who will be employed in the construction of the plant will come from within 97 km (60 miles) of the plant site and will reside primarily in Polk and Hillsborough counties. For the purposes of this analysis, it is assumed that up to 85 percent of the construction workers will come from the population centers of Lakeland, Winter Haven, and Plant City which are located within about 40 to 56 km (25 to 35 miles) north, northeast, and northwest of the site. This area also includes the smaller communities of Bartow and Mulberry, as well as Bradley Junction and Fort Meade. It is expected that the balance of other construction workers will be split about evenly between those who come from the south and southeast in Hardee and DeSoto counties and those who come from the more distant coastal population centers

of Sarasota and Manatee counties. These assumptions are based on population distribution in the area (refer to Table 2.2.3-1) and labor availability.

The vehicular traffic associated with the construction of the Hardee Unit 3 Project was determined by dividing the peak number of construction employees, 450 (see Figure 4.6.2-1), by a vehicle occupancy rate of 1.4 persons per vehicle. This rate was obtained from the most conservative figures used in the recent power plant certification studies identified above. Assuming that all of the construction employees will be arriving and departing the site at the same time, a total of 321 vehicles were distributed on the local roadway network (see Figure 4.6.3-2). The traffic was distributed 85 percent to the north and 15 percent to the south to correspond with the anticipated origin of the construction workforce. This distribution was then used to determine the traffic impact area (TIA).

The TIA was established by using Polk County's criteria identified in Ordinance 92-10, Concurrency Management Ordinance of Polk County, Florida, for determining an "Impacted Segment." The definition of an impacted segment is "Any segment on the Concurrency Determination Network on which the project traffic consumes five percent or more of the peak hour level of service 'C' generalized planning capacity." These criteria are the most stringent of all of the local governmental and agency study area requirements. The project traffic volume used to determine the TIA for the construction phase was the peak-hour volume during the peak phase of construction which will occur in the last quarter of 1997. Construction employment will be substantially lower for the remainder of the construction schedule, thereby, minimizing any projected impacts to the TIA. Table 4.6.3-1 lists the results of the TIA analysis. From this analysis, the following list depicts the local roadway segments within the Hardee Unit 3 Project TIA (those links with project traffic greater than 5 percent LOS C capacity):

- CR 663 from SR 62 to HPS Site
- Fort Green Road from HPS to CR 630
- SR 37 from CR 630 to Old Highway 37
- SR 37 from Old Highway 37 to CR 640
- CR 630 from SR 37 to Fort Green Road
- CR 630 from Fort Green Road to CR 555
- CR 630 from CR 555 to US 17/SR 35

A roadway segment link analysis was performed on these identified segments using the 1985 Highway Capacity Manual (HCM) software. To analyze the roadway segment links within the TIA, 1993 Polk County and FDOT traffic counts were projected to 1997 conditions using a 2.1 percent growth rate compounded annually. This growth rate of 2.1 percent is consistent with the previous transportation studies conducted. After calculating the 1997 conditions, the FPC and TECO projects' anticipated traffic was added to 1997 conditions. The results of the analyses are depicted in Table 4.6.3-2. All roadway links are expected to operate at a LOS B or better. The HCS summary reports are located in Appendix 10.13.

In addition to the segment analysis, an analysis was conducted at each major intersection within the TIA which are indicated below:

Fort Green Road and CR 630

CR 630 and SR 37

CR 630 and CR 555

CR 630 and US 17/SR 35

CR 640 and SR 37

CR 663 and SR 62

The methodology used to predict 1997 conditions for the link analyses was also used for the intersection analyses. The counts obtained for the intersection analysis were obtained from the FPC and TECO reports and were augmented by KBN in 1993 and 1994 where necessary. The analysis was performed using the 1985 HCM non-signalized intersection methodology except for the intersection of CR 630 and US 17/SR 35 and the intersection of SR 37 and CR 640. As was shown in the FPC study, a signal would be warranted for the 1997 background traffic at the CR 640/SR 37 intersection; therefore, the intersection was modeled assuming a signal would be in place. Table 4.6.3-3 summarizes the p.m. peak-hour peak construction conditions for the above-referenced intersections in the TIA.

In addition to the construction workforce traffic, truck and rail traffic associated with delivering equipment and supplies to the site will have an impact to the local transportation network. These impacts should be minimal as most of the deliveries are expected to occur throughout the workday and are not expected to access the site during the a.m. or p.m. peak hours.

Based on traffic analyses, no significant impacts to the network are anticipated. It should also be noted that 67 percent of the construction workforce demand will be required during the first year of construction, and project traffic during operation of the plant (after completion of construction) will be greatly reduced (i.e., peak-hour traffic generated will be only 28 vehicles). Therefore, any impacts caused during construction will be temporary.

Table 4.6.3-1. Construction Phase Traffic Impact Area (Page 1 of 2)

Roadway Segment	Peak-Hour LOS C Volume		Project Traffic	Percent of Capacity Utilized by Project Traffic ^a	
	Polk County	FDOT		Polk County	FDOT
POLK COUNTY					
Fort Green Road					
HPS Entrance to CR 630	540	NA	272	50.4	NA
CR 630					
SR 37 to Fort Green Road	540	NA	122	22.5	NA
Fort Green Road to CR 555	540	NA	131	24.3	NA
CR 555 to US 17/98	540	NA	96	17.8	NA
SR 37					
SR 674 to CR 630	540	460	12	2.2	2.6
CR 630 to Old Hwy 37	540	460	108	0.20	23.5
Old Hwy 37 to CR 640	540	460	91	16.9	20.4
CR 640 to Cameron Street	540	460	22	4.1	4.8
Old Hwy 37					
CR 630 to SR 37	540	NA	10	1.8	NA
CR 640					
Hillsborough County Line to SR 37	540	NA	23	4.3	NA
SR 37 to CR 555	540	NA	18	3.3	NA

Table 4.6.3-1. Construction Phase Traffic Impact Area (Page 2 of 2)

Roadway Segment	Peak-Hour LOS C Volume		Project Traffic	Percent of Capacity Utilized by Project Traffic ^a	
	Polk County	FDOT		Polk County	FDOT
POLK COUNTY (cont.)					
CR 555					
CR 630 to CR 640	540	NA	21	3.8	NA
US 17					
CR 630 to South 9th Street	1,090	1,540	14	1.3	0.9
US 17/98					
CR 640 to CR 630	2,280	2,190	78	3.4	3.6
HARDEE COUNTY					
CR 663					
Polk County Line to SR 62	NA	460	49	NA	10.7
SR 62					
SR 37 to CR 663	NA	460	15	NA	3.3
CR 663 to US 17	NA	460	21	NA	4.6

^a To determine the percentage of traffic utilized by the project, the more conservative peak-hour level of service volume was used.

Sources: Polk County, 1992.
FDOT, 1992.
KBN, 1994.

Table 4.6.3-2. Peak-Hour Link Analysis for Construction Traffic

Roadway Link	1997 Background Traffic	FPC Traffic	TECO Traffic	Project Traffic	Total Traffic	Level of Service
POLK COUNTY						
Fort Green Road						
HPS to CR 630	69	0	1	272	342	B
CR 630						
SR 37 to Fort Green Road	255	0	0	122	377	B
Fort Green Road to CR 555	274	24	41	131	470	B
CR 555 to US 17/SR 35	282	125	27	108	542	B
SR 37						
CR 630 to Old Hwy 37	220	0	61	108	389	B
Old Hwy 37 to CR 640	241	0	0	91	332	A
HARDEE COUNTY						
CR 663						
HPS Entrance to SR 62	122	0	0	49	171	A

Sources: TECO, 1992.
FPC, 1992.
KBN, 1994.

Table 4.6.3-3. 1997 Construction--Peak-Hour Intersection Analysis

Intersection	Lowest LOS Designation per Intersection Movement	
	1997 Background Level of Service	1997 Project Traffic Level of Service
POLK COUNTY		
SR 37 and CR 630	C	D
SR 37 and CR 640	B	B
CR 630 and Fort Green Road	C	D
CR 630 and CR 555	C	D
CR 630 and US 17/SR 35	C	C
HARDEE COUNTY		
CR 663 and SR 62	A	A

Note: All intersections were analyzed using non-signalized intersection methodology except the intersection of SR 37 and CR 640 and the intersection of CR 630 and US 17/SR 35.

Sources: KBN, 1994.
TRB/NRC, 1985.
USDOT/FHA, 1987.

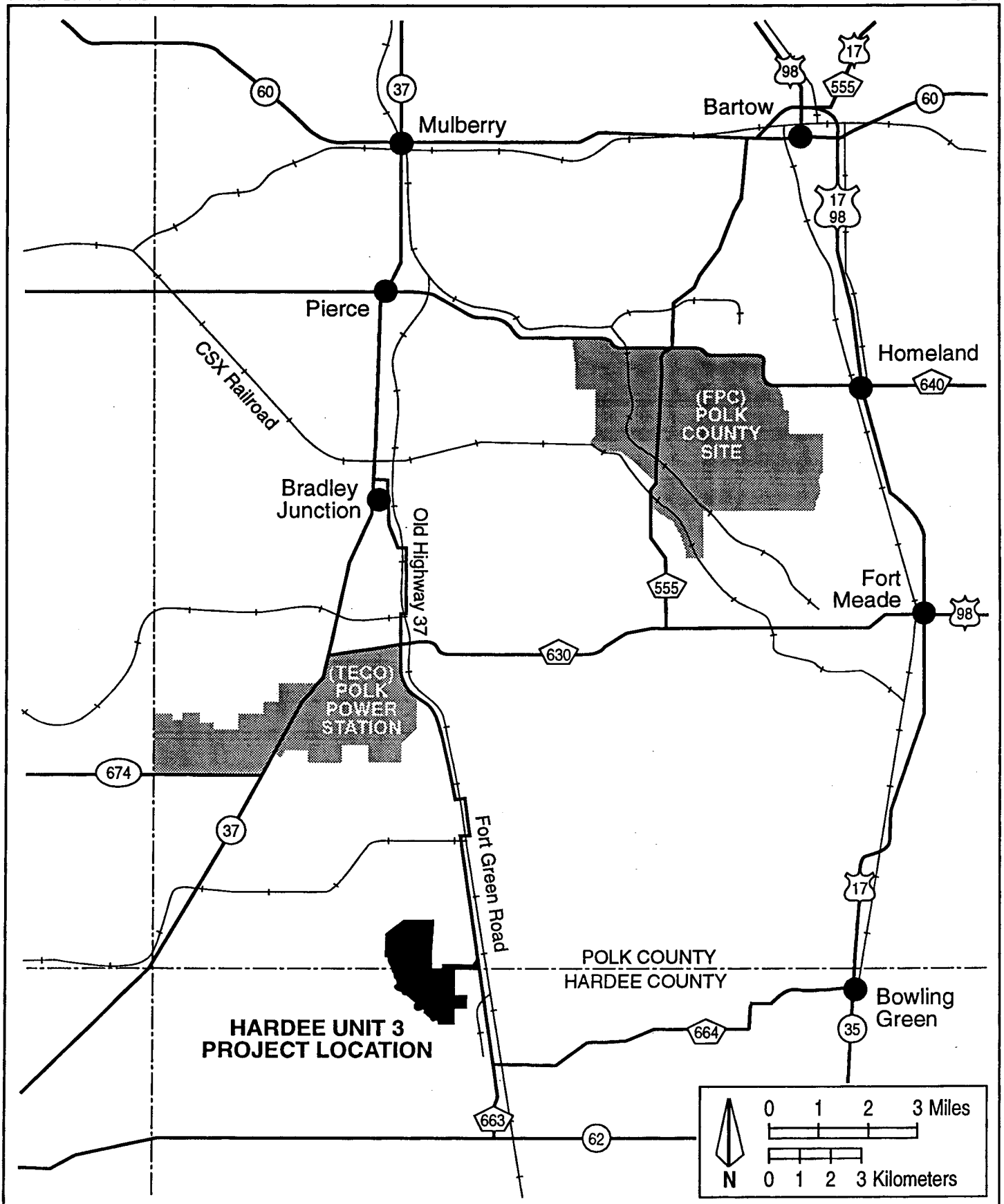


Figure 4.6.3-1
 Certified Power Plants Located in the Vicinity of the
 Hardee Unit 3 Project

Sources: SECI, FPC, TECO, KBN, 1994.



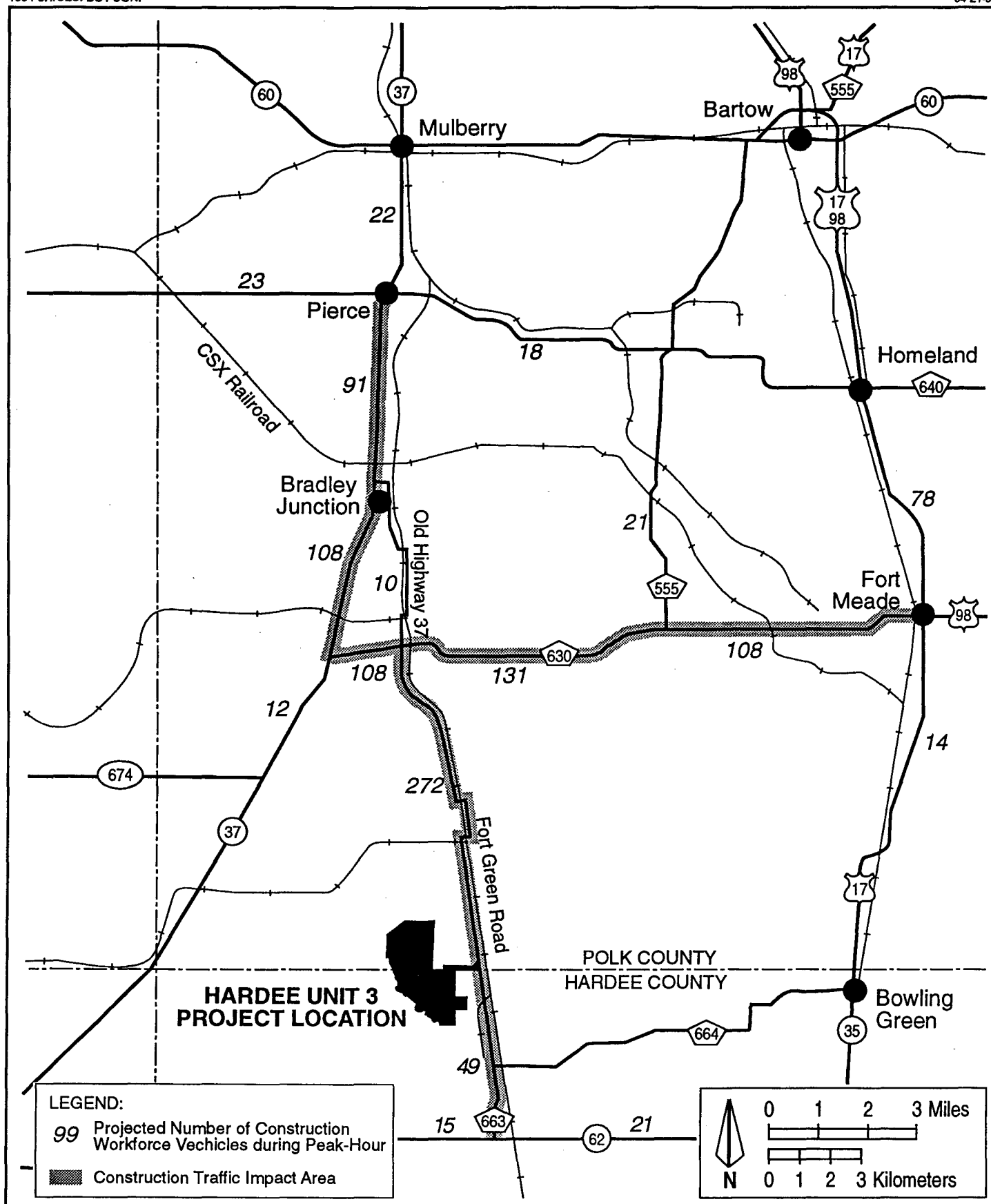


Figure 4.6.3-2
Hardee Unit 3 Peak-Hour Construction Traffic Distribution

Source: KBN, 1994.



4.6.4 HOUSING IMPACTS

According to the Florida Department of Labor and Employment Statistics (FDLES), approximately 10,000 construction workers reside within the Central Florida Region. Since a more-than-adequate labor supply exists within commuting distance, it is anticipated that workers will be hired from within the region with minimal relocation required. Consequently construction should have no effect on permanent housing within the region. As is typical with longer construction projects, some workers commuting from the longer distances may choose to drive a recreational vehicle to the area and camp near the site on a weekly basis, returning to their permanent homes and families on weekends. Several campgrounds providing various amenities and more than 1,000 full hookups for recreational vehicles are located within the region which could serve these weekly commuters. Since commuting is not anticipated to be a problem, the number of workers who utilize the campground facilities is not expected to be sufficient to cause a change in usage patterns of regular users of these facilities.

With the exception of the occasional use of campgrounds, no new impacts are expected on community services and facilities within the region as a result of the construction effort. Those workers hired from the area will have already established usage patterns and will probably continue to frequent the same facilities and establishments that they used prior to employment on this project. Consequently, any new demands will be dispersed throughout the region and should not create any noticeable change in the availability of area resources.

4.7 IMPACT ON LANDMARKS AND SENSITIVE AREAS

No federal, state, regional, or local scenic, cultural, or natural landmarks are located within the 8-km (5-mile) study area surrounding the proposed facility. Consequently, the construction of Hardee Unit 3 will have no effect on any such resources.

4.8 IMPACT ON ARCHAEOLOGICAL AND HISTORIC SITES

No significant archaeological and historic sites or sites recommended for preservation occur on the HPS site (see Section 2.2.6 and Appendix 10.6). Therefore, no impact mitigation is expected to be required for construction and operation of Hardee Unit 3. If any site or sites are found during construction, the Applicant will implement a "chance/find" procedure where a certified archaeologist will evaluate the site and will determine the significance of the find in consultation with the Division of Historical Resources (DHR). If the site is considered significant by DHR, measures will be taken by the Applicant to preserve or mitigate the impact to the site.

4.9 SPECIAL FEATURES

There will be no unusual products, raw materials, garbage disposal services, incinerator effluents, or residues produced during construction that will have an influence on the environment or ecological systems of the plant site and the adjacent areas.

4.10 BENEFITS FROM CONSTRUCTION

Numerous benefits will result directly from site preparation and construction activities. Site preparation and construction will create job opportunities within Hardee and Polk counties, a region that is currently suffering from high unemployment. A detailed description of the socioeconomic benefits associated with construction of Hardee Unit 3 is presented in Chapter 7.0.

4.11 VARIANCES

No variances from applicable standards due to construction will be sought as part of the state certification procedures.

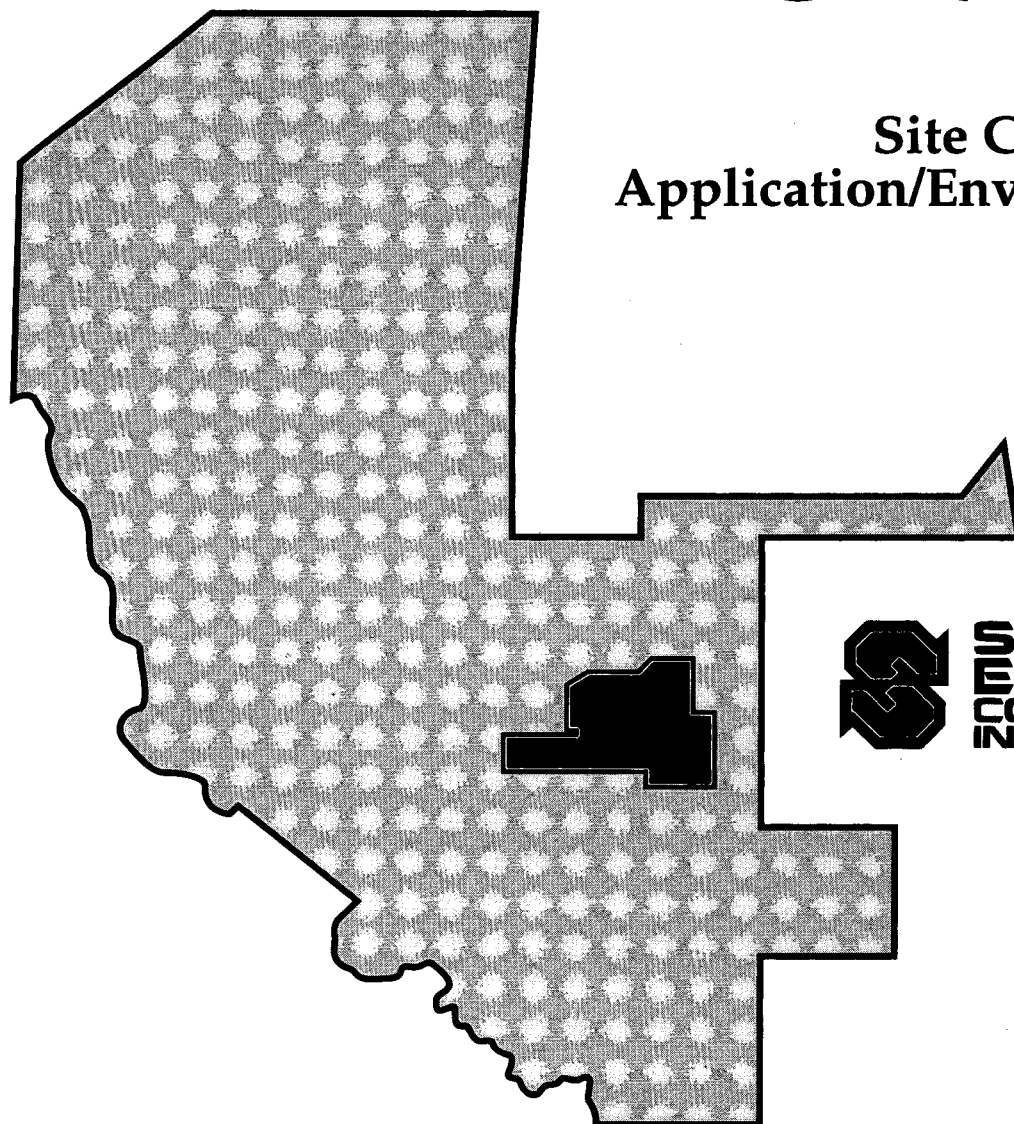
4.12 REFERENCES

The following references are cited in Chapter 4.0.

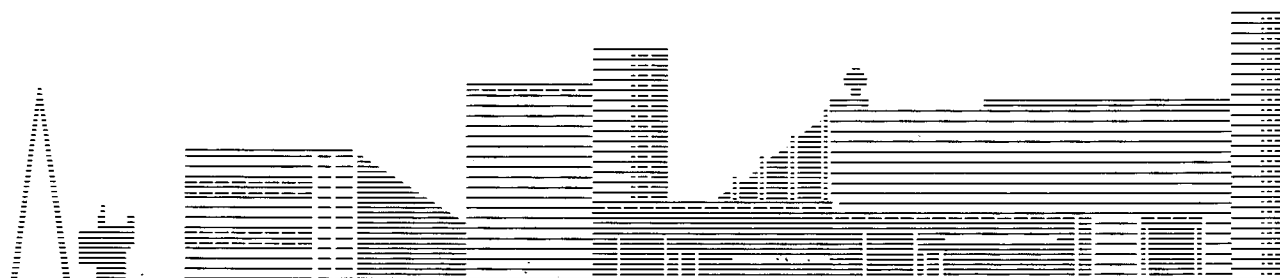
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HARDEE UNIT 3

Site Certification
Application/Environmental
Analysis



 **SEMINOLE
ELECTRIC
COOPERATIVE
INCORPORATED**



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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

As previously described in Section 3.5, the existing 230-hectare (ha) (570-acre) cooling reservoir will be used for condenser cooling/heat dissipation for the steam portion of Hardee Unit 3. There will be no physical or operational changes to the reservoir related to Hardee Unit 3 with the exception of the new intake and return structures for the circulating water pipes. The reservoir will function as the condenser cooling water supply, condenser cooling point of discharge, and heat dissipation system for the total 880-MW HPS, including the TPS 440-MW Units 1A and 1B and the SECI 440-MW Hardee Unit 3. The cooling reservoir has been designed to: (1) collect, store, and supply water for use in condenser cooling, and (2) reject heat through evaporative, radiation, and other cooling mechanisms.

As a recirculating/recycling cooling system, the reservoir is designed to maximize water reuse and thereby minimize groundwater withdrawals. Reservoir water will include direct rainfall, runoff and seepage from the upland watershed, treated wastewaters, and as necessary pumped deep well (Floridan aquifer) water. To accommodate the infrequent discharges (i.e., in response to the 10-year, 24-hour rainfall event), the reservoir has an existing overflow to Payne Creek.

To evaluate the potential discharge impacts of the cooling reservoir operation on the adjacent Payne Creek, several component analyses were conducted. First, a reservoir thermal analysis was conducted to determine the reservoir performance and operating conditions during the annual cycle, including a determination of the "cooled" recirculating water/reservoir discharge temperature. Second, a long-term reservoir water balance analysis was conducted to determine water makeup requirements and reservoir discharge conditions. Finally, a mixing zone analysis was conducted to determine the extent of thermal impacts in Payne Creek due to potential reservoir discharges. The reservoir point of discharge has been defined in the conditions of certification as the point where reservoir overflow meets Payne Creek.

To evaluate and predict cooling reservoir performance (e.g., temperature and evaporation), a monthly thermal model analysis was performed. The thermal model was developed based on work by Sonnichsen (1975) and utilized an energy budget/equilibrium temperature approach for determining the exchange of energy between air and water. This approach uses a variety of

available meteorological data (e.g., 37 years of air temperature, dewpoint, relative humidity, wind speed, etc.).

The modeling conducted in this analysis was a real-time simulation of 37 years of meteorological data; therefore, reservoir water temperatures have been estimated for each of the 444 months of historical data. As noted elsewhere, the average load scenario is defined as the expected station demand that ranges from 27 to 100 percent for Units 1A and 1B and from 28 to 100 percent for Unit 3. The annual average load factor for the average load scenario is approximately 57 percent for the "average load" scenario. The maximum load scenario is defined as all HPS units (i.e., Units 1A and 1B and Hardee Unit 3) operating at 100 percent load. For reporting purposes, monthly average and monthly maximum values are presented for each of the two load scenarios (i.e., average load and maximum load). Thus, the cases presented in the following discussions are defined as follows:

1. Average operating conditions, average monthly temperature--When the station is operating under average load conditions, the average value for a given month (e.g., the average of the estimated 37 June temperatures equals the June average monthly temperature).
2. Average operating conditions, maximum monthly temperature--When the station is operating under average load conditions, the maximum value for a given month (e.g., the maximum of the estimated 37 June temperatures equals the June maximum monthly temperature).
3. Maximum operating conditions, average monthly temperature--When the station is operating under maximum load conditions, the average value for a given month (e.g., the average of the estimated 37 June temperatures equals the June average monthly temperature).
4. Maximum operating conditions, maximum monthly temperature--When the station is operating under maximum load conditions, the maximum value for a given month (e.g., the maximum of the estimated 37 June temperatures equals the June maximum monthly temperature).

The temperature within the reservoir was modeled for the full 880-MW buildout using the available regional meteorological data for two operational scenarios: (1) the normal operating conditions, and (2) a maximum, worst-case condition. The results of this reservoir thermal

analysis are summarized in Tables 5.1.1-1 and 5.1.1-2. During average anticipated operating conditions, the predicted maximum temperature on the cold side is 35.4 degrees Celsius ($^{\circ}\text{C}$) [95.7 degrees Fahrenheit ($^{\circ}\text{F}$)] during June; during the maximum, worst-case conditions, the predicted maximum temperature on the cold side is 37.5 $^{\circ}\text{C}$ (99.5 $^{\circ}\text{F}$) during June. These values for the 880-MW buildout compare to the 660-MW facility maximum temperatures of 34.4 $^{\circ}\text{C}$ (94.0 $^{\circ}\text{F}$) under average operating conditions and 36.6 $^{\circ}\text{C}$ (97.9 $^{\circ}\text{F}$) for the maximum, worst-case conditions. These are monthly average temperatures; daily variations within these months may occur and result in slightly higher or lower temperatures. It is also of note that the above maximum values represent hot, dry summer conditions, and the probability of these values being experienced during a discharge event is unlikely because discharge will occur only in response to prolonged wet-season conditions.

Regarding the accuracy and applicability of this model, it should be noted that the natural equilibrium water temperature (e.g., reservoir water temperature without reservoir plant loading) was estimated as part of the overall analysis process. Using the available data, the calculated monthly equilibrium water temperatures generally correspond with temperatures that could be expected in a shallow lake in central/south Florida. More critical, the calculated annual total lake evaporation of 126 centimeters per year (cm/yr) (49.6 inches/yr) corresponds with the various estimates of lake evaporation in the region ranging from 119 to 130 cm/yr (47 to 51 inches/yr). Therefore, it is concluded that this analysis' methodology accurately represents the evaporative phenomenon in the geographic region of the proposed plant and, therefore, is an accurate estimate of the anticipated evaporation from the cooling reservoir.

To evaluate the frequency of discharge, a reservoir water balance analysis was conducted. Water flows into the reservoir include:

1. Rainfall into the reservoir,
2. Surface runoff and surficial aquifer seepage from the upland basin,
3. Treated wastewater discharged to the reservoir, and
4. Makeup water pumped from the Floridan aquifer.

Water losses from the reservoir include:

1. Evaporation,
2. Seepage out into the surficial aquifer,

3. Leakance down through the confining layers into deeper confined aquifers, and
4. Discharges to Payne Creek.

The flows into and out of the cooling reservoir were estimated using the methodology employed in the original application (TPS/SECI, 1989). The methodology is presented in Appendix 10.8.1.

To facilitate water management during varying climatic conditions, 0.6 meter (m) [2 feet (ft)] of allowable operational fluctuation in reservoir water level is maintained. This will allow storage of water during wet conditions within the reservoir for later use and evaporative consumption during later dry periods. If the water level were to fall below the minimum limit [i.e., 0.6 m (2 ft) below the design maximum], sufficient makeup water will be pumped from the Floridan aquifer well(s) to maintain the reservoir at the minimum elevation of 37.19 meters above mean sea level (m-msl) [122.0 feet above mean sea level (ft-msl)]. Conversely, if the water level were to rise above the maximum limit (i.e., during extreme meteorological conditions), sufficient water will flow over the control weir to maintain the reservoir at the design maximum elevation. Reservoir makeup and discharge requirements were estimated based on this allowable operational fluctuation.

Based on this monthly water balance analysis for the 37-year period 1953-1970 and 1973-1991, predicted reservoir elevations are presented in Figure 5.1.1-1. This analysis shows the cooling reservoir level will operate below the control/discharge elevation of 37.8 m-msl (124 ft-msl) most of the time.

Based on the long-term modeling analysis and given a maximum control elevation of 37.8 m-msl (124 ft-msl) and a minimum control elevation of 37.2 m-msl (122 ft-msl), the cooling reservoir elevation typically will be maintained below 37.5 m-msl (123 ft-msl). Thus, based on 37 years of long-term analysis, the reservoir would have exceeded 37.5 m-msl (123 ft-msl) during only two periods during the 37-year period of record and would not have exceeded 37.8 m-msl (124 ft-msl) at any time during that period.

Based on this monthly water balance analysis, no reservoir discharge is estimated during the 37-year period of analysis. Any discharges would occur only during extremely wet meteorological conditions.

These extremely limited discharge occurrences are a direct result of: (1) significant reservoir water losses due to evaporation, and (2) the positive impact of the 0.6 m (2 ft) of allowable operational fluctuation in reservoir water level, allowing water management. Average annual evaporative losses are approximately 15.37 million liters per day (Lpd) [4.06 million gallons per day (mgd)]: average side seepage is approximately 3.483 million Lpd (0.920 mgd).

Based on this analysis, reservoir discharge will be very infrequent; when reservoir discharges do occur, they will be subject to significant dilution by the Payne Creek flow.

To evaluate event-specific discharges and the associated dilution, a HEC-1 model analysis was conducted for the Payne Creek and the cooling reservoir during the preparation of the TPS (1989) application.

The HEC-1 model has been used previously by Agrico to determine pre- and post-mining peak flows to Payne Creek for the preparation of its reclamation plan.

Two different extreme rainfall events were analyzed: the 10-year, 24-hour storm [19 centimeters (cm) (7.5 inches)] and the 25-year, 24-hour storm [23 cm (9.0 inches)]. Model geometry was determined based on available U.S. Geological Survey (USGS) topographic data and topographic (cross section) data collected as part of the monitoring program. Soil conditions were estimated based on curve numbers presented and used in the Agrico modeling program. In accordance with the methodology previously used and accepted by DNR in the Agrico modeling program, the HEC-1 Payne Creek peak flows were adjusted by a factor of 0.7 to account for surface storage in the wetlands and detention and/or routing through the relatively flat Payne Creek sub-basin. For this analysis, a base flow of 22 cubic feet per second (cfs) was included, reflecting an average water yield of approximately 0.9 cfs per square mile (based on USGS data for Payne Creek as presented in Section 2.3.4).

Based on the prediction and analysis of anticipated reservoir elevations (see Figure 5.1.1-1), the initial (i.e., pre-event) reservoir elevation was assumed to be 37.5 m-msl (123 ft-msl) for the initial modeling condition. As previously discussed, this condition is predicted to occur only two times in 37 years, or approximately once every 18 years. Therefore, the assumed initial reservoir elevation of 37.5 m-msl (123 ft-msl) reflects a conservative estimate of wet-season reservoir

elevation. This conservative estimate of wet-season reservoir water elevation and the estimate of infrequent extreme rainfall events (i.e., the 10-year and 25-year, 24-hour storms) represent worst-case discharge conditions.

Based on the HEC-1 analysis, the anticipated Payne Creek runoff hydrograph at the plant site for the 10-year, 24-hour rainfall is presented in Figure 5.1.1-2. Peak Payne Creek flow is estimated to be 4,167 cfs and occurs approximately 17 hours after the start of rainfall. The tail of the HEC-1 Payne Creek hydrograph was extended using a constant rate of recession (e.g. constant percentage decrease with each time step).

Under the previously described reservoir conditions [i.e., wet-season elevation of 37.5 m-msl (123 ft-msl)], no discharge from the reservoir is predicted as a result of the 10-year, 24-hour rainfall. The 0.3 m (1 ft) of storage provided within the reservoir below the discharge weir is sufficient to retain the direct rainfall and runoff into the reservoir from the 10-year, 24-hour rainfall. Under these 10-year, 24-hour rainfall conditions, the reservoir water level will rise from 37.5 m-msl (123 ft-msl) to 37.7 m-msl (123.86 ft-msl) or just under the 37.8 m-msl (124 ft-msl) control or discharge elevation.

Based on this HEC-1 analysis, the anticipated Payne Creek runoff hydrograph at the plant site for the 25-year, 24-hour rainfall is presented in Figure 5.1.1-3. Peak Payne Creek flow is estimated to be 5,372 cfs and occurs approximately 17 hours after the start of rainfall. Peak flow unit discharge was calculated to be 231 cfs per square mile; the peak flow unit discharge determined in the previous Agrico HEC-1 modeling was calculated to be 215 cfs per square mile. Thus, the peak flows in Payne Creek predicted in this analysis are very similar to those previously predicted in the Agrico studies. Given that the actual portions of Payne Creek modeled under these two studies were different, this small difference is not considered to be significant. The tail of the HEC-1 Payne Creek hydrograph was extended using a constant relative rate of recession (e.g., constant percentage decrease with each time step). Based on this recession, Payne Creek flow decreases to the average (base) flow of 22 cfs in approximately 3 days.

The cooling reservoir water budget modeling (in both 1989 and 1994) showed the maximum observed water elevation in the reservoir to be slightly above 37.5 m-msl (123 ft-msl). In order to "create" the discharge that can possibly occur from the reservoir, large storm events (i.e., the

10-year, 24-hour and 25-year, 24-hour events) were artificially imposed on the reservoir when it was at its predicted maximum. If a discharge from the reservoir occurs under similar circumstances, the base flow in Payne Creek will be high prior to the addition of the 10/25-year, 24-hour events and, therefore, will not decrease as rapidly as predicted in the HEC-1 modeling. Therefore, the 22 cfs used for the discharge modeling represents a conservatively low flow estimate because it ignores saturated condition of the watershed that would have to occur in order for a reservoir discharge to be possible.

Reservoir discharge in response to the 25-year, 24-hour rainfall is presented in Figure 5.1.1-4. During this storm, no reservoir discharge occurs early during the rainfall; reservoir discharge begins 20 hours after the start of rainfall. Prior to this time, the 1 ft of storage provided by the reservoir prevents reservoir discharge; discharge occurs only after the available reservoir storage is filled. Peak reservoir discharge of approximately 0.33 cfs occurs at approximately 33 hours and then begins decreasing. Maximum water elevation in the reservoir is estimated to be 37.8 m-msl (124.04 ft-msl), or approximately 1.2 cm (0.04 ft) above the control elevation.

For the cooling reservoir, the decline in the rate of discharge from the reservoir was estimated based on the decline in the volume of water accumulated in the reservoir above the weir elevation. This volume and associated reservoir level were estimated based on losses from the reservoir due to weir discharges and net evaporative/seepage losses. Based on the revised water balance information, the reservoir will operate on an average daily deficit of 9,850,000 Lpd [2,602,000 gallons per day (gpd)], if no makeup water is pumped from the Floridan aquifer wells. Weir discharge losses were estimated based on the declining water level above the 10-ft sharp crested weir set at 37.8 m-msl (124 ft-msl). Based on these two factors, reservoir discharge will decrease to 0 approximately 6.5 days after the beginning of the 25-year, 24-hour rainfall.

Potential for discharge impacts was evaluated by comparing the Payne Creek and the reservoir discharge hydrographs for the 25-year, 24-hour rainfall. These two hydrographs are superimposed and presented in Figure 5.1.1-5. (Note: These hydrographs are presented on two radically different scales.) Due to the slower rate of recession of the reservoir discharge as compared with Payne Creek flows, the relative dilution of discharge waters with Payne Creek decreases after the storm.

Given these worst-case modeling analyses, the worst-case dilution conditions would occur if Payne Creek were to recede to average base flow conditions (22 cfs) while the reservoir continued to discharge at the predicted peak rate of 0.33 cfs for the 25-year, 24-hour storm. This corresponds to a relative dilution of 1.5 percent. As this is less dilution than that which is estimated by comparing the Payne Creek and the reservoir discharge hydrographs, this represents the worst-case conditions which would result from discharges from the 25-year, 24-hour rainfall event. Given that actual dilution will probably be greater, this analysis is conservative.

The mixing and dispersion of these reservoir discharges to Payne Creek and resulting temperature impacts were estimated using the following dispersion model presented by Fischer *et al.* (1979). To execute the dispersion analysis, the various model parameters and coefficients were estimated based on available data and information. For the purposes of this analysis, the water quality parameter of interest (i.e., temperature) was considered to be a conservative parameter. Potentially, there may be some additional radiant or evaporative cooling within the discharge swale and plume areas; therefore, the assumption is conservative since it overestimates the magnitude of the impact.

Reservoir discharge thermal impact modeling conditions were estimated based on the average predicted reservoir discharges and Payne Creek flow conditions during these discharge conditions. Although most significant discharge conditions are predicted to occur in the fall (the wet season), worst-case (i.e., July) temperature conditions in the cooling reservoir were assumed. For the reservoir discharge conditions, a worst-case condition of 36.5°C (97.7°F) was assumed to reflect the average worst-case conditions [35.4°C (95.7°F)] predicted for June, plus an additional 1.1°C (2°F) loading to reflect short-term reservoir variability, adverse meteorological conditions, etc. For Payne Creek, the maximum observed stream temperature of 30°C (86°F), based on historical monitoring data previously collected by Agrico, was used as maximum, worst-case conditions. As such, these modeling conditions reflect maximum reservoir and creek thermal conditions.

The results of this modeling analysis are summarized in Table 5.1.1-3. Based on this modeling analysis, the cooling reservoir discharges will be diluted quickly by Payne Creek flows. For example, at a distance of 25 m (75 ft) below the point of discharge, the maximum plume temperature is 31.2°C (88.1°F), or approximately 1.1°C (2°F) above background conditions. At

this point, the thermal plume will comply with the thermal standards in Chapter 17-302.520, F.A.C.

To evaluate potential thermal impacts during cooler periods (i.e., during those times when creek organisms may be acclimated to colder temperatures and thus potentially more susceptible to thermal shock), an additional analysis was conducted to reflect potential worst-case creek and cooling reservoir temperatures in October. For the reservoir discharge conditions, a worst-case condition of 29.3°C (84.7°F) was assumed to reflect the predicted October worst-case load conditions (28.2°C or 82.7°F) plus an additional 1.1°C (2°F) loading to include short-term reservoir variability, adverse meteorological conditions, etc. For Payne Creek, a minimum October stream temperature of 21.1°C (70°F) was assumed to reflect worst-case receiving water conditions (i.e., maximum difference between reservoir effluent and creek conditions). This minimum October stream temperature is significantly lower than the observed October stream temperature of 24°C (75°F) measured in the monitoring program and lower than the estimated natural or the calculated equilibrium water temperature of 22.6°C (72.6°F). As such, this combination of maximum reservoir and minimum creek temperatures and the resulting temperature differential of 8.3°C (15°F) represent a potential worst-case condition regarding thermal shock.

The results of this modeling analysis are summarized in Table 5.1.1-4. As previously demonstrated by similar modeling analyses, the cooling reservoir discharges will be quickly diluted by Payne Creek flows. For example, at a distance of 25 m (75 ft) below the point of discharge, the maximum plume temperature is 22.2°C (71.9°F), or approximately 1.1°C (2°F) above background conditions. At this point, the thermal plume will approximate background conditions.

This substantial mixing and dispersion is a direct function of the Payne Creek conditions during the infrequent periods when a cooling reservoir discharge is required. As previously discussed, due to the evaporative losses and the ability of the reservoir to accommodate fluctuations in level to manage available water, discharges from the cooling reservoir will be required only during extreme meteorological conditions. Similarly, during the extreme meteorological conditions, Payne Creek flows will increase substantially. Thus, discharges from the reservoir will occur during high-flow conditions in Payne Creek; during these periods, there will be a substantial

dilution of the reservoir water. The impacts of these infrequent discharges are further minimized by existing sheetflow discharge from the reservoir into Payne Creek.

Based on the available data and the impact analysis presented herein, it is anticipated that discharges from the cooling reservoir will not cause adverse thermal impacts, will not significantly increase the temperature of Payne Creek, and will not impair or interfere with its existing or anticipated future beneficial use. This is because of the comparatively high creek flows which will quickly dilute all reservoir discharges. With the previously permitted mixing zone [e.g., 15 m (50 ft)], the proposed infrequent reservoir discharges will meet all requirements of Chapter 17-302.520, F.A.C.

Table 5.1.1-1. Summary of Predicted Reservoir Temperatures for Average Load Conditions for 880-MW Buildout

Month	Unit 1A and 1B Load Factor (%)	Unit 3 Load Factor (%)	Water Temperature at Reservoir Inlet (°F)	
			Average Month	Maximum Month
January	27	59	65.0	71.1
February	27	58	66.5	70.4
March	27	28	68.6	71.7
April	100	100	77.3	82.2
May	51	69	80.2	85.3
June	27	69	86.5	95.7
July	27	73	89.3	94.0
August	27	76	88.1	92.3
September	27	68	82.3	86.7
October	100	68	77.0	82.7
November	51	100	72.6	76.9
December	27	78	68.0	70.5
Annual	43	70	—	—

Note: °C = (°F - 32) 5/9

Source: KBN, 1994.

Table 5.1.1-2. Summary of Predicted Reservoir Temperatures for Maximum Load Conditions for 880-MW Buildout

Month	Unit 1A and 1B Load Factor (%)	Unit 3 Load Factor (%)	Water Temperature at Reservoir Inlet (°F)	
			Average Month	Maximum Month
January	100	100	69.6	75.8
February	100	100	71.1	75.3
March	100	100	74.2	78.1
April	100	100	77.3	82.2
May	100	100	83.0	88.2
June	100	100	90.1	99.5
July	100	100	92.8	97.7
August	100	100	91.6	96.0
September	100	100	86.2	90.8
October	100	100	78.0	83.7
November	100	100	74.3	78.6
December	100	100	70.7	74.3
Annual	100	100	—	—

Note: °C = (°F - 32) 5/9

Source: KBN, 1994.

Table 5.1.1-3. 880-MW HPS Cooling Reservoir Water Discharge and Payne Creek Dispersion Modeling - Maximum (July) Temperature Conditions

Distance Downstream (ft)	Temperature (°F) versus Distance Across Payne Creek										
	0	2	4	6	8	10	12	14	16	18	20
25	89.7	89.5	89.0	88.3	87.6	87.0	86.6	86.3	86.1	86.1	86.0
50	88.6	88.5	88.4	88.1	87.7	87.4	87.1	86.8	86.6	86.4	86.4
75	88.1	88.1	88.0	87.8	87.6	87.4	87.2	87.0	86.9	86.8	86.8
100	87.9	87.8	87.8	87.7	87.6	87.4	87.3	87.2	87.1	87.0	87.0
125	87.7	87.7	87.7	87.6	87.5	87.4	87.4	87.3	87.2	87.2	87.2
150	87.6	87.6	87.6	87.5	87.5	87.4	87.4	87.3	87.3	87.3	87.3
175	87.5	87.5	87.5	87.5	87.5	87.4	87.4	87.4	87.4	87.3	87.3
200	87.5	87.5	87.5	87.5	87.5	87.4	87.4	87.4	87.4	87.4	87.4
225	87.5	87.5	87.5	87.5	87.5	87.4	87.4	87.4	87.4	87.4	87.4
250	87.5	87.5	87.5	87.5	87.5	87.4	87.4	87.4	87.4	87.4	87.4
275	87.5	87.5	87.5	87.5	87.4	87.4	87.4	87.4	87.4	87.4	87.4
300	87.5	87.5	87.5	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
325	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
350	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
375	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
400	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
425	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
450	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
475	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
500	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4

Creek Velocity	0.50 ft/sec
Shear Velocity	0.259 ft/sec
Average Creek Depth	2.5 ft
Creek Width	20 ft
Discharge Location	0 ft from shore
Effluent Temperature	97.70 °F
Effluent Discharge Rate	0.330000 cfs
Background Creek Temperature	86.00 °F
Creek Discharge Rate	22.0 cfs
Transverse Mixing Coefficient	0.389 ft ² /sec

Note: °C = (°F - 32) 5/9
ft x 0.3 = m

Source: KBN, 1994.

Table 5.1.1-4. 880-MW HPS Cooling Reservoir Water Discharge and Payne Creek Dispersion Modeling - October Temperature Conditions

Distance Downstream (ft)	Temperature (°F) versus Distance Across Payne Creek										
	0	2	4	6	8	10	12	14	16	18	20
25	73.2	73.0	72.6	72.0	71.4	70.9	70.5	70.3	70.1	70.1	70.0
50	72.3	72.2	72.0	71.8	71.5	71.2	70.9	70.7	70.5	70.4	70.3
75	71.9	71.8	71.7	71.6	71.4	71.2	71.1	70.9	70.8	70.7	70.7
100	71.6	71.6	71.5	71.5	71.4	71.3	71.1	71.0	71.0	70.9	70.9
125	71.5	71.5	71.4	71.4	71.3	71.3	71.2	71.1	71.1	71.0	71.0
150	71.4	71.4	71.4	71.3	71.3	71.3	71.2	71.2	71.1	71.1	71.1
175	71.3	71.3	71.3	71.3	71.3	71.3	71.2	71.2	71.2	71.2	71.2
200	71.3	71.3	71.3	71.3	71.3	71.3	71.2	71.2	71.2	71.2	71.2
225	71.3	71.3	71.3	71.3	71.3	71.3	71.2	71.2	71.2	71.2	71.2
250	71.3	71.3	71.3	71.3	71.3	71.3	71.2	71.2	71.2	71.2	71.2
275	71.3	71.3	71.3	71.3	71.3	71.3	71.2	71.2	71.2	71.2	71.2
300	71.3	71.3	71.3	71.3	71.3	71.3	71.2	71.2	71.2	71.2	71.2
325	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.2	71.2	71.2	71.2
350	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.2	71.2	71.2	71.2
375	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.2	71.2
400	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3
425	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3
450	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3
475	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3
500	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3
Creek Velocity											
0.50 ft/sec											
Shear Velocity											
0.259 ft/sec											
Average Creek Depth											
2.5 ft											
Creek Width											
20 ft											
Discharge Location											
0 ft from shore											
Effluent Temperature											
87.70 °F											
Effluent Discharge Rate											
0.330000 cfs											
Background Creek Temperature											
70.00 °F											
Creek Discharge Rate											
22.0 cfs											
Transverse Mixing Coefficient											
0.389 ft ² /sec											

Note: °C = (°F - 32) 5/9
ft x 0.3 = m

Source: KBN, 1994.

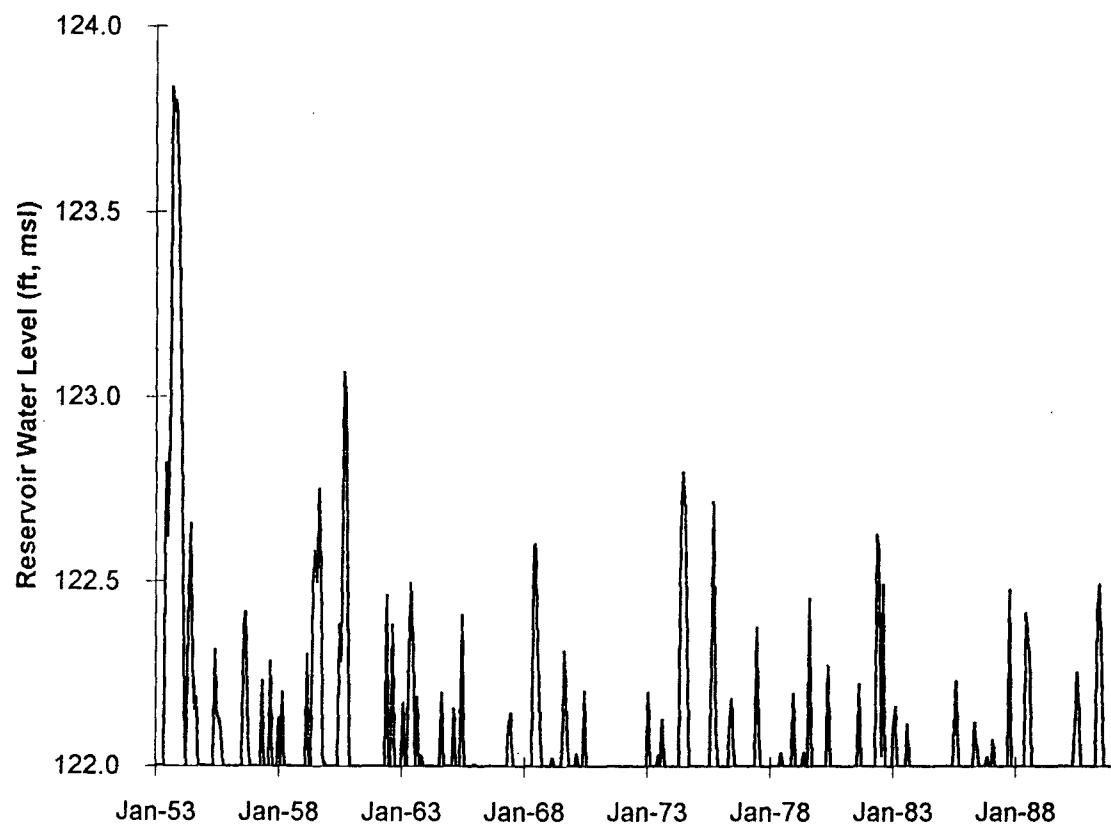


Figure 5.1.1-1
Predicted Cooling Reservoir Elevations
(38 Years)

Source: KBN, 1994.



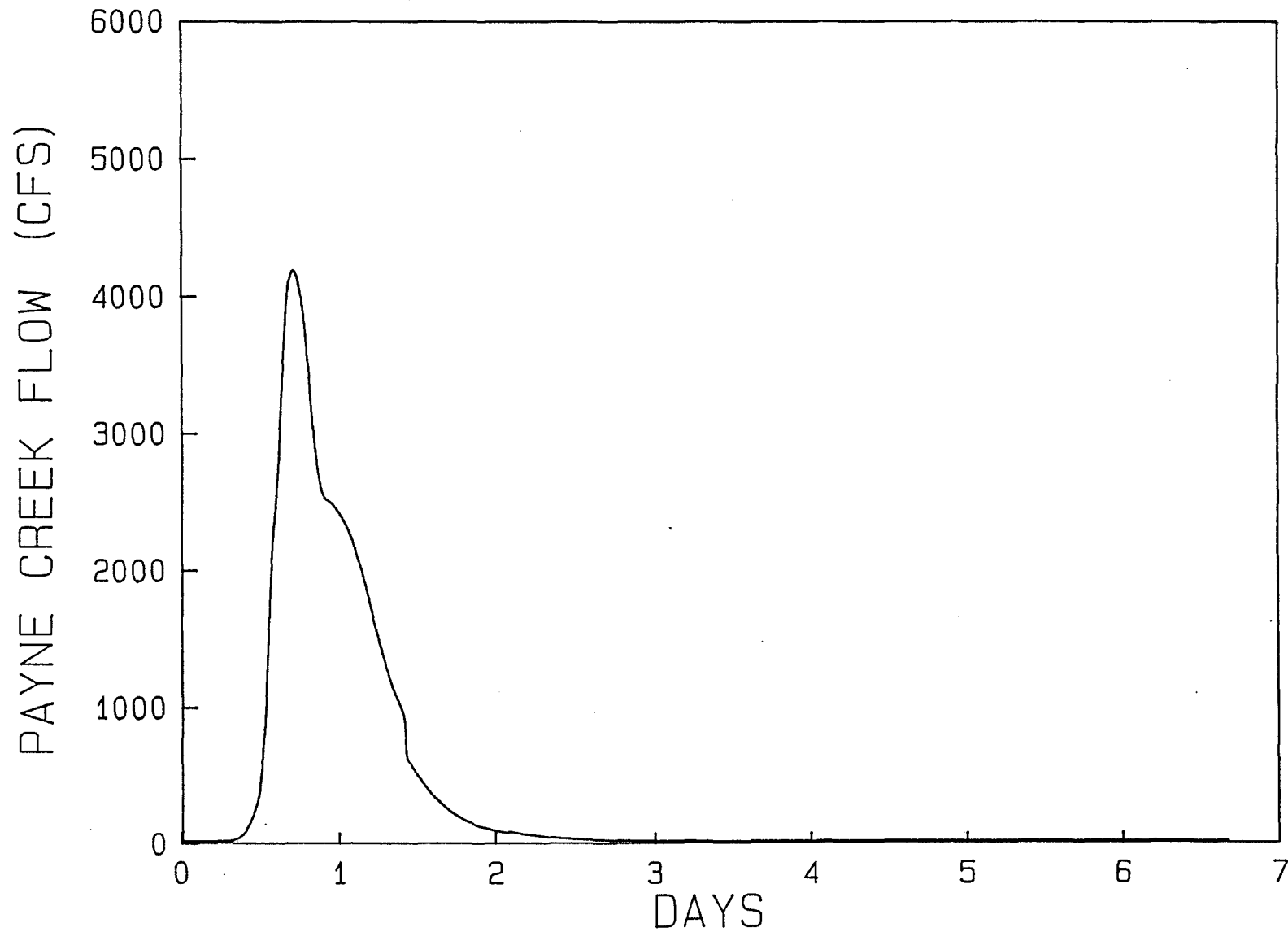


Figure 5.1.1-2
Payne Creek Runoff Hydrograph
(10-Year, 24-Hour Storm)

Source: TPS/SECI, 1989.



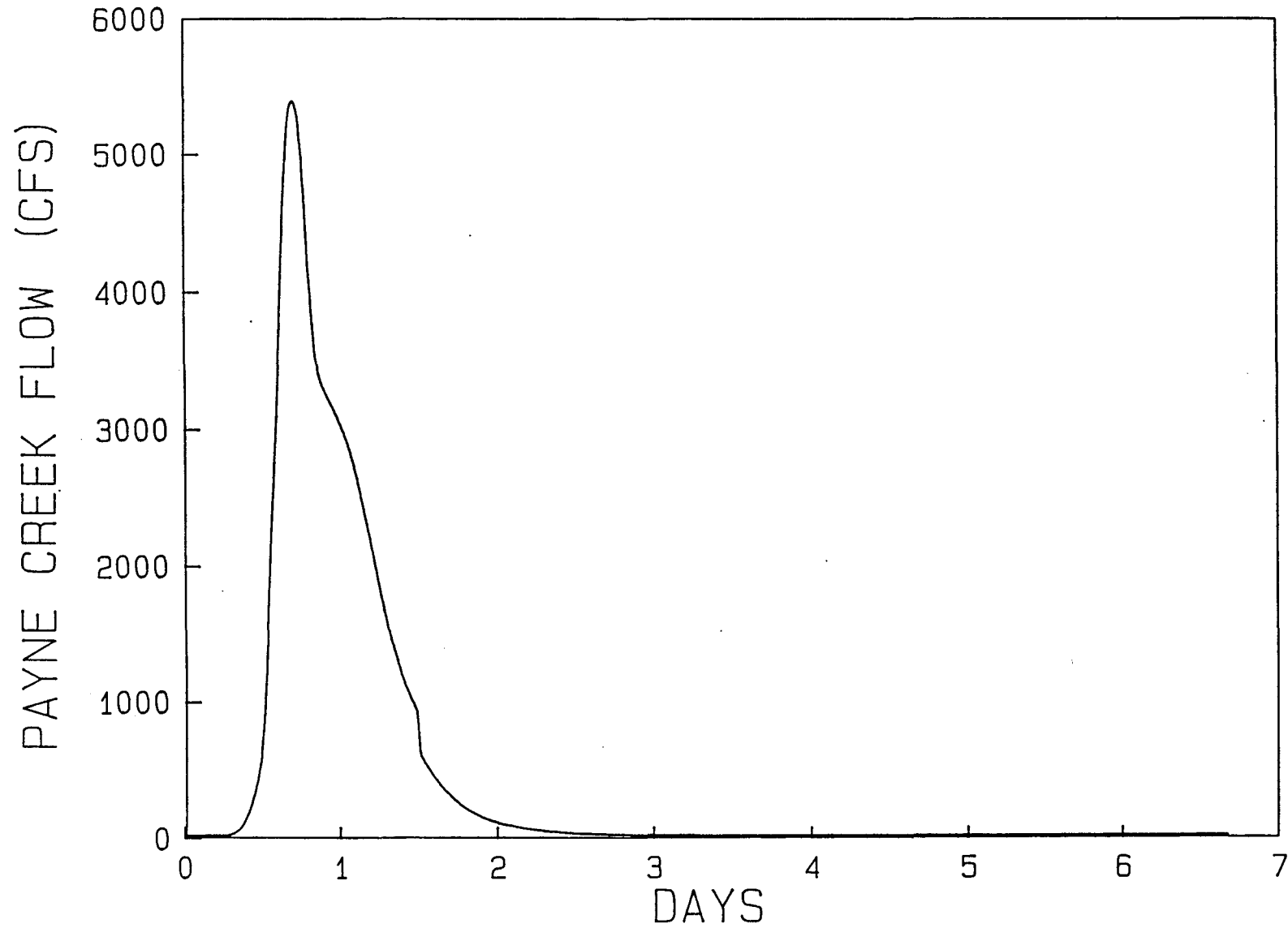


Figure 5.1.1-3
Payne Creek Runoff Hydrograph
(25-Year, 24-Hour Storm)

Source: TPS/SECI, 1989.



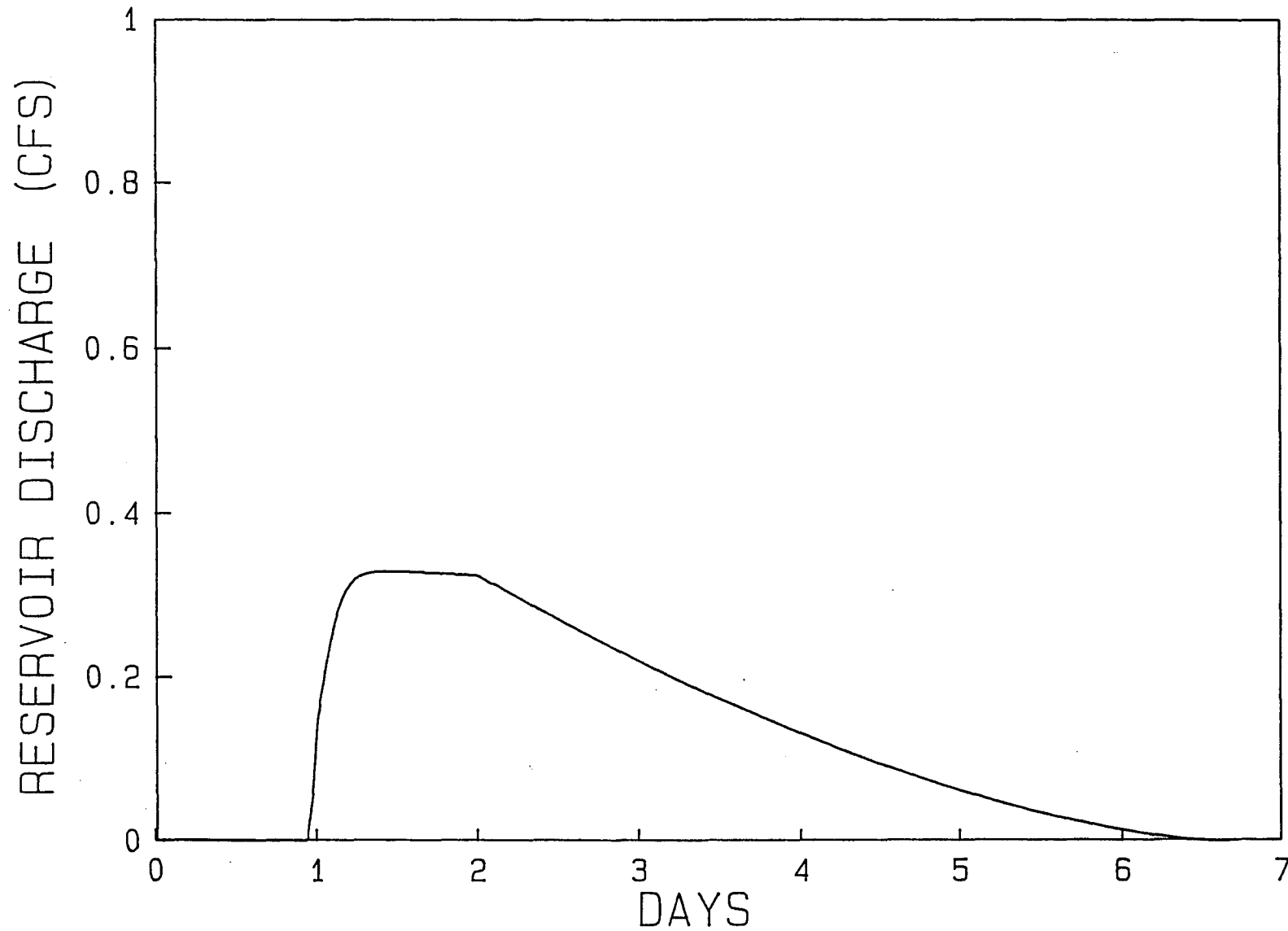


Figure 5.1.1-4
Predicted Cooling Reservoir Discharge
(25-Year, 24-Hour Storm)

Source: TPS/SECI, 1989.



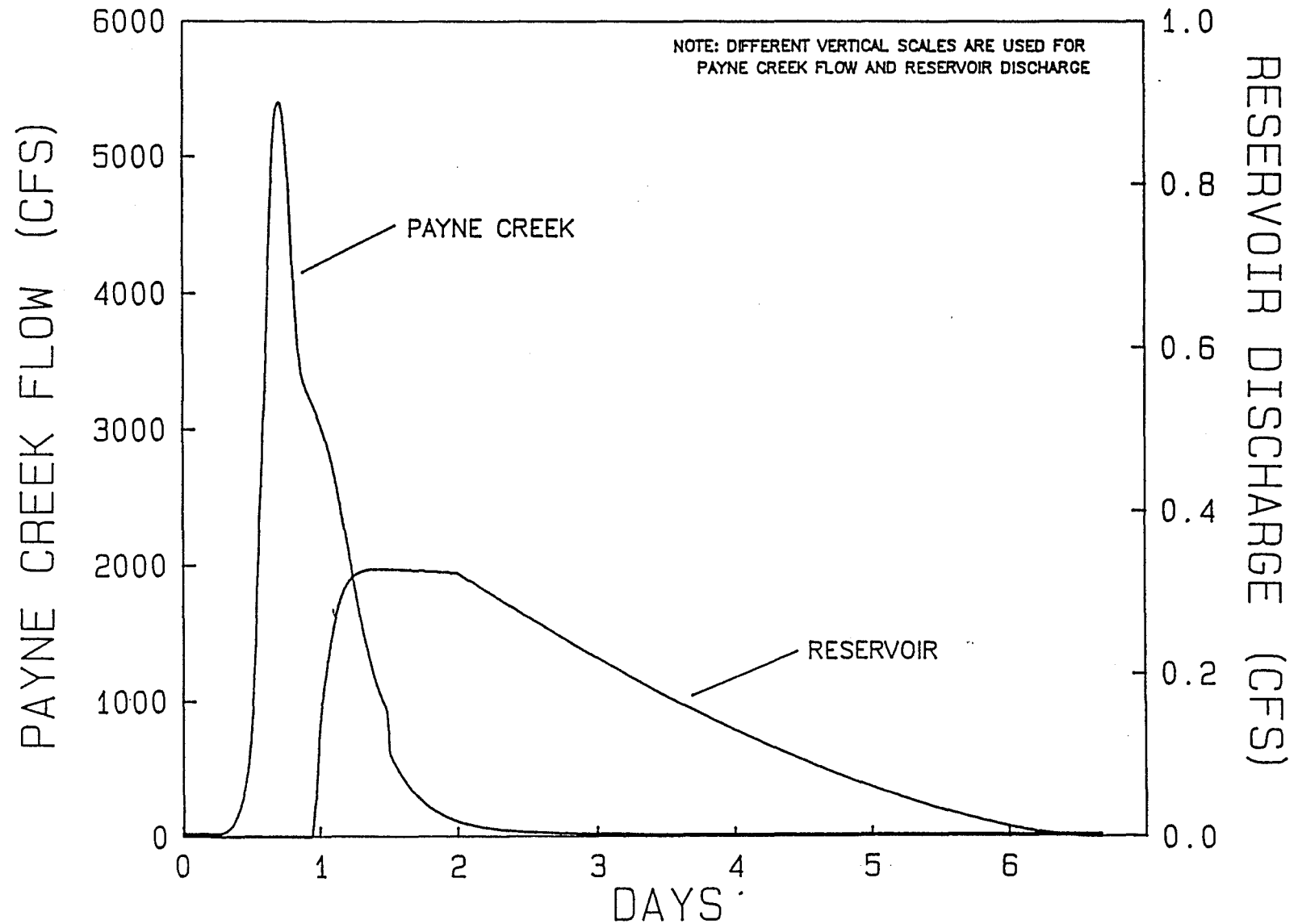


Figure 5.1.1-5
Comparison of Payne Creek Flow and Reservoir Discharge
for the 25-Year, 24-Hour Storm

Source: TPS/SECI, 1989.



5.1.2 EFFECTS ON AQUATIC LIFE

5.1.2.1 THERMAL IMPACTS

The proposed incremental thermal increase in the cooling reservoir from Hardee Unit 3 will not be significantly different from the expected discharge from the originally certified HPS.

Reservoir discharge could occur only during very intensive, wet periods, such as hurricanes or major frontal storms, i.e., 10-year, 24-hour storm. These periods of discharge will coincide with natural high flow in the creek, thus the effluent will be subject to significant dilution.

The predicted maximum average reservoir temperature under average load conditions is conservatively estimated to be 31.8°C (89.3°F) during July and the maximum monthly temperature under average load conditions is 35.4°C (95.7°F) during June (see Section 5.1.1).

The predicted maximum average discharge temperature conditions are within the acceptable water quality criteria for peninsular Florida, and thus should not affect the aquatic resources. Discharge of effluent at the predicted maximum worst-case temperature will exceed the water quality temperature limitation for peninsular Florida [criterion of 33°C (92°F) versus discharge of 35.4°C (95.7°F)]. However, applicable temperature criterion will be met outside the established mixing zone (see Section 5.1.1). Based on creek flow and anticipated dilution, the temperature impacts under worst-case conditions should be localized in the immediate vicinity of the point of discharge. At a distance of 25 m (75 ft), the thermal plume will approximate background conditions; therefore, no impacts to aquatic life are anticipated outside the mixing zone.

5.1.2.2 IMPINGEMENT AND ENTRAINMENT

Impingement and entrainment effects are not potential sources of impact because all plant make up water will be groundwater, surface runoff and precipitation. Surface waters will not be used as a source of makeup water.

5.1.2.3 THERMAL SHOCK

Based on the assumption that the highest Payne Creek water temperature of 30°C (86°F) occurs during July, and that the estimated average worst-case plant discharge during the summer is 35.4°C (95.7°F), a temperature differential of 5.4°C (9.7°F) may occur within the mixing zone under ambient conditions.

Payne Creek water temperatures are within 1.1°C (2°F) of ambient for 90 percent of the stream's width at the edge of the thermal mixing zone. Thus, the potential for greatest thermal shock will be localized within 8 m (25 ft) downstream from the discharge point which is within the currently permitted mixing zone (see Table 5.1.1-3). During the summer, aquatic organisms are acclimated to high-temperature conditions and are more tolerant to higher temperatures. Fish and invertebrates can detect and avoid areas of thermal stress. Because of the localized area of impact, no thermal blockage to movement by aquatic animals will occur. Additional modeling was carried out to evaluate potential worst-case conditions during the winter months. The assumptions included a reservoir temperature of 27°C (80°F) and a creek temperature of 21.1°C (70°F). The model predicted that the cooling reservoir discharge will be quickly diluted by Payne Creek flows. Within the currently permitted mixing zone [60 m (200 ft)], the plume temperature is predicted to be <1.1°C (<2.0°F) above background (see Table 5.1.1-4).

5.1.3 BIOLOGICAL EFFECTS OF MODIFIED CIRCULATION

No water intakes will be placed in Payne Creek, and no additional cooling water discharges will occur in Payne Creek. Based on the physical and biological conditions of Payne Creek, the thermal mixing zone described in Section 5.1.1 will not have an adverse impact on the biological communities of Payne Creek. Due to the size and subsequent dilution of the cooling reservoir and the anticipated retention time in the system, no major changes in water quality are anticipated in Payne Creek from the incremental increase from Hardee Unit 3, thus no impacts (TPS/SECI, 1989) are anticipated on the aquatic communities.

Because of the existing preventative measures (e.g., weir, riprap, etc.) associated with the HPS discharge structure and because there will be no change in the discharge flows and volumes, no scouring, erosion and deposition of suspended solids is expected to occur to Payne Creek with the addition of Hardee Unit 3. The overflow is directed to a protected channel which results in sheetflow to the floodplain. This sheetflow is 9 m (30 ft) or more in length and 5 m (15 ft) or more in width before it reaches the creek. During periods of discharge, the discharge volume will not increase over existing volumes, and no effect to the biological communities will occur.

5.1.4 EFFECTS OF OFFSTREAM COOLING

Operation of the Hardee Unit 3 facility will not affect the previously certified use and operational parameters of the existing cooling reservoir. The use of the existing cooling reservoir for condenser cooling for the Hardee Unit 3 facility will not affect groundwater resources since no physical or operational modifications to the reservoir are proposed.

5.1.4.1 GROUNDWATER/SURFACE WATER INTERCHANGE

Groundwater and surface waters interchange directly along Payne Creek which forms the southwestern boundary of the site. Except for recent alluvium, the material in the bed of Payne Creek is comprised of clays of the Bone Valley Formation which also forms the base of the surficial aquifer. Groundwater flows parallel to the water table toward Payne Creek where it is discharged. Slug test data collected for the evaluation of the cooling reservoir indicate that the seepage through the reservoir berm is about 3,480,000 Lpd (920,000 gpd). Operation of the cooling reservoir has not modified this general pattern.

5.1.4.2 FOGGING

The potential to increase the number of days of fogging due to HPS was addressed in the original Site Certification Application (SCA) (TPS/SECI, 1989). It was determined that operation of the cooling reservoir would not result in a significant increase in the amount of fog that existed in the area. The proposed Hardee Unit 3 facility will rely on the existing reservoir for condenser cooling. Since the additional heat load represents an incremental increase, it is not expected that significant additional fogging will result from the Hardee Unit 3 Project.

The Tampa area experiences approximately 22 days a year during which fog reduces visibility to 0.4 kilometer (km) (0.25 mile) or less. Night ground fog occurs frequently during the cooler winter months. The annual frequency of night fog occurrence at the project site is expected to be similar to that of the Tampa area. However, at the project site, fog will vary in duration and intensity during the day from that observed in the Tampa area because of the inland location of the project site.

5.1.5 MEASUREMENT PROGRAM

5.1.5.1 GROUNDWATER

Information regarding the implementation of a groundwater monitoring plan for the HPS existing facilities was previously submitted to FDEP in the original SCA/EA document (TPS/SECI, 1989). The approved monitoring plan requires the installation of six monitor wells at selected locations around the cooling and detention ponds at the existing HPS site facilities. The existing well locations are described in Section 2.3.2.1.1., with well locations presented in Figure 2.3.2-2, and a summary of analytical results is presented in Table 2.3.2-3. TPS will continue to maintain the existing groundwater monitoring program.

Groundwater monitoring at the Hardee Unit 3 site is proposed to be conducted in a manner consistent with ongoing activities. Locations for proposed additional monitor wells have been selected to characterize potential impacts to groundwater quality in the surficial aquifer and include the following areas:

1. Upgradient from Hardee Unit 3 site to characterize background conditions,
2. Upgradient from Hardee Unit 3 detention pond,
3. Downgradient from Hardee Unit 3 detention pond, and
4. Downgradient from Hardee Unit 3 power block and upgradient from HPS existing facilities.

It is intended that groundwater monitoring at these locations will characterize ambient groundwater quality trends, identify potential groundwater quality impacts due to plant operation, and provide a means to distinguish between potential sources of impacts. Information required by Chapter 17-522, F.A.C., regarding the details of the proposed groundwater monitoring plan for the Hardee Unit 3 site are presented in Appendix 10.5.2.

5.1.5.2 SURFACE WATER

The temperature monitoring program resulting from the original certification was structured to provide the necessary data on operational water temperatures at the site for determination of project compliance and impacts. Temperatures will be recorded if discharge occurs from the cooling reservoir (Station RES-1). The location of the temperature monitoring station is shown in Figure 5.1.5-1.

No additional surface water monitoring for temperature is proposed.

5.1.5.3 BIOLOGICAL MONITORING

Because of the absence of anticipated ecological impacts, no biological monitoring is proposed.

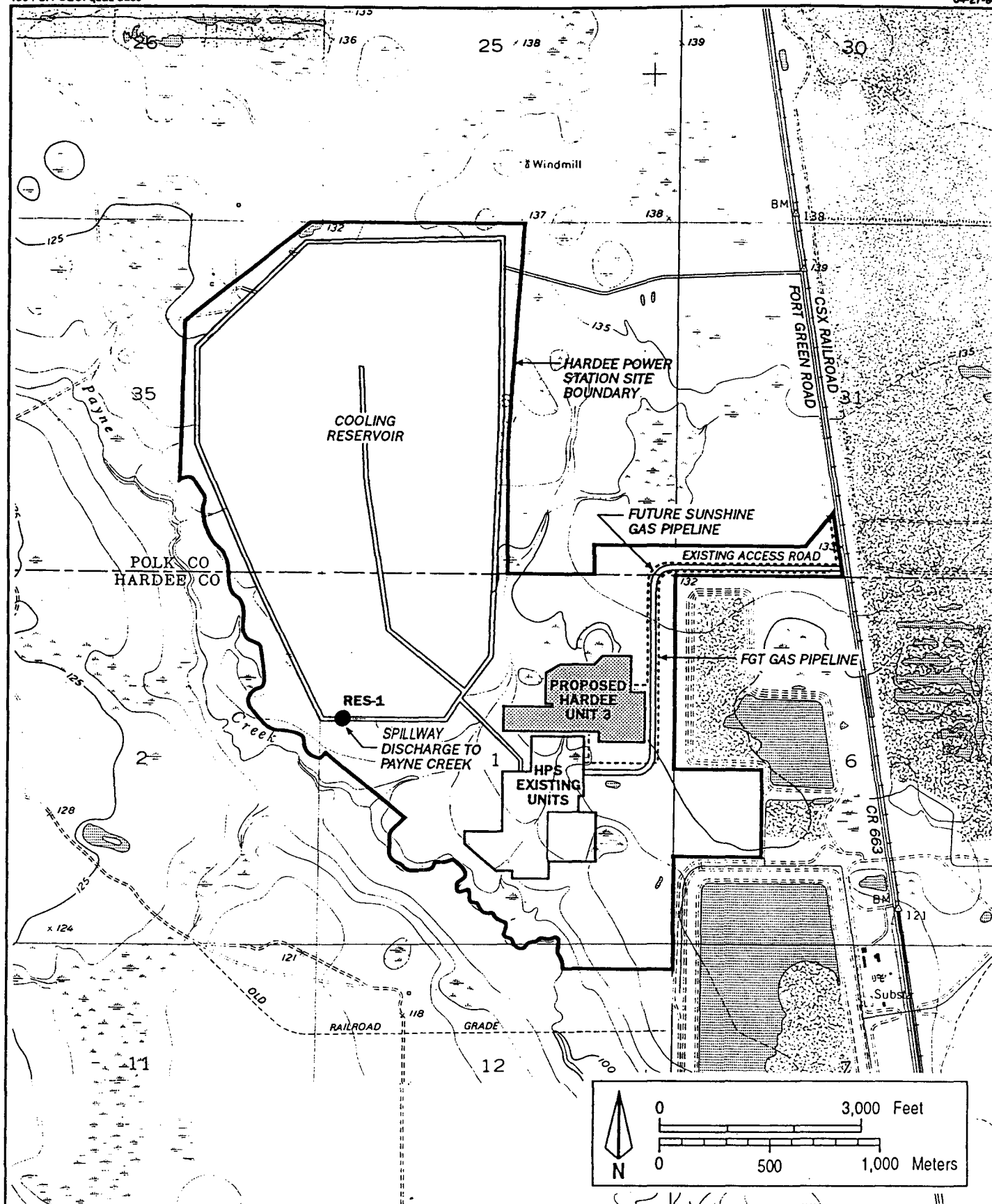


Figure 5.1.5-1
Operational Monitoring Temperature and Water Quality
Station Location

Sources: USGS, 1987; KBN, 1994.



5.2 EFFECTS OF CHEMICAL AND BIOCIDES DISCHARGES

5.2.1 INDUSTRIAL WASTEWATER DISCHARGES

5.2.1.1 SURFACE WATER DISCHARGES

In addition to the previously described recirculating cooling system discharges, Hardee Unit 3 will have three other types of wastewater discharges: low-volume plant wastewaters; plant-related sanitary wastewater; and plant site stormwater. Treatment and potential impacts of low-volume plant wastewaters are discussed below; plant site stormwater and plant-related sanitary wastewater are discussed in Sections 5.3 and 5.5, respectively.

The proposed plant as designed will treat, retain, and/or recycle all wastewater flows minimizing offsite surface water discharges, consistent with Florida Department of Environmental Protection (FDEP) policy. As such, the proposed plant wastewaters will have virtually no adverse surface water quality impacts on downstream water quality of Payne Creek.

Power plant low-volume wastewaters include plant and equipment drain wastes, boiler blowdown, demineralizer regenerant wastestreams, plant water pretreatment filter backwash, and sanitary wastewaters. Anticipated generation rates for these wastewater streams are presented in Figures 3.5-3 through 3.5-5. Given the anticipated fuels (i.e., gas or oil), no fuel or flue gas desulfurization related wastewaters will occur.

The proposed plant will incorporate a neutralization unit to treat demineralizer regenerant wastestreams and miscellaneous chemical drain wastes prior to discharge to the cooling reservoir. This proposed neutralization unit will treat these wastes by pH neutralization, flow equalization, sedimentation, and mixing and dilution. These neutralized and treated wastewaters will be collected and recycled to the cooling reservoir. Miscellaneous floor drains will be directed to an oil separator and then discharged to the cooling reservoir for reuse as cooling water.

Given the plant size, overall design, and anticipated fuels, low-volume plant wastewaters will be relatively small flows and relatively good quality. Under average annual conditions, the total quantity of these wastewaters will be approximately 352 m³/day (93,000 gpd) for Hardee Unit 3 under average annual load conditions. Anticipated low-volume wastewater quality is discussed in

Section 3.5. The cooling reservoir will be neither waters of the State of Florida nor waters of the United States; therefore, no discharge criteria or water-quality-based effluent limitations apply.

Use of the cooling reservoir to receive treated plant wastewaters maximizes the retention and recycling of treated wastewater flows and thus minimizes offsite surface water discharges while maximizing water reuse.

The net dilution received by these wastewaters within the reservoir, prior to surface or subsurface discharge from the reservoir, is a function of the total freshwater entering the reservoir. As presented in Figure 3.5-1, approximately 20,130 m³/day (5,318,400 gpd) of rainfall, upland runoff, and lower Floridan aquifer makeup water will enter the reservoir. Therefore, plant wastewaters will receive an overall 30:1 dilution based on inflows within the reservoir prior to release to adjacent surface or subsurface waters as either surface water or groundwater discharges.

Based on the anticipated plant and cooling reservoir water balance for the total 880-MW facility (presented in Figure 3.5-1) and reservoir inflow water quality (including the treated plant wastewaters and sanitary wastewaters), the long-term reservoir water quality has been estimated. Given the increased evaporative losses and the minimized discharge, some evapo-concentration of water quality constituents will occur over the life of the reservoir. The long-term (i.e., 30 years of facility operation after complete buildout) reservoir water quality has been estimated based on a mass balance of all reservoir water inflows and outflows; see Table 5.2.1-1. FDEP Class III water quality criteria applicable to discharges from the reservoir are presented for comparison.

In evaluating these estimates of reservoir quality, two important factors merit special note when considering the conservative nature of the analyses. First, these reservoir effluent estimates are based on chemical mass balances of water inflows and outflows and do not take into account any chemical reaction, precipitation, sedimentation, deposition or biological activity which will likely occur in the reservoir. These physico-chemical and/or biological activities may result in significant removal of suspended and/or dissolved material from the water column; such removal would significantly reduce actual reservoir and discharge concentrations. Following the conservative basis of the analyses, credit for the above types of mass losses was not included in the water quality estimations.

Second, in the determination of neutralization unit or reservoir concentrations for the various parameters in which one or more source waters were less than the analytical detection limit, the source water concentration was mathematically assumed to be at the reported analytical detection limit or modified per the provisions of Chapter 17-4.426(8), F.A.C. Given the concentrating effect of long-term cooling reservoir operation and the demineralizer resin regeneration, this presumption of the presence of these parameters at these concentrations significantly influences the long-term reservoir concentration. If these parameters are present at concentrations substantially less than the analytical detection limits, predicted long-term reservoir concentrations will be reduced proportionally. Thus, the mathematical assumption of these concentrations at the reported analytical detection limits results in a maximum or worst- case estimate.

Given both factors (the absence of physico-chemical and/or biological removal and the assumption of the analytical detection limit as the actual concentration), these estimates of reservoir discharge quality are conservative.

Based on these conservative, long-term (30-year) water quality estimates, the cooling reservoir discharge at the weir may exceed the applicable FDEP Class III water quality criteria for the parameters listed in Table 5.2.1-2.

To assess mixing and dilution of these discharges and to estimate the mixing zone necessary to meet the applicable FDEP Class III water quality criteria, the runoff and mixing models previously described in Section 5.1.1 were used. As previously estimated using the reservoir water balance and HEC-1 models, the reservoir will only discharge for storms which exceed the 10-year, 24-hour rainfall. Thus, reservoir discharges will be infrequent and subject to substantial dilution.

Based on the predicted discharge and streamflow rates for the 25-year, 24-hour storm, the estimated mixing zone lengths and widths are summarized in Table 5.2.1-2. Given the low discharge rates and relatively high streamflow rates, mixing zone lengths are typically very short and mixing zone widths correspondingly narrow. The mixing depth will extend the entire depth of the water column. For all these parameters, the mixing zone length required to meet the applicable FDEP Class III water quality criteria is 15 m (50 ft) or less. This calculated mixing zone is within the previously certified 61 m (200 ft) mixing zone length.

The mixing zone calculations and requirements for the several parameters listed in Table 5.2.1-2 are discussed below:

1. Turbidity--The estimated reservoir concentration for turbidity is 31 NTU, and the receiving water concentration is 1.7 NTU. The Class III water quality standard for turbidity is the ambient concentration plus 29 NTU (i.e., 30.7 NTU for Payne Creek). The required mixing zone for turbidity is minimal (i.e., <50 ft) because the estimated reservoir and Payne Creek concentrations are approximately equal.
2. Cyanide--The estimated reservoir concentration for cyanide is 0.01 mg/L, and the receiving water concentration is <0.004 mg/L. The Class III water quality standard for cyanide is 0.005 mg/L. The required mixing zone for cyanide is minimal (i.e., <50 ft) because the dilution required to bring the estimated reservoir discharge concentration below Class III standards is relatively small (i.e., 6:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).
3. Beryllium--The estimated reservoir concentration for beryllium is 1.6 $\mu\text{g/L}$, and the receiving water concentration is <0.1 $\mu\text{g/L}$. The Class III water quality standard for beryllium is 0.13 $\mu\text{g/L}$. According to Chapter 17-4.426(8), F.A.C., when the receiving water concentration is below the analytical detection limit and the standard is greater than the detection limit, a value of 50 percent of the detection limit (i.e., 0.05 $\mu\text{g/L}$) can be used as the ambient concentration during the modeled discharge event. Using this method, the required mixing zone for beryllium is minimal (i.e., <50 ft) because the dilution required to bring the estimated reservoir discharge concentration below Class III standards is relatively small (i.e., 11:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).
4. Cadmium--The estimated reservoir concentration for cadmium is 1.0 $\mu\text{g/L}$, and the receiving water concentration is <0.4 $\mu\text{g/L}$. The Class III water quality standard for cadmium is 0.82 $\mu\text{g/L}$. The required mixing zone for cadmium is minimal (i.e., <50 ft) because the dilution required to bring the estimated reservoir discharge concentration below Class III standards is relatively small (i.e., 1:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).
5. Copper--The estimated reservoir concentration for copper is 9.9 $\mu\text{g/L}$, and the receiving water concentration is 7 $\mu\text{g/L}$. The Class III water quality standard for copper is 8.3 $\mu\text{g/L}$. The required mixing zone for copper is minimal (i.e., <50 ft) because the dilution required to bring the estimated reservoir discharge concentration

below Class III standards is relatively small (i.e., 2:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).

6. Lead--The estimated reservoir concentration for lead is $6.8 \mu\text{g/L}$, and the Class III water quality standard for lead is $1.9 \mu\text{g/L}$. The measured lead concentrations in Payne Creek have ranged from <5 to $7 \mu\text{g/L}$, and those associated with the higher flows have been $<5 \mu\text{g/L}$. The lead concentration in Payne Creek used in the analysis was $0.95 \mu\text{g/L}$ (i.e., 50 percent of the standard) per the provisions of Chapter 17-4.426(8), F.A.C. Using this methodology, the required mixing zone for lead is minimal (i.e., <50 ft) because the dilution required to bring the estimated reservoir discharge concentration below Class III standards is relatively small (i.e., 6:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).
7. Mercury--The estimated reservoir concentration for mercury is $0.097 \mu\text{g/L}$, and the Class III water quality standard for mercury is $0.012 \mu\text{g/L}$. The measured mercury concentrations in Payne Creek were $<0.2 \mu\text{g/L}$ for the higher flow events. The mercury concentration in Payne Creek used in the analysis was $0.006 \mu\text{g/L}$ (i.e., 50 percent of the standard) per the provisions of Chapter 17-4.426(8), F.A.C. Using this methodology, the required mixing zone for mercury is minimal (i.e., <50 ft) because the dilution required to bring the estimated reservoir discharge concentration below Class III standards is relatively small (i.e., 14:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).
8. Selenium--The estimated reservoir concentration for selenium is $40 \mu\text{g/L}$, and the receiving water concentration is $<5 \mu\text{g/L}$. The Class III water quality standard for selenium is $5 \mu\text{g/L}$. According to Chapter 17-4.426(8), F.A.C., when the receiving water concentration is below the analytical detection limit and the standard is greater than the detection limit, a value of 50 percent of the detection limit (i.e., $2.5 \mu\text{g/L}$) can be used as the ambient concentration during the modeled discharge event. Using this methodology, the required mixing zone for selenium is minimal (i.e., <50 ft) because the dilution required to bring the estimated reservoir discharge concentration below Class III standards is relatively small (i.e., 14:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).
9. Silver--The estimated reservoir concentration for silver is $0.14 \mu\text{g/L}$, and the receiving water concentration is $<0.07 \mu\text{g/L}$. The Class III water quality standard

for silver is 0.07 $\mu\text{g/L}$. According to Chapter 17-4.426(8), F.A.C., when the receiving water concentration is below the analytical detection limit and the standard is greater than the detection limit, a value of 50 percent of the detection limit (i.e., 0.035 $\mu\text{g/L}$) can be used as the ambient concentration during the modeled discharge event. Using this methodology, the required mixing zone for silver is minimal (i.e., < 50 ft) because the dilution required to bring the estimated reservoir discharge concentration below Class III standards is relatively small (i.e., 2:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).

10. Zinc--The estimated reservoir concentration for zinc is 370 $\mu\text{g/L}$ and the receiving water concentration is 7 $\mu\text{g/L}$. The Class III water quality standard for zinc is 75 $\mu\text{g/L}$. The required mixing zone for zinc is minimal (i.e., 50 ft) because the dilution required to bring the estimated reservoir discharge concentration below Class III standards is relatively small (i.e., 4:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).
11. Gross alpha--The estimated reservoir concentration for gross alpha is 22.2 pC/L, and the receiving water concentration is 1.9 pC/L. The Class III water quality standard for gross alpha is 15 pC/L. The required mixing zone for gross alpha is minimal (i.e., < 50 ft) because the dilution required to bring the estimated reservoir discharge concentration below Class III standards is relatively small (i.e., 2:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).
12. Radium 226--The estimated reservoir concentration for radium 226 is 7.9 pC/L, and the receiving water concentration is 0.7 pC/L. The Class III water quality standard for radium 226 is 5 pC/L. The required mixing zone for radium 226 is minimal (i.e., < 50 ft) because the dilution required to bring the estimated reservoir discharge concentration below Class III standards is relatively small (i.e., 1:1) compared to the total dilution available in Payne Creek at the lowest flow conditions (i.e., 67:1).

Given the anticipated reservoir water quality, the treatment provided to plant wastewaters, the infrequent occurrences of discharge (discussed in Section 5.1.1), and immediate and substantial dilution afforded by Payne Creek flows during the infrequent discharge events, no adverse water quality impacts are predicted. As seen in Table 5.2.1-1, the estimated changes in reservoir water quality between the existing 660-MW configuration and the proposed 880-MW configuration are minimal. Based on these data, surface discharge of cooling reservoir water will not significantly

or adversely increase water quality concentrations of Payne Creek, impair or interfere with any existing or anticipated future beneficial use of these waters, or cause or contribute to any contravention of FDEP General or Class III water quality criteria.

5.2.1.2 GROUNDWATER DISCHARGES

There will be no direct chemical or biocide discharges to groundwater. Possible indirect discharges could occur from seepage from the cooling reservoir and the runoff detention pond and as accidental spills from chemical handling and storage areas.

The cooling reservoir is constructed of *in-situ* earth materials creating a permeable filter bed. Given the depth of the reservoir, seepage is primarily to the surficial aquifer. As described in the previous section and in Section 3.5, the reservoir receives direct rainfall, surface runoff, wellwater from the Floridan aquifer as makeup and various treated plant wastewater flows. This results in a minimum of 30:1 dilution for wastewaters prior to any seepage to groundwater. It also results in an increase in concentration of various water quality parameters over time. Design water analysis and current water quality in the cooling reservoir are shown in Table 3.5-3.

The impact of seepage of water with the anticipated quality can be considered by comparing concentrations of key parameters to existing water quality in the surficial aquifer and to pertinent groundwater standards. These parameters (total dissolved solids, chlorides, and sulfates) were chosen because they are widely reported, conservative groundwater parameters. The relative differences found can also be applied to other parameters. Table 5.2.1-1 provides a summary of projected reservoir concentrations after 30 years and groundwater standards for the three parameters.

A contour map showing the selected groundwater quality parameters after 30 years of plant operation are shown in Figure 5.2.1-1. This map was prepared using a two-dimensional finite element model to simulate the concentrations produced by full contact of the reservoir water with the surficial aquifer groundwater. Solute concentrations were held constant for the full depth of the aquifer directly under the reservoir. No retardation or adsorption of the cations by clayey soils was taken into account in this simulation. Transport of solute was allowed by advection within the pores of the surficial aquifer at a uniform groundwater velocity of 5 mm/day toward

the south-southwest. Both longitudinal and transverse dispersivity and molecular diffusion were taken into account using parameters derived from Freeze and Cherry (1979).

The analysis indicated that the concentrations remain localized in the immediate vicinity of the reservoir. Concentrations at the end of 30 years are indistinguishable from background levels within 0.4 km (0.25 mile) of the reservoir. At the end of 30 years, the 500 mg/L TDS isopleth will have moved a maximum of 320 ft from the inside of the southern end of the cooling reservoir berm (see Figure 5.2.1-1). The TDS isopleth shown in Figure 5.2.1-2 was used to show the decrease of a conservative indicator parameter. All other water quality parameters will show the same trend. At the edge of this zone of discharge [as defined in the existing conditions of certification for HPS (100 ft from the outside toe of the cooling reservoir)], groundwater concentrations will meet the applicable groundwater quality standards. This established zone of discharge continues to be in compliance with FDEP regulations, Chapter 17-28.700(4), F.A.C. The edge of this zone of discharge is within the HPS property boundary and will not threaten or impair any present or future water supplies. It is of note that the zone of discharge compliance is achieved even with the conservative reservoir concentration estimates (e.g., all compounds remain soluble at all times) and the conservative modeling assumption of no retardation (e.g., sorption of metals into the clay soils).

Seepage from the runoff detention pond will be discontinuous and much less than seepage from the cooling reservoir. In addition, there is no recycling activity to concentrate water quality parameters. The pond will be designed to satisfy criteria for maintenance of water quality. As a result, no adverse impact to groundwater quality should occur.

Impacts to groundwater resulting from accidental spills will also be precluded by design of the chemical (including oil) storage and handling areas. Berms and impermeable liners will surround oil, acid and caustic tanks such that any spills are contained and seepage to groundwater is prevented.

5.2.1.3 BIOLOGICAL IMPACTS

All plant-related wastewaters associated with the Hardee Unit 3 project will be collected, treated, and recycled to the cooling reservoir. No direct discharge of chemical and biocide wastes will be allowed to enter any natural surface water or groundwater.

The long-term reservoir water quality with the Hardee Unit 3 facility is presented in Table 5.2.1-1. For those parameters estimated to exceed the FDEP water quality criteria, a mixing zone was defined in Section 5.2.1 (Table 5.2.1-2). The parameters requiring a mixing zone are estimated to be at concentrations not acutely or chronically toxic to freshwater aquatic life. Therefore, no significant biological impacts to Payne Creek are anticipated from discharges from the cooling reservoir.

Intermittent shock chlorination will be used to prevent biofouling of the circulating water system. Based on the anticipated residence time of the water in the cooling reservoir, the dilution factors, and the natural decay, the level of total residual oxidants near the reservoir discharge outfall will be undetectable. If other biocides are used in the cooling reservoir and the circulating system in the future, under similar conditions, they should also be undetectable if discharged as part of the reservoir outfall.

The sanitary wastewater system and the makeup water demineralization system will also use chemicals for their processes (refer to Section 3.5). Based on the treatment provided prior to discharge to the cooling reservoir, these influents to the cooling reservoir are not expected to be toxic. Chemicals used for cleaning of the heat recovery steam generator (HRSG) and feedwater piping will not be stored onsite and will be administered safely by means of a temporary system. The chemical cleaning contractor will dispose of the chemical cleaning wastes offsite. Stormwater will be treated prior to discharge (Section 3.8) to the wetland tributary and will have no impact on water quality or aquatic life.

5.2.1.4 BIOLOGICAL MONITORING

Because of the lack of anticipated ecological impacts, no biological monitoring is proposed.

Table 5.2.1-1. Estimated Cooling Reservoir Water Quality Characteristics After 30 Years of Operation at Average Load

Parameter	Units	Estimated Cooling Reservoir Water Quality		FDEP Water Quality Criteria	
		880 MW	660 MW	Class III Surface Water	Class G2 Ground Water
Calcium	mg/L as CaCO ₃	310	250		
Magnesium	mg/L as CaCO ₃	140	110		
Sodium	mg/L as CaCO ₃	210	190		696
Potassium	mg/L as CaCO ₃	20	20		
Total Hardness	mg/L as CaCO ₃	440	360		
Alkalinity	mg/L as CaCO ₃	360	280	>20	
Sulfate	mg/L as CaCO ₃	250	230		250
Chloride	mg/L as CaCO ₃	60	50		704
Silica	mg/L	70	60		
Fluoride	mg/L	5.4	4.4	10	2
Cyanide	mg/L	0.01	0.01	0.005	0.2
MBAS	mg/L	0.48	0.38		
Oil and Grease	mg/L	5	5	5	
Turbidity	mg/L	31	24	ambient + 29	
pH, units	std. units	7.5	7.5	6.0-8.5	6.5-8.5
Total Dissolved Solids	mg/L	1080	890		500
Specific Conductivity	µmho/cm	1240	1050	1275	
Total Kjeldahl Nitrogen	mg/L	1.2	1		
Ammonia Nitrogen	mg/L	0.5	0.4		
Unionized Ammonia	mg/L	0.017	0.014	0.02	
Organic Nitrogen	mg/L	0.7	0.6		
Nitrate + Nitrite - Nitrogen	mg/L	0.2	0.2		10
Total Nitrogen	mg/L	1.4	1.2		
Orthophosphorus	mg/L	0.6	0.5		
Total Phosphorus	mg/L	0.6	0.5		
Arsenic	µg/L	30	20	50	50
Barium	µg/L	200	160		2000
Beryllium	µg/L	1.6	1.3	0.13	4
Cadmium	µg/L	1.00	0.77	0.82	5
Chromium	µg/L	40	30	148	100
Copper	µg/L	9.95	7.90	8.3	1000
Iron	µg/L	990	770	1000	300
Lead	µg/L	6.8	4.6	1.9	15
Manganese	µg/L	63	48		50
Mercury	µg/L	0.097	0.072	0.012	2
Nickel	µg/L	60	50	111	
Selenium	µg/L	40	30	5	50
Silver	µg/L	0.14	0.08	0.07	100
Strontium	µg/L	800	640		
Zinc	µg/L	370	290	75	5000
Alpha, Gross	pC/L	22.2	17.7	15	
Radium 226	pC/L	7.9	6.3	5	

Table 5.2.1-2. Estimated Mixing Zones for Discharges from the HPS Cooling Reservoir

Parameter	Estimated Cooling Reservoir Quality (a)	Payne Creek Average Water Quality	Mixing Zone		FDEP Class III Surface Water Quality Criteria
			Length (ft)	Width (ft)	
Cyanide, mg/L	0.01	<0.004	<50	<3	0.005
Turbidity, NTU	31	1.7	<50	<3	29 above background
Beryllium, ug/L	1.6	<0.1	<50	<3	0.13
Cadmium, ug/L	1.0	<0.4	<50	<3	0.82
Copper, ug/L	9.9	7	<50	<3	8.3
Lead, ug/L	6.8	1	<50	<3	1.9
Mercury, ug/L	0.097	0.006	<50	<3	0.012
Selenium, ug/L	40	2.50	<50	<3	5
Silver, ug/L	0.14	<0.035	<50	<3	0.07
Zinc, ug/L	370	7	<50	<3	75
Alpha, Gross (pC/L)	22.2	1.9	<50	<3	15
Radium 226 (pC/L)	7.9	0.7	<50	<3	5

Note: All analyses were conducted by an FDEP-certified laboratory (Certification No. 870017G/5) using an FDEP-approved QA/QC plan.

(a) Based on revised water balance, 880-MW, and average annual load.

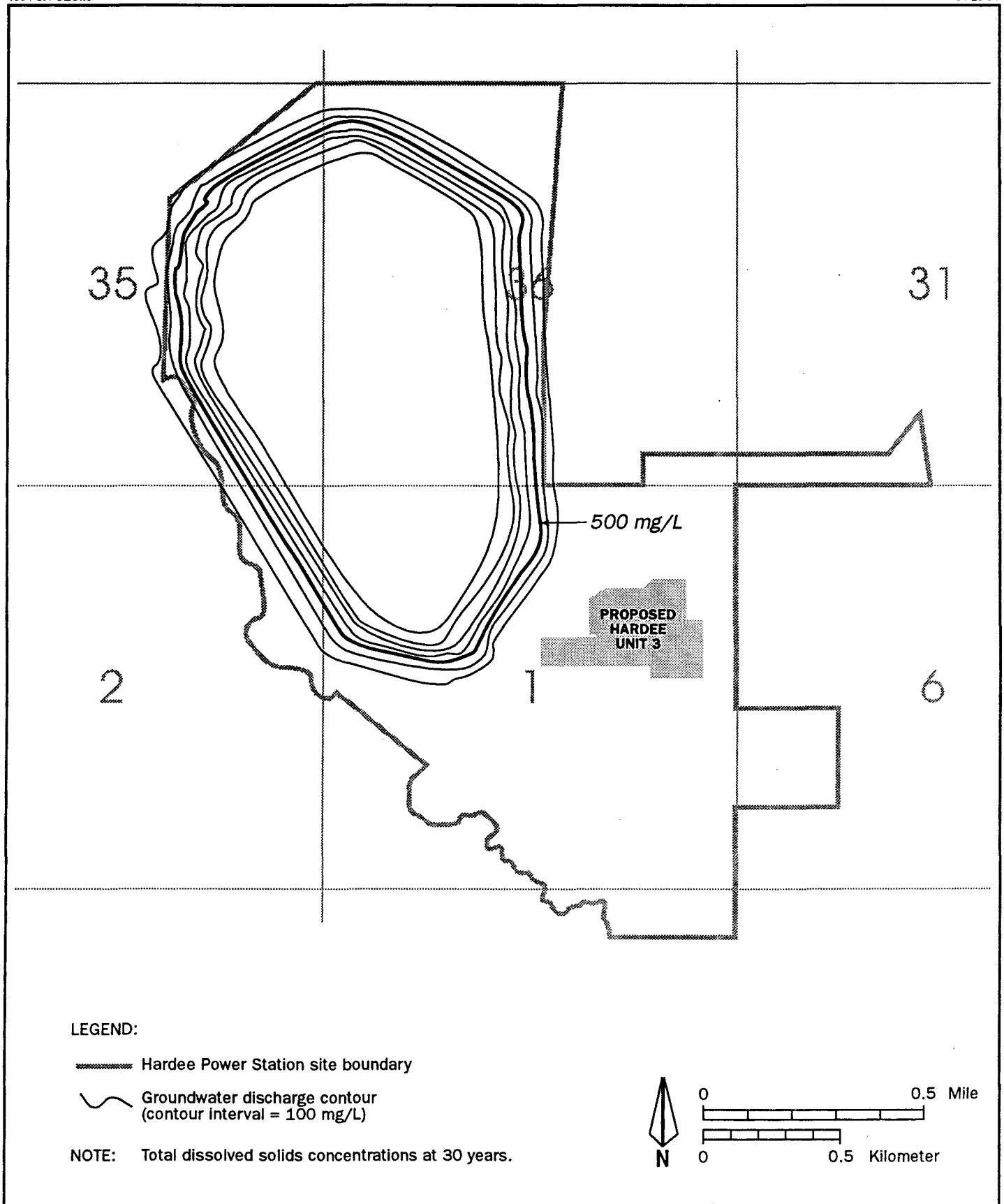


Figure 5.2.1-1
Predicted Groundwater Discharge for 880-MW Facility

Source: KBN, 1994.



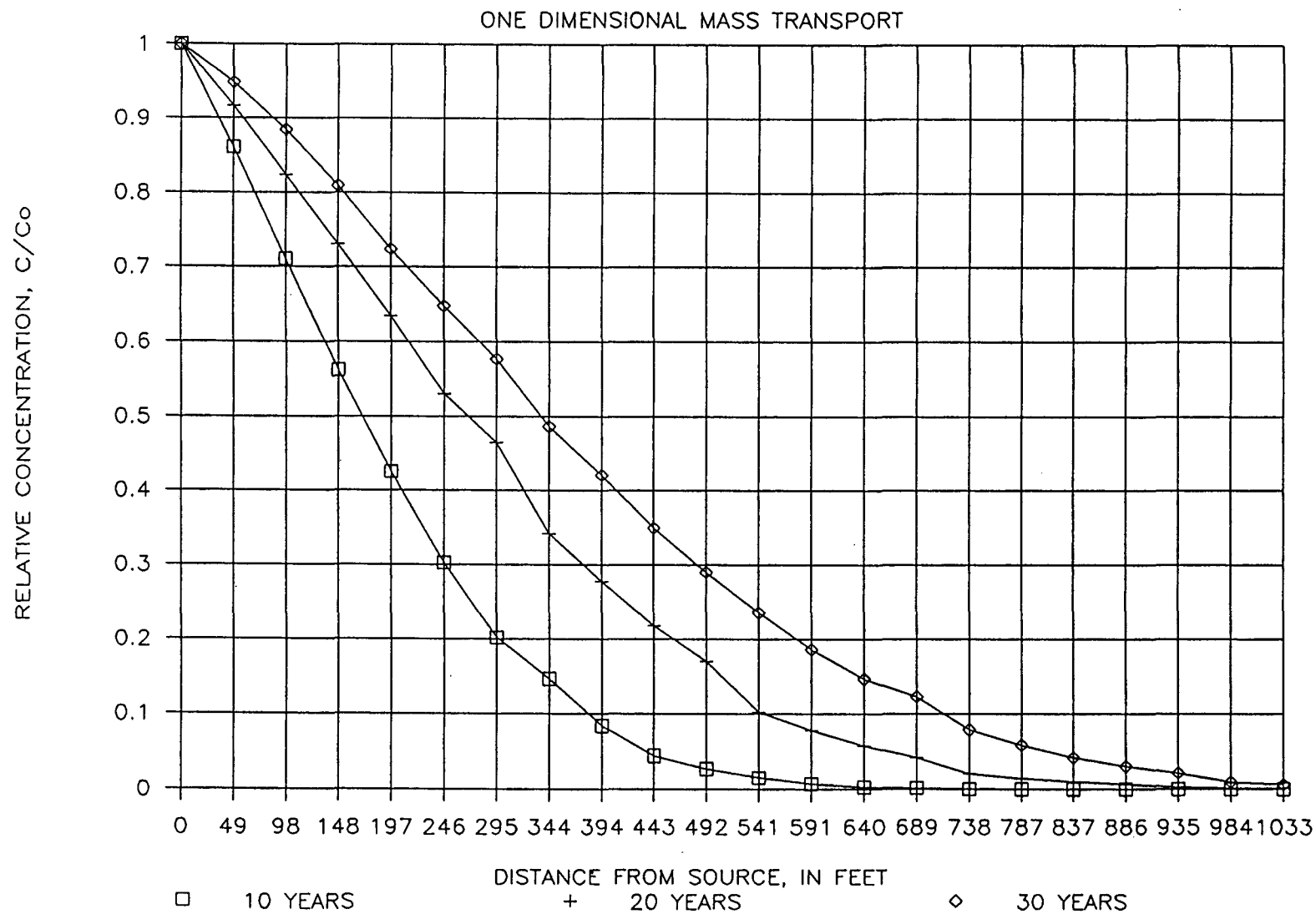


Figure 5.2.1-2
Predicted Solute Transport from Cooling Reservoir

Source: TPS/SECI, 1989; KBN, 1994.



5.2.2 COOLING TOWER BLOWDOWN

Cooling towers were not selected as the primary cooling alternative.

5.2.3 MEASUREMENT PROGRAMS

The cooling reservoir discharge station, Outfall 001, will be sampled during discharge events as follows:

1. Temperature--twice per day (grab), and
2. Other parameters (see those listed in Table 5.2.1-2)--once per day (grab).

5.3 IMPACTS ON WATER SUPPLIES

5.3.1 SURFACE WATER

There are no known consumptive water withdrawals from Payne Creek downstream of the proposed plant; therefore, no adverse impacts regarding consumptive surface water withdrawals are anticipated. Existing uses of Payne Creek include recreational uses and wetland/habitat functions. Potential impacts to wetland/habitat functions are discussed below.

Functionally, the cooling reservoir is a surface reservoir designed to manage all surface and subsurface water inflows and outflows. The cooling reservoir water balance is presented in Figures 3.5.0-1 and 3.5.0-2. Based on the cooling reservoir design, approximately 3,480,000 Lpd (920,000 gpd) will seep through the reservoir edge bordering Payne Creek and into the groundwater systems adjacent to Payne Creek.

5.3.2 GROUNDWATER

5.3.2.1 CONSUMPTIVE USE IMPACTS

The 880-MW power plant configuration will have the same groundwater allocation as the previously licensed 660-MW configuration (i.e., average monthly withdrawal of 3.8 mgd and a maximum monthly withdrawal of 8.64 mgd). There will be no incremental impacts on consumptive use from the Hardee Unit 3 Project because water use will not change.

5.3.2.2 RECHARGE OF WATER TABLE AQUIFER

There will be no incremental impacts related to water table aquifer recharge from the Hardee Unit 3 Project because no physical modification to the cooling reservoir will be made.

5.3.3 DRINKING WATER

There will be no impacts to potable water supplies. Payne Creek is not a source of drinking water. There are no municipal wells within 8 km (5 miles) of the site; most wells listed in Section 2.3.3 are in fact monitoring wells and are not used as potable drinking water supply wells. Predicted drawdown contours, discussed in Section 5.3.1, confirms that the cone of drawdown does not impact the domestic water supply wells of adjacent property owners.

5.3.4 LEACHATE AND RUNOFF

The plant site drainage and stormwater system will be designed to meet all applicable Southwest Florida Water Management District (SWFWMD) and FDEP stormwater quantity and quality control requirements. Plant runoff will be discharged, after treatment, to a tributary of Payne Creek. Details regarding this stormwater system design are presented in Appendix 10.11.

Given the anticipated fuels (i.e., gas or oil), no fuel-related stormwaters (e.g., coal pile runoff) are anticipated. Runoff from several "contact" areas such as the fuel unloading station and the transformer area will be routed to and treated by an oil-water separator prior to being routed to the cooling reservoir. Discharge of treated stormwater will have no adverse impacts on downstream water quality.

There are no sources of leachate on the proposed plant site.

5.3.5 MEASUREMENT PROGRAMS

Methodologies used to determine the impacts are discussed in detail in Section 5.3.1. No water supply monitoring is proposed.

5.4 SOLID/HAZARDOUS WASTE DISPOSAL IMPACTS

5.4.1 SOLID WASTE

Because of the types of fuel to be utilized at the Hardee Unit 3 (e.g., natural gas and fuel oil), only small quantities of solid wastes will be generated at the plant (see Section 3.7.1). Solid wastes will be limited to municipal solid waste, sanitary waste treatment sludge, and infrequent replacement of demineralized resins. The sanitary waste sludge will be disposed of offsite by a contractor. Other wastes will be disposed of by a trash disposal contractor to an available sanitary landfill. There will be no onsite disposal of solid wastes. Because of the small quantities of wastes generated, no significant impacts to existing landfill space are predicted.

5.4.2 HAZARDOUS WASTES

The only potential hazardous wastes generated by the operation of the Hardee Unit 3 facility are wastestreams produced during regeneration of the demineralizer resin bed ion exchangers and, periodically, boiler chemical cleaner wastes. The demineralizer wastestreams will be treated and neutralized in an elementary neutralization unit, which qualifies these wastes for exemption from obtaining a RCRA permit.

Boiler chemical cleaning wastes (see Section 3.6.5) will be disposed of offsite at a licensed facility. No onsite or offsite impacts will result from the wastes generated by the operation of the facility.

5.5 SANITARY AND OTHER WASTE DISCHARGES

As previously discussed in Sections 3.6.3 and 5.2.1, sanitary wastewaters will be treated and discharged to the cooling reservoir for dilution and reuse in the cooling system. Sanitary wastewaters will be treated in a sewage treatment plant designed to provide secondary treatment. All effluent will be chlorinated prior to discharge to the cooling reservoir.

No adverse cooling reservoir or offsite water quality impacts due to sanitary wastewater discharges are anticipated; details regarding cooling reservoir water quality and receiving water impacts are presented in Section 5.2.

No other wastewater discharges are anticipated.

5.6 AIR QUALITY IMPACTS

5.6.1 IMPACT ASSESSMENT

The proposed Hardee Unit 3 facility will be a new air pollution source that will result in increases in air emissions in Hardee County. The U.S. Environmental Protection Agency (EPA) has implemented regulations requiring a PSD review for new or modified sources that increase air emissions above certain threshold amounts. Because the threshold amounts will be exceeded by the proposed project, the project is subject to PSD review. PSD regulations are promulgated under 40 Code of Federal Regulations (CFR) Part 52.21 and implemented through delegation to the FDEP. Florida's PSD regulations are codified in Chapter 17-212.400, F.A.C. These regulations incorporate the EPA PSD regulations by reference.

The technical information and analysis required by the federal and state PSD regulations are contained in this PSD application document. Although this document is an appendix to the SCA for the facility, it has been prepared as a stand-alone PSD application to allow FDEP, EPA, and other involved agencies to readily review the project.

Based on the emissions from the proposed project, a PSD review is required for each of the following regulated pollutants:

- particulate matter (PM) as total suspended particulate matter (TSP),
- particulate matter with aerodynamic diameter of 10 microns or less (PM10),
- sulfur dioxide (SO₂),
- nitrogen dioxide (NO₂),
- carbon monoxide (CO),
- volatile organic compounds (VOC), and
- other trace elements.

Hardee County has been designated as an attainment area for all criteria pollutants [i.e., ozone (O₃), PM10, SO₂, CO, and NO₂] and is classified as a PSD Class II area for PM(TSP), SO₂, and NO₂; therefore, the PSD review will follow regulations pertaining to such designations.

The proposed methods and assumptions used in the air quality modeling and emission control technology analyses to support the air permit application were submitted in a separate protocol

document to FDEP (KBN, 1993). The objective of developing and submitting a technical protocol document was to obtain concurrence with the proposed methodologies from FDEP and appropriate regulatory agencies prior to performing the detailed analyses. Based on the comments received from FDEP, the proposed protocol incorporated the recommended changes.

The following sections describe the methods and assumptions used to determine the air quality impacts due to the proposed Hardee Unit 3 and provide a summary of the maximum air quality impacts associated with the proposed project.

5.6.1.1 ANALYSIS APPROACH AND ASSUMPTIONS

GENERAL MODELING APPROACH

The general modeling approach followed EPA and FDEP modeling guidelines for determining compliance with AAQS and PSD increments. In general, when model predictions are used to determine compliance with AAQS and PSD increments, current policies stipulate that the highest annual average and highest, second-highest short-term (i.e., 24 hours or less) concentrations are to be compared to the applicable standard when a 5-year period of meteorological data is used.

The highest, second-highest concentration is calculated for a receptor field by:

1. Eliminating the highest concentration predicted at each receptor,
2. Identifying the second-highest concentration at each receptor, and
3. Selecting the highest concentration among these second-highest concentrations.

This approach is consistent with the air quality standards, which permit a short-term average concentration to be exceeded once per year at each receptor.

To develop the maximum short-term concentrations for the proposed facility, the general modeling approach was divided into screening and refined phases. The basic difference between the two phases is that the receptor grid used to predict concentrations in the refined phase is more dense than that used in the screening phase.

After final lists of highest annual and highest, second-highest short-term concentrations were developed, the refined phase of the analysis was conducted by predicting concentrations for a refined receptor grid centered on the receptor at which the highest annual or highest, second-highest short-term concentration from the screening phase was produced. The air dispersion

model was executed for the entire year with the refined receptor grid. This approach was used to ensure that valid highest, second-highest concentrations were obtained. Descriptions of the emission inventory and receptor grids used in the screening and refined phases of the analysis are presented in the following sections with detailed discussions given in the PSD Permit Application, Appendix 10.1.5.

MODEL SELECTION

The selection of a model was based on its applicability to simulate impacts in areas surrounding the proposed facility. Within 3.0 km of the proposed facility, the terrain can be described as simple, i.e., flat to gently rolling. As defined in the EPA modeling guidelines, simple terrain is considered to be an area where the terrain features are all lower in elevation than the top of the stack(s) under evaluation. Beyond 3.0 km and within 10 km of the proposed facility's site, the terrain has maximum elevations of 6.1 m (20 ft) above ground elevation at the facility. These areas are also considered to be simple since the stacks being modeled are greater than the terrain elevation. Therefore, a simple terrain model was used to predict maximum ground-level concentrations.

The Industrial Source Complex Short Term (ISCST2) dispersion model, Version 93109, (EPA, 1993a) was used to evaluate the pollutant emissions from proposed facility and existing major facilities. This model is contained in EPA's User's Network for Applied Modeling of Air Pollution (UNAMAP), Version 6 (EPA, 1988). The ISCST2 model is applicable to sources located in either flat or rolling terrain where terrain heights do not exceed stack heights.

The ISCST2 model has rural and urban options which affect the wind speed profile exponent law, dispersion rates, and mixing-height formulations used in calculating ground level concentrations. The criteria used to determine when the rural or urban mode is appropriate are based on land use near the proposed plant's surroundings (Auer, 1978). If the land use is classified as heavy industrial, light-moderate industrial, commercial, or compact residential for more than 50 percent of the area within a 3 km radius circle centered on the proposed source, the urban option should be selected. Otherwise, the rural option is more appropriate. Based on a review of the land use around the facility and discussions with the FDEP, the rural mode was selected because of the lack of residential, industrial and commercial development within 3 km of the proposed facility site.

For modeling analyses that will undergo regulatory review, such as PSD permit applications, the following model features are recommended by EPA (1993b) for rural mode and are referred to as the regulatory default options in the ISCST model:

1. Final plume rise at all receptor locations,
2. Stack-tip downwash,
3. Buoyancy-induced dispersion,
4. Default wind speed profile coefficients for rural mode,
5. Default vertical potential temperature gradients, and
6. Calm wind processing.

In this analysis, the EPA regulatory default options were used to address maximum impacts.

METEOROLOGICAL DATA

Meteorological data used in the ISCST2 model to determine air quality impacts consisted of a concurrent 5-year period of hourly surface weather observations and twice-daily upper air soundings from the National Weather Service (NWS) stations at Tampa International Airport and Ruskin, respectively. The 5-year period of meteorological data was from 1982 through 1986.

The NWS station in Tampa, located approximately 67 km to the west-northwest of the proposed site, was selected for use in the study because it is the closest primary weather station to the study area with similar surrounding topographical feature. In addition, FDEP requested the use of these meteorological data. This station also has the most readily available and complete database which is representative of the plant site. Descriptions of the meteorological data collected at this station are presented in Section 2.3.7 with the methods used to process the data discussed in the PSD Permit Application.

EMISSION INVENTORY

Stack and operating parameters and emission rates of criteria pollutants for the CTs were developed from design data supplied by the turbine manufacturer, Westinghouse, Inc., selected by SECI for this project. The design data were developed for the turbines firing natural gas and distillate fuel oil and operating at 50, 75, and 100 percent of maximum capacity (see Section 2.0). Because the inlet ambient air temperature directly affects turbine combustion and operation, design data were also provided for four ambient air temperatures that cover the range of

temperatures for the project site location: 32, 59, 72, and 95°F. Air dispersion modeling was performed for the three operating loads and two extreme ambient temperatures of 32 and 95°F to provide a range of operating conditions that will potentially produce maximum ground-level impacts. These modeling scenarios encompass the operating conditions that will produce the maximum emissions on a short-term basis (i.e., 100 percent load at 32°F) and the minimum plume rise (i.e., 50 percent load at 95°F).

For most pollutants, the highest air impacts were based on the use of fuel oil since the maximum hourly and annual emission rates are generated with fuel oil combustion. For CO and NO_x, additional modeling was performed for the turbines firing natural gas. For CO, the short-term air impacts were also developed for the 1-hour and 8-hour averaging periods (basis of the averaging periods for the AAQS) assuming the turbines were firing natural gas for power augmentation. For NO_x, the annual impacts were also estimated for the PSD Class I increment consumption based on the turbines firing fuel oil (1,500 hours), natural gas (5,260 hours), and natural gas for power augmentation (2,000 hours).

In summary, the operating scenarios considered for the proposed turbines were as follows:

- A. All pollutants and averaging periods when firing distillate fuel oil:
 - 1. Operating loads of 100, 75, and 50 percent; and
 - 2. Ambient temperatures of 32 and 95°F.
- B. Additional analyses for CO concentrations (1-hour and 8-hour averaging period) when firing natural gas during power augmentation at 80°F and 95°F.
- C. Additional analyses for NO_x concentrations (annual averaging period) for assessing impacts in the PSD Class I area for the following combinations of annual fuel combustion (turbines operating at 100 percent load):
 - 1. Distillate fuel oil (1,500 hours) at 59°F
 - 2. Natural gas (5,260 hours) at 59°F
 - 3. Natural gas for power augmentation (2,000 hours) at 80°F

The stack, operating, and emission data used in the air dispersion modeling are presented in Appendix 10.1.5, Tables 2-1 through 2-6 and Attachment A.

This modeling provided initial evaluations to determine the source's impacts relative to the significant impact levels and, where applicable, the distance at which the proposed source's impacts are below the significant impact levels. Based on this modeling, subsequent modeling analyses were performed based on the operating load which produced the maximum potential impacts for applicable pollutants and averaging times.

For AAQS and PSD Class II analyses, preliminary modeling indicated that the proposed facility's impacts were below the significant impact levels for the applicable pollutants (i.e., CO, NO₂), except for SO₂ and PM. As a result, further modeling of CO and NO₂ for comparison to applicable AAQS and PSD Class II increments was not required. Because the modeling demonstrated that the facility's impacts were predicted to be above the significant impact levels for SO₂ and PM, further modeling for these pollutants are required. The maximum SO₂ and PM concentrations from the proposed source were predicted to be greater than the significant impact levels at a distance of approximately 1 km from the facility for both pollutants. This distance was used to limit receptor locations and background sources to be modeled.

Emission inventories for background sources of SO₂ and PM were developed from available databases, such as FDEP's Air Pollution Inventory System (APIS), previous studies performed by KBN, and recent air construction permit applications submitted in Polk County (e.g., Tampa Electric Company's Polk County Station and Florida Power Corporation's Polk County site). Detailed discussions about the development of the emission inventory is presented in the PSD Permit Application (Appendix 10.1.5).

Emission inventories of background sources were developed for the proposed source's modeling area and screening area. The modeling area is defined as the significant impact area for the proposed source. The screening area extends 50 km beyond the modeling area. Within the modeling area, cumulative impact analyses are performed for the proposed source and all identified background sources located in the modeling and screening areas. Additional background sources beyond the screening area are also included in the modeling.

In order to reduce the model computation time, the "Screening Threshold" method developed by the North Carolina Department of Natural Resources and Community Development, and approved by EPA and FDEP, was used to effectively model facilities within the screening area that are

most likely to interact with the proposed facility. The method is designed to objectively eliminate from the emission inventory those facilities that are unlikely to have significant interaction with the source undergoing evaluation. In general, those facilities that should be considered in the modeling analyses are those with emissions greater than a screening threshold value (in TPY) that is calculated by the following criteria:

$$Q = 20 \times D$$

where Q = the screening threshold value (TPY), and

D = for short-term analysis, the distance (km) from the proposed facility to the source undergoing evaluation; or
for long-term (annual) analysis, the distance (km) from the edge of the proposed source's significant impact area to the source undergoing evaluation.

For this analysis, the long-term criterion was used since fewer background facilities would be eliminated than with the short-term criterion. Also, the total emissions from a facility were used rather than emissions from individual sources for comparison to the screening threshold value. Both methods result in a more conservative approach to produce higher-than-expected concentrations. Those facilities with maximum allowable emissions that are below the calculated "screening threshold" were eliminated from further consideration in the AAQS and PSD Class II modeling analyses.

Summaries of the SO_2 and PM background emission facilities considered in the modeling analyses and those eliminated using the screening threshold technique are given in Tables 5.6.1-1 and 5.6.1-2. As indicated, most of the SO_2 emission sources (either existing sources or sources with air construction permits but not yet operating) are located more than 10 km from the proposed facility. Similar to the SO_2 emission facilities, most of the PM emissions occur beyond 10 km from the proposed facility.

For PSD Class I analyses, preliminary modeling indicated that the proposed facility's impacts were below the National Park Service (NPS)-recommended PSD Class I significant impact levels for PM and NO_2 , but not for SO_2 . As a result, further modeling of PM and NO_2 for comparison

to applicable PSD Class I increments was not required. Because the modeling demonstrated that the facility's impacts were predicted to be above the NPS-recommended PSD Class I significant impact levels for SO₂, further modeling for this pollutant is required. Emission inventories for SO₂ were developed from available databases, as previously discussed for developing inventories for the AAQS and PSD Class II analyses. A detailed discussion about the development of the PSD Class I emission inventory is presented in the PSD Permit Application. A summary of the SO₂ background emission sources considered in the modeling analyses is presented in Table 5.6.1-3.

RECEPTOR LOCATIONS

As discussed in Section 5.6.1.1, the general modeling approach considered screening and refined phases to address compliance with maximum allowable PSD Class II increments and AAQS. In the ISCST modeling, concentrations were predicted for the screening phase using several receptor grids. The locations of the receptors were based on identifying the significant impact areas and the areas in which maximum concentrations would be expected due to the proposed source. For determining the significant impact areas, a total of 397 receptors were located in a radial grid centered on the proposed facility. The grid extended from the plant property out to 5.0 km from the plant site. After the significant impact areas were determined (i.e., 1.0 km for SO₂ and PM₁₀), a total of 277 receptors were located in a radial grid that was centered on the proposed facility and extended out to 1 km. The specific locations of each receptor in each grid are presented in the PSD Permit Application.

After the screening modeling was completed, refined short-term modeling was conducted using a receptor grid centered on the receptor which had the highest, second-highest short-term concentrations. The receptors were located at intervals of 100 m between the distances considered in the screening phase along nine radials, at 2-degree increments, centered on the radial which the maximum concentration was produced.

To ensure that a valid short-term highest, second-highest concentration was calculated, concentrations were predicted for the refined grid for the entire year during which highest, second-highest concentration was predicted from the screening receptor grid. Refined modeling analysis was also performed for the annual average period. Concentrations were calculated at the

receptor and for the entire year during which the highest annual average concentration was predicted in the screening analysis.

For PSD Class I analysis, the maximum concentrations were predicted at 13 receptors surrounding the PSD Class I area of the Chassahowitzka NWR, the closest PSD Class I area. These receptors have been provided by FDEP for use on previous applications.

BACKGROUND CONCENTRATIONS

To estimate total air quality concentrations, a background concentration must be added to the modeling results. Background concentrations are concentrations due to sources not associated with the proposed source. These concentrations consist of two components: impacts due to other modeled emission sources (i.e., non-project related) and impacts due to sources not explicitly modeled. Background concentrations due to other modeled sources were predicted with the air dispersion model based on the data developed in the emission inventory. Background concentrations due to sources not explicitly modeled were based on the highest concentrations measured at nearby stations. The background concentrations are added to the maximum concentrations predicted from the modeled source to produce the total air quality concentrations.

The non-modeled background concentrations, developed from the latest year of ambient monitoring data, were presented in Section 2.3.7.2. Based on this analysis, the background 3-hour, 24-hour, and annual average SO₂ concentrations are assumed to be 256, 50, and 11 µg/m³, respectively. For PM concentrations, the background 24-hour and annual average concentrations are assumed to be 70 and 20 µg/m³, respectively. These background levels were added to model-predicted concentrations to estimate total air quality levels for comparison to AAQS.

There has been minimal industrial or commercial growth in the area of Hardee Unit 3, indicating minimal, if any, increases of potential air emissions or air quality levels since the monitoring data were collected.

BUILDING DOWNWASH CONSIDERATIONS

Based on the building dimensions associated with buildings or structures at the proposed facility, the stack for the proposed unit will be less than GEP. Therefore, the potential for building downwash to occur is 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, which are input for each wind direction representing a 10-degree sector, are used to modify the dispersion parameters. The building dimensions considered for the proposed facility are presented in Table 3.2-1.

SUPPLEMENTARY PSD CLASS I AREA IMPACTS

A long-range transport modeling analysis was used as a supplemental air quality evaluation to determine compliance with the PSD Class I increment consumption for SO₂ concentrations at the Chassahowitzka NWA. Potential violations of the 3-hour and 24-hour PSD Class I increments were predicted with the ISCST2 model, which required the use of a refined model that accounts for long-range transport. This modeling analysis used the long-range transport model, MESOPUFF II, to address impacts from the proposed Hardee Unit 3 as well as other PSD increment consuming and expanding sources. The analysis is based on the Mesopuff II Modeling Protocol developed by the Interagency Workgroup on Air Quality Modeling (IWAQM). Descriptions of the methods and assumptions used for this analysis are presented in Section 6.9.2 of Appendix 10.1.5.

TOXIC AIR POLLUTANT ANALYSIS

Maximum air quality impacts of toxic air pollutants from the proposed source alone were modeled with the ISCST2 model for comparison to the no-threat levels established by FDEP (Version 3).

5.6.1.2 MODEL RESULTS

PROPOSED FACILITY ONLY

For the screening modeling analysis, a summary of the maximum SO₂, PM₁₀, NO₂, CO, arsenic, beryllium, and sulfuric acid mist concentrations due to the proposed facility is presented in Table 5.6.1-4. These results are presented for a range of conditions for combined cycle and simple cycle operations that could produce high impacts. This analysis was performed for fuel oil

combustion since the hourly emissions are generally higher with the use of fuel oil than natural gas. The conditions were as follows:

1. Combined cycle operation
 - a. Baseload (100 percent) at ambient temperatures of 32 and 95°F
 - b. 75 percent load at ambient temperatures of 32 and 95°F
 - c. 50 percent load at ambient temperatures of 32 and 95°F
2. Simple cycle operation
 - a. Baseload at ambient temperatures of 32 and 95°F
 - b. 75 percent load at ambient temperatures of 32 and 95°F
 - c. 50 percent load at ambient temperatures of 32 and 95°F

An additional analysis was performed to determine the maximum CO concentrations when firing natural gas during power augmentation since this operation produces the highest CO emissions.

The maximum predicted 3-hour, 24-hour, and annual SO₂ concentrations are 65.1, 27.8, and 0.18 µg/m³, respectively. The maximum 24-hour concentration is above the *de minimis* monitoring level and, therefore, preconstruction monitoring data are required to be submitted by the Applicant as part of the permit application. As indicated in Section 2.3.7.2, existing monitoring data collected by the FDEP and other monitoring stations (i.e., TECO and FPC) are being used in this application to satisfy preconstruction monitoring requirements and to establish background concentrations.

The maximum predicted 24-hour and annual average PM₁₀ concentrations are 21.5 and 0.12 µg/m³, respectively. The maximum 24-hour concentration is above the *de minimis* monitoring level, and, therefore, preconstruction monitoring is required for the permit application. Similar to the SO₂ analysis, existing monitoring data collected by FDEP and other monitoring stations are being used to satisfy the preconstruction monitoring requirements and establish background concentrations.

The maximum predicted annual NO₂ concentration is 0.59 µg/m³, which is below the *de minimis* monitoring level. Preconstruction monitoring requirements is not required for the permit application.

The maximum predicted 1-hour and 8-hour average CO concentrations are 255 and 115 $\mu\text{g}/\text{m}^3$, respectively. During power augmentation, the maximum 1-hour and 8-hour average concentrations are predicted to be 380 and 168 $\mu\text{g}/\text{m}^3$, respectively. These maximum values are less than the significance levels. The maximum 8-hour concentration is also less than the *de minimis* monitoring levels and, therefore, preconstruction monitoring is not required. Because the maximum predicted impacts due to the proposed facility are less than the CO significance levels, additional modeling is not required for this pollutant.

The maximum predicted 24-hour average beryllium concentration is 0.0014 $\mu\text{g}/\text{m}^3$, which is greater than the *de minimis* monitoring levels of 0.001 $\mu\text{g}/\text{m}^3$. This maximum concentration was predicted for the combustion turbines operating at 50 percent load during combined cycle mode. At 100 percent load, the maximum predicted 24-hour concentration is less than the *de minimis* concentration. Also, the maximum beryllium concentrations are predicted to be less than the NTLs for all operating loads. Because of the limited number of hours of expected fuel oil usage (1,500 hours or less) and the limited operation of the turbines, preconstruction monitoring is not warranted for this project.

For sulfuric acid mist and arsenic, there are no significant impact or *de minimis* monitoring levels established by EPA. However, these pollutants were addressed as toxic air pollutants for comparison to the Florida NTLs.

TOTAL AIR QUALITY IMPACT

From the refined modeling analysis, summaries of the maximum total SO_2 and PM_{10} concentrations predicted for comparison to the AAQS are presented in this section. The total concentrations are determined from the impacts of the modeled sources added to the background concentration determined from monitoring data.

SO_2 Concentrations

The maximum predicted total SO_2 concentrations from the refined analysis for all modeled AAQS sources are presented in Table 5.6.1-5. The 3-hour and 24-hour results are based on the maximum concentrations predicted when the Hardee Unit 3 facility was predicted to have significant impacts. Based upon the refined analysis results, the maximum total predicted SO_2 concentrations, including a non-modeled background concentration are as follows:

406 $\mu\text{g}/\text{m}^3$, HSH 3-hour average, or 31 percent of the AAQS of 1,300 $\mu\text{g}/\text{m}^3$
138 $\mu\text{g}/\text{m}^3$, HSH 24-hour average, or 53 percent of the AAQS of 260 $\mu\text{g}/\text{m}^3$
29 $\mu\text{g}/\text{m}^3$, annual average, or 48 percent of the AAQS of 60 $\mu\text{g}/\text{m}^3$

The AAQS modeling analysis indicates that the SO_2 air quality within the significant impact distance from the proposed plant will be in compliance with the AAQS, when the proposed unit was predicted to have a significant impact.

Based on these results, the maximum impacts predicted by the proposed plant by itself and together with other emission sources (when the proposed plant's impacts are predicted to be significant), including non-modeled background concentrations, will ensure compliance and maintenance of the AAQS.

PM10 Concentrations

The maximum refined PM10 concentrations for comparison to the AAQS are presented in Table 5.6.1-6. Based upon the refined analysis results, the maximum total predicted PM10 concentrations, including a non-modeled background concentration are as follows:

101 $\mu\text{g}/\text{m}^3$, HSH 24-hour average, or 67 percent of the AAQS of 150 $\mu\text{g}/\text{m}^3$
24 $\mu\text{g}/\text{m}^3$, annual average, or 48 percent of the AAQS of 50 $\mu\text{g}/\text{m}^3$

The AAQS modeling analysis, therefore, indicates that the PM10 air quality within the significant impact distance from the proposed plant will be in compliance with the AAQS.

Based on these results, the maximum impacts predicted by the proposed plant by itself and together with other emission sources, including non-modeled background concentrations, will ensure compliance and maintenance of the AAQS.

PSD CLASS II INCREMENT CONSUMPTION

SO_2 Concentrations

Results of the PSD Class II refined analysis are presented in Table 5.6.1-7. The 3-hour and 24-hour results are based on the maximum concentrations predicted when the proposed Hardee Unit 3 was predicted to have a significant impact. The maximum predicted Class II increment consumptions due to all increment consuming sources from the refined analyses are:

150 $\mu\text{g}/\text{m}^3$, HSH 3-hour average, or 29 percent of the allowable increment of 512 $\mu\text{g}/\text{m}^3$
45.4 $\mu\text{g}/\text{m}^3$, HSH 24-hour average, or 50 percent of the allowable increment of 91 $\mu\text{g}/\text{m}^3$
-4.0 $\mu\text{g}/\text{m}^3$, annual average, or less than 0 percent of the allowable increment of 20 $\mu\text{g}/\text{m}^3$

The PSD Class II modeling analysis indicates that the predicted maximum annual concentrations will be in compliance with the annual PSD Class II increment, when the proposed unit was predicted to have a significant impact.

Based on these results, the maximum impacts predicted by the proposed plant by itself and together with other emission sources (when the proposed plant's impacts are predicted to be significant) will ensure compliance and maintenance of PSD Class II increments.

PM10 Concentrations

The maximum predicted PM10 PSD Class II increment consumption impacts due to all increment-consuming sources from the refined analysis, presented in Table 5.6.1-8, are:

14 $\mu\text{g}/\text{m}^3$, HSH 24-hour average, or 47 percent of the allowable increment of 30 $\mu\text{g}/\text{m}^3$
0.6 $\mu\text{g}/\text{m}^3$, annual average, or 4 percent of the allowable increment of 17 $\mu\text{g}/\text{m}^3$

Based on these results, the maximum impacts predicted by the proposed plant by itself and together with other emission sources will ensure compliance and maintenance of PSD Class II increments.

PSD CLASS I INCREMENT CONSUMPTION

The maximum potential impacts from the proposed Hardee Unit 3 facility only predicted at the PSD Class I area of the Chassahowitzka NWA for SO_2 , NO_2 , and PM10 concentrations are presented in Table 5.6.1-9. The maximum impacts for each pollutant were compared to the NPS-recommended significant impact levels for PSD Class I areas. The results indicated that SO_2 is the only pollutant that is predicted to exceed the NPS-recommended significant impact levels. Based on these results, a PSD Class I impact assessment for SO_2 concentrations was performed with other PSD increment consuming sources to determine compliance with allowable PSD Class I increments.

The results of the Class I analysis for SO₂ concentrations are presented in Table 5.6.1-10. The results indicate the maximum PSD increment consumed at the PSD Class I areas is predicted to be above the allowable PSD Class I increments for 3-hour and 24-hour averaging periods.

The maximum predicted Class I increment consumption due to all increment consuming sources from the refined analysis is:

- 26.4 µg/m³, HSH 3-hour average, or 106 percent of the allowable increment of 25 µg/m³
- 6.4 µg/m³, HSH 24-hour average, or 130 percent of the allowable increment of 5 µg/m³
- 0.3 µg/m³, annual average, or less than 15 percent of the allowable increment of 2 µg/m³

Additional modeling was performed with the ISCST2 model to determine the number of potential violations of the 3-hour and 24-hour PSD Class I SO₂ increments and the proposed project's contribution to those predicted violations. A summary of the results that show the number of predicted violations and the project's predicted contributions to those violations is presented in Table 5.6.1-11. Based on these results, additional modeling was performed using the MESOPUFF II model for the proposed project and other PSD emission sources located more than 50 km from the PSD Class I area. These results were added to the ISCST2 model results for sources located within 50 km of the Class I area to produce the total PSD Class I increment consumption.

A summary of the maximum SO₂ concentrations predicted for the proposed Hardee Unit 3 plant at the PSD Class I area using the MESOPUFF II model is presented in Table 5.6.1-12. The MESOPUFF II results indicate that, for the periods during which the ISCST2 model predicted potential violations and the proposed project's contribution was greater than the NPS significant impact levels, the proposed project's impacts are less than the significant impact levels. When the proposed source was modeled for 1 year with the MESOPUFF II model, there was only one 24-hour period during which the proposed source was predicted to have a significant impact. When other sources were modeled for this period (i.e., using the MESOPUFF II model for the PSD emission sources located more than 50 km and the ISCST2 model for sources located within 50 km of the Class I area), the total impacts were predicted to be less than the PSD Class I increment.

Based on these results, the maximum impacts predicted by the proposed Hardee Unit 3 facility by itself and together with other emission sources will ensure compliance and maintenance of PSD Class I increments.

TOXIC AIR POLLUTANTS

The maximum impacts of regulated and nonregulated toxic air pollutants that will be emitted by the proposed Hardee Unit 3 plant are presented in Table 5.6.1-13. These impacts represent the highest impacts predicted from the screening analysis for the combined cycle operation at 100, 75, and 50 percent load and for ambient temperatures of 32°F and 95°F.

The maximum 8-hour, 24-hour, and annual concentrations are compared to the Florida NTLs. As shown, the predicted impacts are below the NTLs for all pollutants and averaging times, except for sulfuric acid mist for the 8-hour and 24-hour averaging periods. The NTLs are not environmental standards but, rather, evaluation tools to determine if an apparent threat to the public health may exist. For sulfuric acid mist, the maximum concentrations are predicted to occur during 75-percent and 50-percent operating loads at locations along the fenced property around the Hardee Unit 3 site. Since the emission estimates are based on conservative assumptions (more than 10 percent of the SO₂ is assumed to be converted to sulfuric acid mist) and impacts at locations off of SECI's property (where the public health would be of greatest concern) will be much lower than the NTLs, the predicted sulfuric acid mist impacts due to the proposed facility are not expected to pose a threat to public health. Therefore, the emissions from the proposed facility are not expected to pose a significant health risk to the public.

SUMMARY

Based on the results of the air quality modeling analyses, Hardee Unit 3 is expected to comply with applicable AAQS and PSD increments. Within the AAQS and PSD Class II areas, the maximum impacts of the proposed unit alone are predicted to be less than significant impact levels for CO and NO₂. As a result, the proposed unit will be in compliance with and maintain applicable AAQS and PSD Class II increments.

Because the proposed Hardee Unit 3 impacts are predicted to be greater than the significant impact levels for SO₂ and PM₁₀, additional modeling was required to address the potential interaction of background sources with the proposed unit. As demonstrated by the air modeling

analyses, when the proposed unit's impacts are greater than the significant impact levels, the maximum total PM10 and SO₂ air quality impacts will be in compliance with the applicable SO₂ and PM10 AAQS and PSD Class II increments.

The proposed Hardee Unit 3 impacts for PM10 and NO₂ are predicted to be less than the recommended NPS PSD Class I significant impact levels and, therefore, will be in compliance with and maintain the applicable PSD Class I increments. For SO₂, additional modeling was performed to address the potential interaction of the proposed unit with other PSD Class I sources. Based on these results, the impacts from the proposed unit and other sources will comply with and maintain the PSD Class I increments.

5.6.1.3 ADDITIONAL IMPACT ANALYSIS

The additional impact analysis considers the potential effects to soils, vegetation, wildlife, and visibility from Hardee Unit 3. A large number of elements and compounds may be emitted from the proposed facility (Table 5.6.1-13). Since the predicted levels of all elements and compounds are below the levels to cause biological effects, this analysis will focus on representative elements and compounds including SO₂, NO_x, CO, TSP, beryllium, and mercury.

SOILS

Many of the soils in the region and a large portion of the site have been disturbed and altered by phosphate mining. They were originally sandy, siliceous hyperthermic Haploquods with very strongly acid subsoils. The undisturbed soils of the Payne Creek floodplain have formed in unconsolidated loamy textured sediment influenced by calcareous material (Robbins *et al.*, 1984). They are mapped as coarse-loamy siliceous, hyperthermic Typic Ochraqualfs.

SO₂ and NO₂ that reach the soil by deposition from the air are converted by physical and biotic processes to sulfates and nitrates. (CO, particulates, and metals have no effect on soils at the levels predicted.) The effects can be beneficial to plants if either sulfates or nitrates in native soils are less than plant requirements for optimum growth. However, sulfates and nitrates can also increase acidity of unbuffered soils, causing adverse effects due to changes in nutrient availability and cycling. The predicted concentrations of SO₂ and NO₂ from stack emissions are not expected to have a significant adverse effect on soils in the vicinity because (1) the predicted concentrations of both gases are low, and (2) Payne Creek floodplain and other wetland soils contain organic matter and/or calcium carbonate nodules that buffer changes in acidity. Therefore, the predicted emissions from the Hardee Unit 3 facility are not expected to have a significant adverse impact on regional soils.

VEGETATION AND WILDLIFE

The response of vegetation and wildlife to atmospheric pollutants is influenced by the concentration of the pollutant, duration of exposure, and frequency of exposures. 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 and animals 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. The impact of the HPS facility including the Hardee Unit 3 facility on regional vegetation and wildlife was assessed by comparing pollutant doses that are predicted from modeling with threshold doses reported from the scientific literature which could adversely affect plant or animal species typical of those present in the region.

Sulfur Dioxide

Plants can be grouped into three levels of sensitivity to SO_2 based on concentration and exposure (EPA, 1982b). Sensitive crop species include legumes and blackberries. Ranges of concentrations reported to cause visible injury in sensitive species are 1,310 to 2,620 $\mu\text{g}/\text{m}^3$ (0.5 to 1.0 ppm) for 1-hour exposure and 790 to 1,570 $\mu\text{g}/\text{m}^3$ (0.3 to 0.6 ppm) for 3-hour exposures. Intermediate resistant species include many crops and garden species. Ranges of concentrations reported to cause visible injury in intermediate species are 2,620 to 5,240 $\mu\text{g}/\text{m}^3$ (1.0 to 2.0 ppm) for 1-hour exposure and 1,570 to 2,100 $\mu\text{g}/\text{m}^3$ (0.6 to 0.8 ppm) for 3-hour exposures. Resistant species include potato and corn. Ranges of concentrations reported to cause visible injury in intermediate species are $> 5,240 \mu\text{g}/\text{m}^3$ (> 2.0 ppm) for 1-hour exposure and $> 2,100 \mu\text{g}/\text{m}^3$ (> 0.8 ppm) for 3-hour exposures. Chronic effects to forest growth have been reported where SO_2 annual ambient concentrations averaged 45 or 115 $\mu\text{g}/\text{m}^3$ (0.02 or 0.05 ppm) (EPA, 1982b).

The maximum 1-hour, 3-hour, 24-hour average, and annual SO_2 concentrations predicted for Hardee Unit 3 within the modeling area of Hardee Unit 3 are 135, 65.1, 27.8, and 0.18 $\mu\text{g}/\text{m}^3$, respectively. These concentrations are predicted to occur within 1 km (0.62 mile) of the stacks and represent the concentrations that occur during worst-case meteorological conditions of the 5 years considered in the air dispersion modeling. By adding background concentrations developed from monitoring data (see Section 6.1.1 of the PSD application) to impacts from all sources (see Table 5.6.1-5), the total 1-hour, 3-hour, 24-hour, and annual average concentrations are predicted to be 458, 406, 138, and 29 $\mu\text{g}/\text{m}^3$, respectively. These predicted doses from operation of Hardee Unit 3 combined with background sources are much lower than doses known to cause a detrimental effect on vegetation and wildlife (Table 5.6.1-14).

Nitrogen Oxides

A review of the literature (EPA, 1982a) indicates greater variability in the NO₂ dose-response relationship in vegetation, and no threshold effect levels are supported. The NO₂ doses known to adversely affect some animals and plants are shown in Tables 5.6.1-14 and 5.6.1-15, respectively. The maximum predicted 3-hour and annual average NO₂ concentrations due to Hardee Unit 3 is predicted to be 206 and 0.59 µg/m³, respectively. The predicted doses of NO₂ due to the proposed facility are far lower than the doses reported to injure vegetation and animals; therefore, the proposed facility's NO₂ emissions are not expected to have an adverse effect on vegetation and wildlife.

Combined Effects of Sulfur Dioxide and Nitrogen Dioxide

SO₂ in combination with NO₂ can cause vegetation effects although the studies are not as extensive as studies on single pollutant effects. Plants show varying sensitivities at various SO₂ and NO₂ concentration combinations for various exposure periods. A review of the literature (EPA, 1982a) indicates that a lower visible-injury threshold may occur at 2-hour SO₂ and NO₂ exposures of 1,310 µg/m³ (0.5 ppm) and 940 µg/m³ (0.5 ppm), respectively. Air dispersion modeling has shown that this threshold exposure condition does not occur.

Total Suspended Particulates

High deposition of particulates on plant leaves can reduce photosynthesis through shading and impede diffusion of gases. However, at least 5 g/m² leaf surface of particulates are required to cause these impacts (Thompson *et al.* 1984). This concentration is not expected due to the maximum predicted impacts from the HPS. The maximum 24-hour and annual average concentrations for modeled sources are predicted to be 31 and 4 µg/m³, respectively. These concentrations are predicted to occur between 0.6 and 1 km to the north of the stacks. By adding background concentrations developed from monitoring data (see Section 6.1.1) to these modeled sources' impacts, the total 24-hour and annual average concentrations are predicted to be 101 and 24 µg/m³, respectively. Predicted particulate levels are lower than reported effects levels in animals (Newman, 1975).

Carbon Monoxide

Soil microorganisms can use carbon monoxide as a carbon source and are a major sink for this pollutant (Bennett and Hill, 1975). Plants are not known to be injured by CO. The maximum

predicted 1-hour and 8-hour average CO concentrations due to the facility are 380 and 168 $\mu\text{g}/\text{m}^3$, respectively. No adverse impacts to vegetation are expected from CO emissions from the Hardee Power Station. Predicted carbon monoxide levels are lower than levels known to affect animals (Newman, 1975).

Beryllium

The maximum 24-hour average Be concentration due to the proposed facility is predicted to be 0.0014 $\mu\text{g}/\text{m}^3$. Levels of Be greater than 2 $\mu\text{g}/\text{g}$ in nutrient solution have been found to reduce growth of experimental plants (Gough *et al.* 1979). Therefore, the low levels of Be predicted from plant operation are not expected to adversely affect vegetation. Inhalation of levels of Be greater than 35 $\mu\text{g}/\text{m}^3$ for 6 months produced respiratory changes in rats. These levels are significantly greater than predicted values, therefore no effects are predicted to occur (Newman, 1975).

Mercury

The maximum 24-hour average Hg concentration due to the proposed facility is predicted to be 0.0048 $\mu\text{g}/\text{m}^3$. Siegel *et al.* (1984) reported that 7 days of exposure to 50 $\mu\text{g}/\text{m}^3$ Hg vapor resulted in massive leaf abscission in 15 plant species and cultivars. This dose is orders of magnitude higher than the dose expected from operation of the Hardee Power Station. Therefore, the predicted Hg concentrations due to the proposed facility are not expected to adversely affect vegetation.

Of all the trace metals, only mercury is known to be a problem contaminant in Florida, particularly in the Everglades. Mercury readily biomagnifies at higher trophic levels. Mercury bioaccumulates more readily in animals than in plants and biomagnifies through both the terrestrial and aquatic food webs (Eisler, 1987). The sources of mercury contamination in Florida are not known. Potential sources include natural sources such as natural fires, volcanic activity, natural degassing from oceans, land surfaces, and other water bodies. Potential manmade sources include past use of mercuric pesticides and mercury-based paints, emissions from municipal and medical waste incinerators, and fossil fuel power plants. Regional and historical studies are presently being conducted in the state to define the sources, amount, and timing of mercury deposition and accumulation. Because of the uncertainty regarding the contribution of various mercury sources, the risk to local fish and wildlife from this facility cannot be precisely

determined. Because the potential mercury emissions from Hardee Unit 3 are very low relative to other mercury-emitting sources (FDEP, 1992), no significant adverse effects to fish and wildlife are anticipated.

VISIBILITY

Potential impacts to local visibility due to the proposed power plant will be minimal. The proposed plant will meet all applicable emission standards including opacity.

5.6.1.4 AIR QUALITY RELATED VALUES ANALYSIS: VEGETATION, SOILS, AND WILDLIFE

The vegetation and soils components of the additional impacts analysis have been expanded to constitute an air quality-related values (AQRVs) analysis to assess the potential risk to AQRVs of the Chassahowitzka NWA due to the development of the Hardee Unit 3 project. Potential air quality impacts of the proposed project were predicted at the PSD Class I area portion of the Chassahowitzka NWA. 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.

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.

Except for visibility, AQRVs have not been specifically defined by the U.S. Fish and Wildlife Service (USFWS) for Chassahowitzka NWR. However, soil, flora, fauna, cultural resources, geological features, water, and climate potentially affected by air quality have been identified by land managers as general AQRVs to be addressed in these types of analyses. This AQRV analysis evaluates the effects of air quality on general vegetation types and wildlife found on the Chassahowitzka NWR.

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, and 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 have been defined as endangered species, waterfowl, marsh and waterbirds, shorebirds, reptiles, and mammals.

A screening approach was used that 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 that 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, and species of the hardwood swamplands and mangrove forest found in the Chassahowitzka NWR, no specific air quality citations were found that addressed these species. Therefore, studies on general vegetation effects and other similar Florida species can be used as indicators of effects. In conducting the assessment, both direct (fumigation) and indirect (soil accumulation/uptake) exposures were considered for flora, and direct exposure (inhalation) was considered for wildlife.

VEGETATION

The effects of air contaminants on vegetation occur primarily from SO₂, NO₂, O₃, and particulates. Effects from minor air contaminants such as fluoride, chlorine, hydrogen chloride, ethylene, ammonia, hydrogen sulfide, CO, and pesticides have been reported in the literature. However, most of these air contaminants have not resulted in major effects (e.g., crop damage).

As stated earlier, the effects of contaminants are dependent both on the concentration of the contaminant and the duration of the exposure. The term "injury," as opposed to damage, is commonly used to describe all plant responses to air contaminants and will be used in the context of this analysis. Air contaminants are thought to interact primarily with plant foliage, which is

considered to be the major pathway of exposure. For purposes of this analysis, it is assumed that 100 percent of each air contaminant of concern is accessible to the plants. The maximum predicted impacts due to proposed project for the applicable 1-hour, 3-hour, 8-hour, 24-hour, and annual averaging periods are presented in Table 5.6.1-16.

Injury to vegetation from exposure to various levels of air contaminants can be termed acute, physiological, and 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. 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.

Effects of Sulfur Dioxide

SO₂ concentrations at elevated levels have long been known to cause injury to plants. Acute SO₂ injury usually develops within a few hours or days of exposure and symptoms include marginal, flecked, and/or intercostal necrotic areas which 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). Phytotoxic symptoms demonstrated by plants can occur as low as 88 µg/m³ (U.S. Department of Health, Education, and Welfare, 1971). However, this occurs with the more primitive plants (i.e., mosses, ferns, lichens).

A study of native Floridian species (Woltz and Howe, 1981) demonstrated that cypress, slash pine, live oak, and mangrove exposed to 1,300 µg/m³ SO₂ for 8 hours were not visibly damaged. This supports the levels cited by other researchers on the effects of SO₂ 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 were visibly injured at 3-hour SO₂ concentrations of 920 µg/m³.

Jack pine seedlings exposed to SO₂ concentrations from 470 to 520 µg/m³ for 24 hours demonstrated inhibition of foliar lipid synthesis; however, this inhibition was reversible (Malhotra

and Kahn, 1978). Black oak exposed to $1,310 \mu\text{g}/\text{m}^3$ SO_2 for 24 hours a day for 1 week demonstrated a 48 percent reduction in photosynthesis (Carlson, 1979). By comparison of these levels, it is apparent that the maximum predicted 24-hour concentrations are well below the concentrations that cause damage in SO_2 -sensitive plants.

Plants can be grouped into three levels of sensitivity to SO_2 based on concentration and exposure (EPA, 1982b). Sensitive crop species include legumes and blackberries. Ranges of concentrations reported to cause visible injury in sensitive species are $1,310$ to $2,620 \mu\text{g}/\text{m}^3$ (0.5 to 1.0 ppm) for 1-hour exposure and 790 to $1,570 \mu\text{g}/\text{m}^3$ (0.3 to 0.6 ppm) for 3-hour exposures. Intermediate resistant species include many crops and garden species. Ranges of concentrations reported to cause visible injury in intermediate species are $2,620$ to $5,240 \mu\text{g}/\text{m}^3$ (1.0 to 2.0 ppm) for 1-hour exposure and $1,570$ to $2,100 \mu\text{g}/\text{m}^3$ (0.6 to 0.8 ppm) for 3-hour exposures. Resistant species include potato and corn. Ranges of concentrations reported to cause visible injury in intermediate species are $> 5,240 \mu\text{g}/\text{m}^3$ (> 2.0 ppm) for 1-hour exposure and $> 2,100 \mu\text{g}/\text{m}^3$ (> 0.8 ppm) for 3-hour exposures. Chronic effects to forest growth have been reported where SO_2 annual ambient concentrations averaged 45 or $115 \mu\text{g}/\text{m}^3$ (0.02 or 0.05 ppm) (EPA, 1982b).

In order to assess the total air quality SO_2 impacts at the Class I area that can be compared to the reported effects levels, the predicted SO_2 impacts due to Hardee Unit 3 were added to applicable background concentrations. The background concentrations, assumed to be representative of impacts from sources not modeled, were developed from existing ambient monitoring data. In this analysis, the highest 3-hour, 24-hour, and annual concentrations of 335 , 67 , and $7 \mu\text{g}/\text{m}^3$, respectively [collected in 1991 and 1992 from monitoring stations (Nos. 058-003-J02, 058-003-J09, and 058-005-J02) located about 20 km from the Class I area], were used to represent background concentrations. The 3-hour concentration of $335 \mu\text{g}/\text{m}^3$ was also used to represent the 1-hour and 8-hour background levels since data for these averaging times were not available.

The maximum total 3-hour, 24-hour, and annual SO_2 concentrations of 336.9 , 67.3 , and $7.0 \mu\text{g}/\text{m}^3$, respectively, that would be predicted within the Class I area represent levels which are lower than those known to cause damage to test species. The expected doses from operation of Hardee Unit 3 combined with background sources are much lower than doses known to cause a detrimental effect on vegetation AQRVs at Chassahowitzka NWR.

Effects of Nitrogen Dioxide

Acute NO₂ injury symptoms are manifest as water-soaked lesions, which first appear on the upper surface, followed by rapid tissue collapse. Low-concentration, long-term exposures do not induce the lesions associated with acute exposures but may still result in some growth suppression. A review of the literature (EPA, 1982a) indicates greater variability in the NO₂ dose-response relationship in vegetation, and no threshold effect levels are supported. The NO₂ doses known to adversely affect some plants are shown in Table 5.6.1-15.

The maximum predicted annual average NO₂ concentration due to Hardee Unit 3 is predicted to be 0.03 µg/m³. No representative nearby NO₂ monitoring data are available to provide background conditions. The predicted doses of NO₂ in the Chassahowitzka NWA due to the proposed facility are far lower than the doses reported to injure vegetation and animals; therefore, the proposed facility's NO₂ emissions are not expected to have an adverse effect on vegetation AQRVs at Chassahowitzka NWA.

Combined Effects of Sulfur Dioxide and Nitrogen Dioxide

SO₂ in combination with NO₂ can cause vegetation effects below injury threshold for each of these pollutants individually. Plants show varying sensitivities at various SO₂ and NO₂ concentration combinations for various exposure periods. A review of the literature (EPA, 1982a) indicates that a lower visible-injury threshold may occur at 2-hour SO₂ and NO₂ exposures of 1,310 µg/m³ (0.5 ppm) and 940 µg/m³ (0.5 ppm), respectively. Air dispersion modeling has shown that this threshold exposure condition will not occur at Chassahowitzka NWA.

SOILS

Sulfur Dioxide

The majority of the soil in the Class I area is classified as Weekiwachee-Durbin muck. This is an euic, hyperthermic typic sufihemist that is characterized by high levels of sulfur and organic matter. This soil is flooded daily with the advent of high tide and the pH ranges between 6.1 and 7.8. The upper level of this soil may contain as much as 4 percent sulfur (USDA, 1991).

The greatest threat to soils from increased SO₂ deposition (in the form of sulfate) is a decrease in pH or an increase of sulfur to levels considered unnatural or potentially toxic. The ground deposition of sulfate from the proposed unit was calculated to be 2.69 g/ha/yr. The results from

the Florida Acid Deposition Study (FADS) network for two sampling stations (Site 8 and Site 5) located to the north of the Class I area indicate that the average sulfate deposition ranges from 14.5 to 17.7 kg/ha/yr (Pollman, 1994). The predicted amount of sulfate deposited is inconsequential in light of the sulfate deposition measured in the area and the inherent sulfur content of the soils. The regular flooding of these soils by the Gulf of Mexico regulates the pH, and any rise in acidity would be buffered by this activity.

Trace Metals

The annual deposition (g/m^2) of lead, arsenic, beryllium, mercury, manganese, nickel, cadmium, chromium, copper, vanadium, selenium, antimony, barium, cobalt, and zinc were assumed to partition into the soil (bulk density of 1.25 g/cc) to a depth of 10 cm. From this soil concentration, it was assumed that equal partitioning would ensue into dry plant matter. These values are considered to be quite conservative due to the assumption that all of the elements would be 100 percent available for plant uptake and would be internalized in plant tissue at a concentration equal to that of the soil.

Maximum depositions were predicted using the ISCST2 model using particle size distribution for large, uncontrolled gas turbines firing distillate oil as presented in EPA's document, Compilation of Air Pollutant Emission Factors, AP-42. This distribution assumes that 100 percent of the particles have a diameter of 1 μm or less. The maximum depositions to the Class I area due to the proposed sources are described in the following section.

Arsenic

Naturally occurring levels of As in plants range from 0.01 to 5.0 $\mu\text{g/g}$ (EPA, 1989). A concentration of 5 to 20 $\mu\text{g/g}$ in plants is considered excessive (Gough *et al.*, 1979). The annual amount of 1.38×10^{-7} $\mu\text{g/g}$ predicted for the Hardee Unit 3 to be absorbed by vegetation is 6.9×10^{-9} to 2.8×10^{-8} of the values that are considered excessive.

Barium

Naturally occurring levels of barium in plants range from 7.5 to 165 $\mu\text{g/g}$ (Lawrey, 1978). The annual amount of 5.51×10^{-7} $\mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 3.3×10^{-9} to 7.4×10^{-8} of the values at which no phytotoxic observations were noted.

Beryllium

Toxicity of plants has been reported at concentrations of $2 \mu\text{g/g}$ in liquid culture (Gough *et al.*, 1979). The annual amount of $7.06 \times 10^{-8} \mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 3.6×10^{-8} of the value at which retardation of growth occurred.

Cadmium

Cadmium is a relatively rare element that resides in nature at levels of 0.15 to $0.2 \mu\text{g/g}$. Generally, 3 to $5 \mu\text{g/g}$ retards the growth of plants (Gough *et al.*, 1979). The annual amount of $2.96 \times 10^{-7} \mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 5.9×10^{-8} to 9.9×10^{-8} of the values at which retardation of growth occurred.

Chromium

A soil concentration of 1,370 to $2,740 \mu\text{g/g}$ chromium was reported to cause chlorosis in citrus (Gough *et al.*, 1979), but liquid cultures that contained $150 \mu\text{g/g}$ were toxic to citrus seedlings. The annual amount of $1.34 \times 10^{-6} \mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 8.9×10^{-9} of the value at which toxic symptoms were observed.

Cobalt

Plant concentrations as high as 2,000 to $10,000 \mu\text{g/g}$ cobalt have been detected in leaves of persimmon and ash, respectively (Gough *et al.*, 1979). Cobalt was reported to cause chlorosis and stunting in a variety of plants at levels from 6 to $142 \mu\text{g/g}$ in soils (Aller *et al.*, 1990). The annual amount of $2.56 \times 10^{-7} \mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 1.8×10^{-9} to 4.3×10^{-8} of the values at which toxic symptoms were observed.

Copper

Copper is an essential element for plant growth. Vary few instances of toxicity have been reported, and copper deficiency is more often a problem than toxicity. Citrus seedlings that were exposed to approximately $150 \mu\text{g/g}$ of copper demonstrated appreciable chlorosis (Gough *et al.*, 1979). The annual amount of $3.67 \times 10^{-5} \mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 2.5×10^{-7} of the value at which toxic symptoms were observed.

Lead

Naturally occurring levels of lead in plants range from 0.1 to 10 $\mu\text{g/g}$ with an average of 2.0 $\mu\text{g/g}$ (Kabata-Pendias and Pendias, 1984). A lead soil concentration of 30 to 100 $\mu\text{g/g}$ generally retards the growth of plants (Gough *et al.*, 1979). The annual amount of 1.64×10^6 $\mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 1.6×10^{-8} to 5.5×10^{-8} of the values at which growth retardation was observed.

Manganese

Manganese is another element that is essential for plant growth. However, toxicity does occur at elevated levels and a generally toxic concentration of manganese is reported to be greater than 400 to 500 $\mu\text{g/g}$ (Gough *et al.*, 1979). The annual amount of 9.59×10^9 $\mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 2.4×10^{-8} of the level at which toxicity was observed.

Mercury

Although mercury compounds are toxic to bacteria and fungi, higher plants are relatively resistant to mercury poisoning. Tea plants growing above mercury-rich deposits contained as much as 3.5 $\mu\text{g/g}$ without showing signs of toxicity. Apparently healthy spanish moss plants collected had a mercury content of 0.5 $\mu\text{g/g}$ (Gough *et al.*, 1979). From the few studies available on the effects of mercury on plants, it seems as if mercury is not concentrated to a great extent (Gough *et al.*, 1979). The annual amount of 2.48×10^7 $\mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 7.1×10^{-8} to 5.0×10^{-7} of the values at which no signs of toxicity were observed.

Nickel

The general range of excessive or toxic amounts of nickel in most plant species varies from 10 to 100 ppm (Kabata-Pendias and Pendias, 1984). The annual amount of 3.39×10^5 $\mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 3.4×10^{-7} to 3.4×10^{-6} times the values at which growth retardation was observed.

Selenium

No recorded instances of naturally occurring selenium damage have been documented to date (Gough *et al.*, 1979). Plants absorb and accumulate selenium, but the general responses of these

plants vary over such a wide range of concentrations, a level considered toxic to plants is hard to determine (Gough *et al.*, 1979). Concentrations of selenium in plants are known to range from 3 to 4,190 $\mu\text{g/g}$. The annual amount of $6.61 \times 10^7 \mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 1.6×10^{-10} to 2.2×10^{-7} times the values at which no effects have been observed.

Vanadium

Plants absorb and accumulate vanadium differentially, with concentrations in various plants ranging from 20 to 700 $\mu\text{g/g}$ (Gough *et al.*, 1979). However, phytotoxic responses were observed in some plants grown in soils at a concentration of 140 $\mu\text{g/g}$ (Aller *et al.*, 1990). The annual amount of $1.96 \times 10^{-6} \mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 1.4×10^{-8} of the value at which phytotoxicity occurred.

Zinc

Zinc is another element that is essential for plant growth. However, toxicity does occur at elevated levels and a generally toxic concentration of zinc is reported to be greater than 300 $\mu\text{g/g}$ (Fischer and Luttge, 1978). The annual amount of $4.46 \times 10^{-5} \mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 1.5×10^{-7} of the value at which toxicity was observed.

WILDLIFE

The predicted SO_2 , NO_2 , and particulate concentrations are well below the lowest observed effects levels in animals (Table 5.6.1-14). Given these conditions, the proposed source's emissions poses no risk to wildlife AQRVs at Chassahowitzka NWA. Because predicted levels are below those known to cause effect to vegetation, there is also no risk to their habitat.

A review of literature (U.S. Fish and Wildlife Service, 1985a, b; 1986; 1987; 1988a, b; and 1993) shows that the USFWS's recommended safety levels for As, Cd, chromium (Cr), Hg, Pb, Se, and Zn for threshold effects for these metals are several orders of magnitude higher than the concentrations predicted to occur in plants. Although these metals bioaccumulate, the predicted levels are so low that adverse effects to fish and wildlife of Chassahowitzka NWA through the food web are not expected.

SUMMARY

In summary, no toxic effects from proposed plant emissions are expected. Safety factors as great as 900 million have been demonstrated in this assessment. For the trace metal assessment, it is important to note that the elements were modeled with the assumption that 100 percent was available for plant uptake which is rarely the case in a natural ecosystem.

5.6.1.5 PSD CLASS I VISIBILITY ANALYSIS

The visibility analysis required by PSD regulations is directed primarily toward PSD Class I areas. 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 caused by various pollutants. There are no PSD Class I areas located within 100 km of the Hardee Unit 3 facility. The nearest Class I area to the plant site is the Chassahowitzka NWA located approximately 130 km to the northwest of the plant site.

A Level-1 visibility screening analysis was performed to determine the potential adverse visibility effects using the approach suggested in the *Workbook for Plume Visual Impact Screening and Analysis* (EPA, 1988). The Level-1 screening analysis is designed to provide a conservative estimate of plume visual impacts (i.e., impacts higher than expected). The EPA model, VISCREEN, was used for this analysis. The PM, NO_x, and sulfuric acid mist (assumed to be sulfate) emissions from the proposed plant were used as input to the model.

As presented in Section 8.5 of Appendix 10.1.5 (Figure 8-1), the maximum visibility impacts caused by the proposed plant do not exceed the screening criteria inside or outside the Class I area. As a result, Hardee Unit 3 is predicted to have no adverse effects to visibility on the Class I area.

5.6.1.6 ULTIMATE SITE CAPACITY

Based on the results summarized in Sections 5.6.1.2, 5.6.1.3, 5.6.1.4, and 5.6.1.5, Hardee Unit 3 will comply with applicable AAQS and PSD increments; will not pose a significant health risk to the public relative to toxic air pollutant emissions; and will not adversely affect the soils, vegetation, wildlife, and visibility around the proposed plant site. The air quality modeling analyses were based on Hardee Unit 3 at a nominal electrical-generating capacity of 440 MW.

The modeling analyses also included the existing TPS plant at a nominal electrical-generating capacity of 295 MW.

If the nominal electrical-generating capacity of the existing TPS plant were increased by 145 MW to a total generating capacity of 440 MW (to account for the ultimate site capacity of 880 MW), the air quality impacts from Hardee Unit 3 and the future TPS plant would comply with currently applicable AAQS and PSD increments and not pose a significant adverse risk to public health, vegetation, soils, or wildlife. One combustion turbine, one heat recovery steam generator, and one steam turbine will be added at the TPS plant to generate the additional 145 MW of electricity. The combustion turbine is assumed to be fired with natural gas and fuel oil with the fuel oil having a maximum sulfur content of 0.05 percent (same sulfur content as proposed for Hardee Unit 3).

For AAQS analyses, the maximum PM₁₀, NO₂, and CO impacts from Hardee Unit 3 were predicted to be less than the significant impact levels or, when other sources were also modeled, were well below the applicable ambient standard. As a result, the incremental impacts due to the future TPS plant (total of 440 MW generation capacity) are expected to be minimal and still maintain compliance with AAQS.

For SO₂ AAQS analyses, the maximum 3-hour, 24-hour, annual concentrations due to all modeled sources and background concentrations were predicted to be 406, 138, and 29 $\mu\text{g}/\text{m}^3$, respectively. As a result, the maximum predicted SO₂ concentrations will be in compliance with AAQS when the ultimate site capacity of 880 MW is reached. The incremental impacts due to the future TPS plant are expected to be minimal and still maintain compliance with AAQS.

Similar to the AAQS analyses for PSD Class II increment analyses, the maximum PM₁₀ and NO₂ concentrations from Hardee Unit 3 were predicted to be less than the significant impact levels or, when other PSD sources were also modeled, were well below the applicable PSD increments. As a result, the incremental impacts due to the future TPS plant are expected to be minimal and still maintain compliance with AAQS.

For SO₂ PSD Class II analyses, the maximum 3-hour, 24-hour, and annual concentrations due to all modeled PSD sources were predicted to be 150, 45.4, and -4 $\mu\text{g}/\text{m}^3$, respectively. The

incremental impacts due to the future TPS plant are expected to be minimal and still maintain compliance with PSD Class II increment. As a result, the maximum predicted SO₂ concentrations will be in compliance with the current PSD Class II increments when the ultimate site capacity is reached.

For PSD Class I analyses, the maximum PM₁₀ and NO₂ impacts from Hardee Unit 3 were predicted to be less than the NPS significant impact levels. As a result, the maximum PM₁₀ and NO₂ impacts from the future TPS units are also expected to be less than the NPS significant impact levels. Although initial modeling was performed for SO₂ concentrations for Hardee Unit 3 which indicated potential violations of the PSD Class I increment, additional modeling with the MESOPUFF II model indicated that Hardee Unit 3's impacts were less than significant during the potential violations. As a result, the maximum SO₂ impacts from the future TPS units are also expected to be less than the significant impact levels.

Based on these results, the air quality impacts associated with the ultimate site capacity of 880 MW (440-MW generation for Hardee Unit 3 and 440-MW generation for the future TPS plant) are expected to comply with currently applicable AAQS and PSD increments.

Table 5.6.1-1. SO2 Screening Analysis for the AAQS and PSD Class II Inventories for Hardee Unit 3

Facility Name	UTM Coordinates (km)		Relative Coordinate to proposed Hardee Unit 3 (km)		Distance to Proposed Facility (km)	Direction (degrees)	Screening Emission Threshold (TPY)(a)	Maximum Allowable Emissions (TPY)	Included in AAQS and/or PSD Class II Modeling Analysis?
	E	N	X	Y					
TPS Hardee Station (295 MW) (b)	404.8	3057.3	-0.2	-0.4	0.4	207	(c)	2,412	YES
TECO - Polk Power Station (b)	402.5	3067.4	-2.5	9.7	10.0	345	100	2,010	YES
Imperial Phosphate (Brewer)(b)	404.8	3069.5	-0.2	11.8	11.8	359	136	275	YES
Gardinier Fort Meade	415.3	3063.3	10.3	5.6	11.7	61	134	1,173	YES
IMC-Agrico Chem - S. Pierce (b)	407.5	3071.3	2.5	13.6	13.8	10	177	4,377	YES
Mobil Mining - Big Four Mine (b)	394.8	3067.7	-10.2	10.0	14.3	314	186	589	YES
Borden Hillsborough (b)	394.6	3069.6	-10.4	11.9	15.8	319	216	-225	YES
U.S. Agri-Chemicals Ft. Meade (b)	416.0	3069.0	11.0	11.3	15.8	44	215	3,438	YES
Central Florida Power	416.2	3069.2	11.2	11.5	16.1	46	222	38	NO
City of Wauchula	418.4	3047.0	13.4	-10.7	17.1	129	243	180	NO
Estech/Swift (b)	411.5	3074.2	6.5	16.5	17.7	22	255	-4,853	YES
FPC - Polk (b)	414.3	3073.9	9.3	16.2	18.7	30	274	859	YES
Dolime(b)	404.8	3069.5	-0.2	11.8	11.8	359	136	-355	YES
IMC-Agrico Chem - Pierce (b)	404.1	3079.0	-0.9	21.3	21.3	358	326	-1,645	YES
Mobil Electrophosphate (b)	405.6	3079.4	0.6	21.7	21.7	2	334	-1,441	YES
Farmland Industries Green Bay (b)	409.5	3079.5	4.5	21.8	22.3	12	345	4,087	YES
IMC Agrico Chem- New Wales (b)	396.6	3078.9	-8.4	21.2	22.8	338	356	13,921	YES
Mulberry Cogeneration (b)	413.6	3080.6	8.6	22.9	24.5	21	389	464	YES
IMC Agrico Chem - Noralyn Mine Road	414.7	3080.3	9.7	22.6	24.6	23	392	505	YES
CF Industries Bartow Bonnie Mine Road(b)	408.4	3082.4	3.4	24.7	24.9	8	399	4,982	YES
Kaplan Industries	418.3	3079.3	13.3	21.6	25.4	32	407	398	NO
American Orange Corp.	429.8	3047.3	24.8	-10.4	26.9	113	438	198	NO
IMC Agrico/Conserve (b)	398.4	3084.2	-6.6	26.5	27.3	346	446	1,593	YES
Mulberry Phosphates (Royster) (b)	406.8	3085.1	1.8	27.4	27.5	4	449	2,013	YES
Geologic Recovery	401.8	3085.8	-3.2	28.1	28.3	354	466	98	NO
Mobil Mining - Nichols (b)	398.4	3085.3	-6.6	27.6	28.4	347	468	2,304	YES
Cargill/Seminole Fertilizer Bartow (b)	409.8	3087.0	4.8	29.3	29.7	9	494	5,000	YES
IMC Fertilizer - Prairie	402.9	3087.0	-2.1	29.3	29.4	356	488	109	NO
Orange Co.	418.7	3083.6	13.7	25.9	29.3	28	486	26	NO
Imperial/Pavex Corp - W Bartow	413.0	3086.2	8.0	28.5	29.6	16	492	75	NO
US-Agri Chemicals Bartow (b)	413.2	3086.3	8.2	28.6	29.8	16	495	-1,579	YES
FPL - Manatee	367.2	3054.1	-37.8	-3.6	38.0	265	659	83,351	YES
Laidlaw Env. Services	424.7	3091.9	19.7	34.2	39.5	30	689	240	NO
Consolidated Minerals Plant City	393.8	3096.3	-11.2	38.6	40.2	344	704	809	YES
Citrus Hill	447.9	3068.3	42.9	10.6	44.2	76	784	411	NO
Cargill Citro-America	447.9	3068.3	42.9	10.6	44.2	76	784	223	NO
Ridge Cogeneration (b)	416.7	3100.4	11.7	42.7	44.3	15	785	480	NO
Lakeland City Power Larsen (b)	409.2	3102.8	4.2	45.1	45.2	5	805	5,024	YES
TECO - Big Bend (b)	361.9	3075.0	-43.1	17.3	46.4	292	829	237,854	YES
FPL-Avon Park	451.4	3050.5	46.4	-7.2	47.0	99	839	67	NO

Table 5.6.1-1. SO₂ Screening Analysis for the AAQS and PSD Class II Inventories for Hardee Unit 3

Facility Name	UTM Coordinates (km)		Relative Coordinate to proposed Hardee Unit 3 (km)		Distance to Proposed Facility (km)	Direction (degrees)	Screening Emission Threshold (TPY)(a)	Maximum Allowable Emissions (TPY)	Included in AAQS and/or PSD Class II Modeling Analysis?
	E	N	X	Y					
Macasphalt Winter Haven	423.1	3101.5	18.1	43.8	47.4	22	848	48	NO
Cargill/Gardinier Riverview (b)	363.4	3082.4	-41.6	24.7	48.4	301	868	5,872	YES
Lakeland City Power McIntosh (b)	408.5	3105.8	3.5	48.1	48.2	4	865	30,567	YES
Auburndale Cogen (b)	420.8	3103.3	15.8	45.6	48.3	19	865	222	NO
Owens-Brockway	423.4	3102.8	18.4	45.1	48.7	22	874	120	NO
Coca Cola Auburndale	421.6	3103.7	16.6	46.0	48.9	20	878	709	NO
Adams Packing Auburndale	421.1	3104.2	16.1	46.5	49.2	19	884	94	NO
SFE Processing	421.7	3104.2	16.7	46.5	49.4	20	888	188	NO
Hillsborough RRF	368.2	3092.7	-36.8	35.0	50.8	314	916	771	NO
Borden Polk (b)	414.5	3109	9.5	51.3	52.2	10	943	-184	NO
CLM/Pacific Chloride	361.8	3088.3	-43.2	30.6	52.9	305	959	702	NO
TECO - Gannon	360.0	3087.5	-45.0	29.8	54.0	304	979	93,265	YES
Gulf Coast Lead	364.0	3093.5	-41.0	35.8	54.4	311	989	1,498	YES
Alcoma Packing	451.6	3085.5	46.6	27.8	54.3	59	985	327	NO
<u>Additional Sources Outside 55km Considered in Modeling Analysis</u>									
Lafarge Corp.	357.7	3090.6	-47.3	32.9	57.6	305	1052	20,293	YES
TECO - Hookers Point	358.0	3091.0	-47.0	33.3	57.6	305	1052	13,524	YES
FPC - Bartow	342.4	3082.6	-62.6	24.9	67.4	292	1247	62,618	YES
FPC - Higgins	336.5	3098.4	-68.5	40.7	79.7	301	1494	19,619	YES
FPC - Intercession City (b)	446.3	3126.0	41.3	68.3	79.8	31	1496	17,667	YES

Note: All facilities with a total maximum allowable SO₂ emissions of more than 20 TPY that are within 55 km of the proposed facility are included in the screening analysis.

- (a) Screening emissions threshold is $20 \times [\text{Distance (km) to facility} - 5\text{km}]$, based on North Carolina Screening Method. A significant impact distance of 5 km was assumed in order to include additional facilities into the inventory.
- (b) Indicates PSD sources at this facility
 Proposed facility UTM coordinates(km 405 3057.7
 Screening area is 55 km from the proposed facility.
- (c) Sources within 5 km of the proposed facility are modeled without regard to the screening criteria.

Source: KBN, 1994

Table 5.6.1-2. PM Screening Analysis for the AAQS and PSD Class II Inventories for Hardee Unit 3

Facility/Source Name	UTM E (km)	UTM N (km)	Relative Location to Proposed Facility (km)		Distance to Proposed Facility (km)	Direction (degrees)	Screening Threshold Emissions (TPY) (a)	Maximum Allowable Emissions (TPY)	Included in AAQS and PSD Class II Modeling Analysis?
			X	Y					
TPS Hardee Power Station (295 MW) (b)	404.8	3057.3	-0.2	-0.4	0.4	207	(c)	33	YES
TECO Polk (b)	402.5	3067.4	-2.5	9.7	10.0	346	100	438	YES
Gardinier Fort Meade	415.3	3063.3	10.3	5.6	11.7	61	134	132	NO
Imperial Phosphate (Brewer)	404.8	3069.5	-0.2	11.8	11.8	359	136	162	YES
IMC-Agrico Chemical South Pierce (b)	407.5	3071.3	2.5	13.6	13.8	10	177	858	YES
Mobil Big Four Mine	394.8	3067.7	-10.2	10.0	14.3	314	186	68	NO
US Agri-Chemicals Fort Meade (b)	416.0	3069.0	11.0	11.3	15.8	44	215	1,066	YES
Central Florida Power	416.2	3069.2	11.2	11.5	16.1	46	222	47	NO
Florida Privatization Inc	418.3	3048.0	13.3	-9.7	16.5	126	229	281	YES
City of Wachula	418.4	3047.0	13.4	-10.7	17.1	129	243	21	NO
Estech/Swift	411.5	3074.2	6.5	16.5	17.7	22	255	311	YES
FPC-POLK (b)	414.3	3073.9	9.3	16.2	18.7	30	274	149	NO
Estech-Duette Phosphate Mine	388.9	3047.2	-16.1	-10.5	19.2	237	284	751	YES
IMC Kingsford	398.2	3075.7	-6.8	18.0	19.2	339	285	417	YES
C & M Products Co	405.5	3079.1	0.5	21.4	21.4	1	328	162	NO
Farmland Industries Green Bay Plant (b)	409.5	3079.5	4.5	21.8	22.3	12	345	503	YES
IMC-Agrico New Wales	396.6	3078.9	-8.4	21.2	22.8	338	356	1,427	YES
Ewell Ind Bonnie Mine Rd	407.7	3080.9	2.7	23.2	23.4	7	367	96	NO
Mulberry Cogeneration (b)	413.6	3080.6	8.6	22.9	24.5	21	389	70	NO
IMC-Agrico Noralyn Mine	414.7	3080.3	9.7	22.6	24.6	23	392	1,690	YES
Ridge Pallets Inc	419.1	3078.1	14.1	20.4	24.8	35	396	96	NO
C F Industries Bartow Bonnie Mine (b)	408.4	3082.4	3.4	24.7	24.9	8	399	1,748	YES
Bio-Medical Service Corp of GA	413.9	3081.3	8.9	23.6	25.2	21	404	46	NO
Kaplan Industries	418.3	3079.3	13.3	21.6	25.4	32	407	53	NO
American Orange Corp	429.8	3047.3	24.8	-10.4	26.9	113	438	181	NO
Orange Cogen (b)	414.8	3083.0	9.8	25.3	27.1	21	443	44	NO
IMC-Agrico/Conserve (Nichols) (b)	398.4	3084.2	-6.6	26.5	27.3	346	446	1,598	YES
Mulberry Phosphates (Royster)	406.8	3085.1	1.8	27.4	27.5	4	449	1,394	YES
Kaiser Aluminum	408.3	3085.5	3.3	27.8	28.0	7	460	106	NO
Mobil Mining & Minerals Nichols	398.4	3085.3	-6.6	27.6	28.4	347	468	991	YES
Orange Co of Florida	418.7	3083.6	13.7	25.9	29.3	28	486	119	NO
IMC Fertilizer Prairie	402.9	3087.0	-2.1	29.3	29.4	356	488	288	NO
Purina Mills	402.0	3087.0	-3.0	29.3	29.5	354	489	88	NO
Pavex	413.0	3086.2	8.0	28.5	29.6	16	492	44	NO
Cargill/Seminole Fertilizer (b)	409.8	3087.0	4.8	29.3	29.7	9	494	544	YES

Table 5.6.1-2. PM Screening Analysis for the AAQS and PSD Class II Inventories for Hardee Unit 3

Facility/Source Name	UTM E (km)	UTM N (km)	Relative Location to Proposed Facility (km)		Distance to Proposed Facility (km)	Direction (degrees)	Screening Threshold Emissions (TPY) (a)	Maximum Allowable Emissions (TPY)	Included in AAQS and PSD Class II Modeling Analysis?
			X	Y					
Ridge Pallets Inc.	418.6	3084.1	13.6	26.4	29.7	27	494	165	NO
US Agri-Chemicals Bartow (b)	413.2	3086.3	8.2	28.6	29.8	16	495	444	NO
Florida Rock Industries	416.8	3085.8	11.8	28.1	30.5	23	510	57	NO
Ewell Ind S Florida Ave	406.3	3092.9	1.3	35.2	35.2	2	604	348	NO
All Sun Products	413.5	3093.8	8.5	36.1	37.1	13	642	318	NO
FPL - Manatee	367.2	3054.1	-37.8	-3.6	38.0	265	659	40,765	YES
Manatee Scrap Processing	366.9	3053.8	-38.1	-3.9	38.3	264	666	108	NO
Sun Pac Foods	422.7	3092.6	17.7	34.9	39.1	27	683	62	NO
Lykes Pasco Packing	412.4	3096.5	7.4	38.8	39.5	11	690	48	NO
Consolidated Minerals Inc Plant City	393.8	3096.3	-11.2	38.6	40.2	344	704	749	YES
Pavers Incorporated	414.0	3098.2	9.0	40.5	41.5	13	730	479	NO
Schering Berlin Polymers	410.7	3098.9	5.7	41.2	41.6	8	732	30	NO
Rinker Cencon Corp	412.4	3099.0	7.4	41.3	42.0	10	739	159	NO
Quikrete of Florida	412.8	3099.0	7.8	41.3	42.0	11	741	253	NO
Zipperer S. Agape Mortuary Services	363.0	3064.7	-42.0	7.0	42.6	279	752	21	NO
Florida M&M	362.2	3066.2	-42.8	8.5	43.6	281	773	21	NO
Alumax Extrusions	385.6	3097.0	-19.4	39.3	43.8	334	777	172	NO
Ero Industries	427.5	3095.6	22.5	37.9	44.1	31	782	33	NO
Citrus Hill Mfg	447.9	3068.3	42.9	10.6	44.2	76	784	66	NO
Florida Brick & Clay Co	384.9	3097.1	-20.1	39.4	44.2	333	785	26	NO
Ridge Cogeneration (b)	416.7	3100.4	11.7	42.7	44.3	15	785	414	NO
Union Camp Corp	402.0	3102.0	-3.0	44.3	44.4	356	788	47	NO
Amcon Concrete	364.0	3075.0	-41.0	17.3	44.5	293	790	39	NO
Erly Juice Inc	399.0	3101.8	-6.0	44.1	44.5	352	790	117	NO
Florida Tile	405.4	3102.4	0.4	44.7	44.7	1	794	309	NO
C-Cure of Florida	386.0	3098.7	-19.0	41.0	45.2	335	804	21	NO
Lakeland City Power Larsen (b)	409.2	3102.8	4.2	45.1	45.3	5	806	107	NO
Monier Roof tile	414.0	3102.5	9.0	44.8	45.7	11	814	44	NO
Driggers Concrete	360.0	3065.9	-45.0	8.2	45.7	280	815	21	NO
Palm Harbor Homes	391.8	3101.5	-13.2	43.8	45.7	343	815	22	NO
Vigoro Industries	427.9	3097.4	22.9	39.7	45.8	30	817	136	NO
Westcon	375.3	3092.8	-29.7	35.1	46.0	320	820	21	NO
TECO Big Bend (b)	361.9	3075.0	-43.1	17.3	46.4	292	829	6,014	YES
Citrus World	441.0	3087.3	36.0	29.6	46.6	51	832	601	NO
IMC-Agrico Chemical Big Bend	362.1	3076.1	-42.9	18.4	46.7	293	834	195	NO

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Table 5.6.1-2. PM Screening Analysis for the AAQS and PSD Class II Inventories for Hardee Unit 3

Facility/Source Name	UTM E (km)	UTM N (km)	Relative Location to Proposed Facility (km)		Distance to Proposed Facility (km)	Direction (degrees)	Screening Threshold Emissions (TPY) (a)	Maximum Allowable Emissions (TPY)	Included in AAQS and PSD Class II Modeling Analysis?
			X	Y					
Macasphalt	423.1	3101.5	18.1	43.8	47.4	22	848	70	NO
Florida Rock Industry	365.8	3085.0	-39.2	27.3	47.8	305	855	21	NO
Lakeland City Power McIntosh (b)	408.5	3105.8	3.5	48.1	48.2	4	865	15,151	YES
Auburndale Cogeneration (b)	420.8	3103.3	15.8	45.6	48.3	19	865	161	NO
Florida Mining & Materials Alabama Land	420.8	3103.4	15.8	45.7	48.4	19	867	40	NO
Cargill/Gardiner Fertilizer Riverview	363.4	3082.4	-41.6	24.7	48.4	301	868	880	YES
Owens-Brockway Glass Container	423.4	3102.8	18.4	45.1	48.7	22	874	189	NO
Packaging Corp of America	423.4	3102.8	18.4	45.1	48.7	22	874	38	NO
Coca Cola	421.6	3103.7	16.6	46.0	48.9	20	878	387	NO
Adams Packing Association	421.1	3104.2	16.1	46.5	49.2	19	884	144	NO
Eger Concrete Lake Ida & 5th St	428.1	3102.0	23.1	44.3	50.0	28	899	49	NO
S I Lime Co Division of Longview Lime	362.9	3084.7	-42.1	27.0	50.0	303	900	48	NO
R C Martin Concrete Products	368.6	3092.1	-36.4	34.4	50.1	313	902	28	NO
Graves Enterprises Riverview	363.1	3085.3	-41.9	27.6	50.2	303	903	350	NO
The Florida Brewery	422.8	3104.7	17.8	47.0	50.3	21	905	121	NO
Hillsborough Co Resource Recovery	368.2	3092.7	-36.8	35.0	50.8	314	916	172	NO
John Carlos Florida	426.2	3104.1	21.2	46.4	51.0	25	920	29	NO
Reed Minerals Division	362.2	3085.5	-42.8	27.8	51.0	303	921	70	NO
Eastern Electric Apparatus Repair Cp	366.6	3092.0	-38.4	34.3	51.5	312	930	21	NO
Southeastern Galvanizing Division	368.5	3094.5	-36.5	36.8	51.8	315	937	21	NO
City of Tampa Dept.	364.0	3089.5	-41.0	31.8	51.9	308	938	48	NO
Kearney Development Company	368.7	3094.8	-36.3	37.1	51.9	316	938	21	NO
Gaylord Container Corp	366.3	3092.3	-38.7	34.6	51.9	312	938	108	NO
Southeastern Wire	368.3	3094.5	-36.7	36.8	52.0	315	939	21	NO
GAF Building Materials Corp	362.2	3087.2	-42.8	29.5	52.0	305	940	57	NO
Florida Rock Industries	428.0	3105.2	23.0	47.5	52.8	26	956	55	NO
Leisey Shell Corp	352.7	3064.8	-52.3	7.1	52.8	278	956	20	NO
Nitram	362.5	3089.0	-42.5	31.3	52.8	306	956	218	NO
GNB Inc (PAC CHL)	361.8	3088.3	-43.2	30.6	52.9	305	959	25	NO
Paktank Florida	360.8	3087.3	-44.2	29.6	53.2	304	964	178	NO
Florida Steel Corp	364.6	3092.8	-40.4	35.1	53.5	311	970	144	NO
Amcon Products	364.6	3092.8	-40.4	35.1	53.5	311	970	32	NO
Bay Concrete	365.1	3093.8	-39.9	36.1	53.8	312	976	37	NO
IMC Port Sutton Terminal	360.1	3087.5	-44.9	29.8	53.9	304	978	442	NO
TECO Gannon	360.0	3087.5	-45.0	29.8	54.0	304	979	5,855	YES

5.6.1-38

Table 5.6.1-2. PM Screening Analysis for the AAQS and PSD Class II Inventories for Hardee Unit 3

Facility/Source Name	UTM E (km)	UTM N (km)	Relative Location to Proposed Facility (km)		Distance to Proposed Facility (km)	Direction (degrees)	Screening Threshold Emissions (TPY) (a)	Maximum Allowable Emissions (TPY)	Included in AAQS and PSD Class II Modeling Analysis?
			X	Y					
Florida Mega-Mix	364.5	3093.4	-40.5	35.7	54.0	311	980	22	NO
CSX Transportation Inc	361.0	3089.0	-44.0	31.3	54.0	305	980	404	NO
David J Joseph Co	364.0	3092.9	-41.0	35.2	54.0	311	981	123	NO
The Gibson-Homans	365.5	3094.8	-39.5	37.1	54.2	313	984	21	NO
Holman Inc	359.5	3087.3	-45.5	29.6	54.3	303	986	55	NO
Holman Inc	359.3	3087.1	-45.7	29.4	54.3	303	987	54	NO
Gulf Coast Lead	364.0	3093.5	-41.0	35.8	54.4	311	989	25	NO
Eastern Association Terminal	360.2	3088.9	-44.8	31.2	54.6	305	992	534	NO
Glen-Mar Concrete Products	363.2	3093.3	-41.8	35.6	54.9	310	998	22	NO
<u>Additional Sources Outside 55 km Considered in the Modeling Analysis</u>									
TECO Hooker's Point	358.0	3091.0	-47.0	33.3	57.6	305	1,052	107	NO
LaFarge Corp	357.7	3090.6	-47.3	32.9	57.6	305	1,052	1,207	YES
CF Industries Zephyrhills	388.0	3116.0	-17.0	58.3	60.7	344	1,115	1,006	NO
FPC - Bartow	342.4	3082.6	-62.6	24.9	67.4	292	1,247	9,244	YES
FPC - Higgins	336.5	3098.4	-68.5	40.7	79.7	301	1,494	1,082	NO
FPC - Intercession City (b)	446.3	3126.0	41.3	68.3	79.8	31	1,496	809	NO

Note: All sources with the potential to emit more than 20 TPY of PM, based on maximum allowable within 55km of the proposed facility are included in the screening analysis.

Proposed Facility UTM coordinate 405.0 3057.7

Screening area is a 55 km circle centered on the proposed facility.

- (a) Screening emissions threshold is based on the North Carolina screening method, and is equal to $20 \times [\text{Distance (km) to facility} - 5 \text{ km}]$. A significant impact distance of 5 km was assumed in order to include additional facilities into the inventory. The distance may change pending the final design of the proposed plant.
- (b) PSD sources at this facility.
- (c) Sources within 5 km of the proposed facility are modeled without regard to the screening criteria.

Source: KBN, 1994.

Table 5.6.1-3. Summary of Facilities Included in the PSD Class I SO2 Modeling Analysis for Hardee Unit 3

APIS ID #	Facility Description	UTM Location (km)		Maximum SO2 Emissions (TPY)	Distance to Nearest Class I Receptor (km)
		East	North		
40TPA270024	Asphalt Pavers 3	359.9	3162.4	78	20
40TPA270015	Asphalt Pavers 4	361.4	3168.4	78	20
40TPA530221	Auburndale Cogeneration	420.8	3103.3	222	102
NA	Borden Hillsborough	394.6	3069.6	-225	110
NA	Borden Polk	414.5	3109.0	-184	93
40HIL290008	Cargill/Gardinier Riverview	363.4	3082.4	-8430	86
40TPA530046	Cargill/Seminole Bartow	409.8	3087.0	1794	105
40TPA530052	CF Industries Bartow Bonnie Mine Rd	408.4	3082.4	-24445	108
40HIL290005	CF Industries Zephyrhills	388.0	3116.0	-292	69
NA	CLM Chemical	361.8	3088.3	731	80
40TPA510066	Couch Const-Zephyrhills (Asphalt)	390.3	3129.4	123	62
40TPA510041	Couch Const-Odessa (Asphalt)	340.7	3119.5	252	46
	Dris Paving (Asphalt)	340.6	3119.2	8	47
NA	Dolime	404.8	3069.5	-355	116
NA	Estech/Swift Polk	411.5	3074.2	-4853	116
NA	Evans Packing	383.3	3135.8	7	52
40TPA270017	E R Jahna (Lime Dryer)	386.7	3155.8	29	47
40TPA530053	Farmland Industries - Green Bay Plant	409.5	3079.5	1167	111
NA	FDOC Boiler #3	382.2	3166.1	104	40
40TPA270021	FL Crushed Stone Kiln 1	360.0	3162.4	3421	20
40TPA270010	FL Mining and Materials Kiln	356.2	3169.9	50	15
40TPA090004	FPC - Crystal River	334.2	3204.5	-5402	21
30ORL640028	FPC Debary	467.5	3197.2	16213	125
30ORL490014	FPC Intercession City	446.3	3126.0	8162	113
NA	FPC Polk County Site	414.3	3073.9	859	118
NA	General Portland Cement #4	358.0	3090.6	-2190	77
NA	General Portland Cement #5	358.0	3090.6	-2409	77
40HIL290261	Hillsborough Cty RRF	368.2	3092.7	771	78
NA	Hospital Corp of America	333.4	3141.0	6	26
40TPA530057	IMC-Agrico/Conserve Nichols	398.4	3084.2	797	100
40TPA530059	IMC-Agrico New Wales	396.6	3078.9	5050	103
NA	IMC-Agrico Pierce	404.1	3079.0	-1645	108
40TPA530055	IMC-Agrico South Pierce	407.5	3071.3	1471	116
40TPA530080	Imperial Phosphate	404.8	3069.5	-670	116
NA	Kissimmee Utilities	447.7	3127.9	1022	114
30ORL490001	Kissimmee Utilites Exist	460.1	3129.3	1116	125
40TPA530003	Lakeland Utilities Larsen CT	409.2	3102.8	1012	93
40TPA530004	Lakeland Utilities McIntosh 3	408.5	3105.8	17384	91
NA	Lake Cogen	434.0	3198.8	175	93
40HIL290127	McKay Bay RRF	360.0	3091.9	745	76
40TPA530060	Mobil Electrophos Division	405.6	3079.4	-3334	108
40HIL290102	Mobil Big Four Mine /AMAX	394.8	3067.7	589	112
40TPA530047	Mobil-Nichols	398.4	3085.3	-428	99
NA	Mulberry Cogeneration	413.6	3080.6	464	112
40TPA530048	Mulberry Phosphates (Royster)	406.8	3085.1	-7714	104
NA	New Pt Richey Hospital	331.2	3124.5	3	42
NA	Oman Construction	359.8	3164.9	73	20
30ORL480137	Orlando Utilities Commission - Stanton	483.5	3150.6	24083	143
40TPA510028	Overstreet Paving (Asphalt)	355.9	3143.7	128	27
40TPA510056	Pasco Cty RRF	347.1	3139.2	490	27
NA	Pasco Cogen	385.6	3139.0	175	53
40PNL520117	Pinellas RRF	335.3	3084.4	2234	81
30ORL48109	Reedy Creek Energy Services- EPCOT	442.0	3139.0	127	105
30ORL480110	Reedy Creek Energy Services	443.1	3144.3	5	105

Table 5.6.1-3. Summary of Facilities Included in the PSD Class I SO₂ Modeling Analysis for Hardee Unit 3

APIS ID #	Facility Description	UTM Location (km)		Maximum SO ₂ Emissions (TPY)	Distance to Nearest Class I Receptor (km)
		East	North		
NA	Ridge Cogeneration	416.7	3100.4	480	101
40PNL520042	Stauffer Shutdown	325.6	3116.7	-2263	51
40HIL290039	TECO Big Bend	361.9	3075.0	-104320	93
NA	TECO Polk Power	402.5	3067.4	2009	116
40TPA250015	TPS - Hardee (295 MW)	404.8	3057.3	2412	126
40TPA530050	US Agri-Chem Bartow	413.2	3086.3	-1579	108
40TPA530051	US Agri-Chem Ft Meade	416.0	3069.0	-160	123

Source: KBN, 1994.

Table 5.6.1-4. Summary of Maximum Predicted Impacts for the Proposed Hardee Unit 3, Combined and Simple Cycle--Westinghouse 501F, Distillate Oil at 100 Percent, 75 Percent, and 50 Percent Operating Loads

75 Percent, and 50 Percent Operating Loads									
Pollutant	Averaging Period	Maximum Predicted Impacts (ug/m³)						De Minimis Monitoring Concentration (ug/m³)	Significant Impact Level (ug/m³)
		100 Percent Load		75 Percent Load		50 Percent Load			
		32 °F	95 °F	32 °F	95 °F	32 °F	95 °F		
<u>Combined Cycle</u>									
Sulfur Dioxide	3-hour	31.9	48.5	62.1	65.1	60.3	61.7	NA	25
	24-hour	8.3	15.1	21.8	25.3	24.7	27.8	13	5
	Annual	0.16	0.17	0.18	0.17	0.15	0.15	NA	1
Nitrogen Oxides	Annual	0.57	0.39	0.59	0.39	0.52	0.35	14	1
Carbon Monoxide (a)	1-hour	62.4	91.0	137.9	148.6	249.9	255.3	NA	2,000
	8-hour	17.2	30.6	51.8	60.4	105.4	114.9	575	500
Particulate Matter	24-hour	5.5	10.0	14.6	17.3	19.0	21.5	10	5
	Annual	0.11	0.11	0.12	0.12	0.12	0.11	NA	1
Arsenic	24-hour	0.0008	0.0015	0.0021	0.0024	0.0024	0.0027	NE	NA
Beryllium	24-hour	0.0004	0.0007	0.0011	0.0012	0.0012	0.0014	0.001	NA
Sulfuric Acid Mist	24-hour	1.83	3.35	4.84	5.61	5.49	6.18	NM	NA
<u>Simple Cycle</u>									
Sulfur Dioxide	3-hour	9.3	18.6	29.7	36.9	44.4	47.0	NA	25
	24-hour	1.4	3.3	6.1	8.6	11.7	13.7	13	5
	Annual	0.02	0.02	0.02	0.03	0.04	0.05	NA	1
Nitrogen Oxides	Annual	0.07	0.04	0.06	0.06	0.13	0.11	14	1
Carbon Monoxide	1-hour	19.2	33.2	58.6	72.7	159.2	169.4	NA	2,000
	8-hour	3.2	6.3	12.4	16.5	37.6	43.1	575	500
Particulate Matter	24-hour	0.9	2.2	4.1	5.9	9.1	10.6	10	5
	Annual	0.01	0.01	0.01	0.02	0.03	0.04	NA	1
Arsenic	24-hour	0.0001	0.0003	0.0006	0.0008	0.0011	0.0013	NE	NA
Beryllium	24-hour	0.0001	0.0002	0.0003	0.0004	0.0006	0.0007	0.001	NA
Sulfuric Acid Mist	24-hour	0.21	0.51	0.93	1.32	1.80	2.10	NM	NA

Note: NA= not applicable; NM= no ambient measurement method; NE= no monitoring method yet established.

(a) During power augmentation (80°F), the maximum 1-hour and 8-hour average concentrations are predicted to be 380 and 168 ug/m³, respectively with an emission rate of 313.4 lb/hr.

Source: KBN, 1994.

Table 5.6.1-5. Maximum Predicted SO₂ Concentrations Compared With AAQS--Refined Analysis

Averaging Time	Year	Concentration ($\mu\text{g}/\text{m}^3$)			Receptor Location*		Period Ending (YYMMDDHH)	Florida AAQS ($\mu\text{g}/\text{m}^3$)
		Total	Modeled Sources	Background	Direction (degrees)	Distance (m)		
Annual	1984	29	18	11	90	1,000	84-----	60
24-Hour HSH	1983	125	75.1	50	124	175	83020324	260
	1984	138	87.9	50	136	136	84032924	
	1985	138	88.3	50	120	196	85021224	
3-Hour HSH	1982	356	99.6	256	132	146	82011418	1,300
	1984	397	141	256	138	132	84032915	
	1985	406	150	256	16	217	85083121	

Note: YY = year.
MM = month.
DD = day.
HH = hour.
HSH = highest, second-highest.

* Relative to the midpoint between the locations of the two proposed HRSG stacks.

Source: KBN, 1994.

Table 5.6.1-6. Maximum Predicted PM10 Concentrations Compared With AAQS--Refined Analysis

Averaging Time	Year	Concentration ($\mu\text{g}/\text{m}^3$)			Receptor Location*		Period Ending (YYMMDDHH)	Florida AAQS ($\mu\text{g}/\text{m}^3$)
		Total	Modeled Sources	Background	Direction (degrees)	Distance (m)		
Annual	1984	24	4	20	336	1,000	84-----	50
	1986	24	4	20	352	1,000	86-----	
24-Hour HSH	1983	101	31	70	30	1,000	83041724	150
	1984	96	26	70	352	800	84030824	

Note: YY = year.
MM = month.
DD = day.
HH = hour.
HSH = highest, second-highest.

* Relative to the midpoint between the locations of the two proposed HRSG stacks.

Source: KBN, 1994.

Table 5.6.1-7. Maximum Predicted SO₂ Concentrations Compared with PSD Class II Increments--
Refined Analysis

Averaging Time	Modeled Source Concentration ($\mu\text{g}/\text{m}^3$)	Receptor Location ^a		Period Ending (YYMMDDHH)	Allowable PSD Increment ($\mu\text{g}/\text{m}^3$)
		Direction (degrees)	Distance (m)		
Annual	-4	90	1,000	85-----	20
24-Hour HSH	45.4	360	203	85083124	91
3-Hour HSH	150	16	217	85083121	512

Note: YY = year.
MM = month.
DD = day.
HH = hour.
HSH = highest, second-highest.

^a Relative to the midpoint between the locations of the proposed HRSG stacks.

Table 5.6.1-8. Maximum PM10 Concentrations Compared With PSD Class II Increments--Refined Analysis

Averaging Time	Concentration ($\mu\text{g}/\text{m}^3$)	Receptor Location*		Period Ending (YYMMDDHH)	Allowable PSD Increment ($\mu\text{g}/\text{m}^3$)
		Direction (degrees)	Distance (m)		
Annual	0.6	140	128	84-----	17
24-Hour HSH	14	136	136	84032924	30

Note: YY = year.
MM = month.
DD = day.
HH = hour.
HSH = highest, second-highest.

* Relative to the midpoint between the locations of the two proposed HRSG stacks.

Source: KBN, 1994.

Table 5.6.1-9. Summary of Maximum Predicted Impacts for Hardee Unit 3, Combined Cycle, at the PSD Class I Area--Westinghouse 501F, Distillate Oil at 100 Percent, 75 Percent, and 50 Percent Operating Loads

Pollutant	Averaging Period	Maximum Predicted Impacts (ug/m ³)						Significant Impact Level (ug/m ³)
		100 Percent Load		75 Percent Load		50 Percent Load		
		32 °F	95 °F	32 °F	95 °F	32 °F	95 °F	
<u>Combined Cycle</u>								
Sulfur Dioxide	3-hour	1.9	1.8	1.8	1.6	1.4	1.3	0.48
	24-hour	0.30	0.28	0.28	0.25	0.22	0.21	0.07
	Annual	0.012	0.011	0.011	0.010	0.008	0.008	0.025
Nitrogen Oxides	Annual	0.042 (a)	0.026	0.037	0.023	0.029	0.018	0.025
Particulate Matter	24-hour	0.20	0.19	0.19	0.17	0.17	0.16	0.33
	Annual	0.008	0.007	0.007	0.007	0.007	0.006	0.08

(a) Subsequent modeling was performed to account for fuel oil-firing for 1,500 hours and natural gas-firing for 7,260 hours, including 2,000 hours for power augmentation. The maximum annual impact was predicted to be 0.022 ug/m³ by adding: (0.042 ug/m³ x 1,500/8,760 hrs) [oil] + (0.016 ug/m³ x 5,760/8,760 hrs) [gas] + (0.019 ug/m³ x 2,000/8,760 hrs) [power augmentation]. The impacts for other temperatures and operating loads would be lower.

Source: KBN, 1994.

Table 5.6.1-10. Maximum SO₂ Concentrations Compared with PSD Class I Increments

Averaging Time	Concentration (μg/m ³)	Receptor Location ^a		Period Ending (YYMMDDHH)	Allowable PSD Increment (μg/m ³)
		UTM-E (m)	UTM-N (m)		
Annual	-0.4	341100	3183400	82-----	2
	-0.6	341100	3183400	83-----	
	0.3	343700	3178300	84-----	
	-0.4	340300	3165700	85-----	
	-0.3	342000	3174000	86-----	
24-Hour HSH	5.7	340700	3171900	82071524	5
	5.4	340300	3165700	83103024	
	5.4	342000	3174000	84061724	
	5.5	340300	3169800	85112724	
	6.4	343000	3176200	86053124	
3-Hour HSH	22.1	340300	3169800	82011724	25
	21.7	340300	3167700	83081006	
	18.4	340300	3169800	84071703	
	21.3	339000	3183400	85110806	
	26.4	341100	3183400	86111706	

Note: YY = year.
MM = month.
DD = day.
HH = hour.
HSH = highest, second-highest.

^a All receptor coordinates are reported in Universal Transverse Mercator (UTM) coordinates.

Source: KBN, 1994.

Table 5.6.1-11. Predicted 3-Hour and 24-Hour Violations of the SO₂ PSD Class I Increments and Source Contributions From Hardee Unit 3

Date Ending		Receptor UTM Location (km)		Predicted Impacts (ug/m ³) (a)		
Year	Date (MM/DD)	(E)	(N)	Total Impact	Contribution from Hardee Unit 3	
					ISCST2	MESOPUFF 5.10 (b)
24-Hour						
1982	6/10	340300	3169800	5.45	0.232	0.004
1982	6/10	340300	3167700	5.08	0.216	0.004
1982	7/15	340700	3171900	5.65	0	NA
1982	9/9	340700	3171900	5.27	0.011	NA
1983	7/30	340300	3165700	5.12	0.005	NA
1983	7/30	340300	3167700	5.06	0.005	NA
1983	10/30	340300	3165700	5.39	0	NA
1984	3/23	340300	3169800	5.09	0.024	NA
1984	3/23	340300	3167700	5.20	0.03	NA
1984	6/17	342000	3174000	5.40	0	NA
1985	11/12	340300	3167700	5.48	0	NA
1985	11/12	340700	3171900	5.14	0	NA
1985	11/16	340300	3165700	5.54	0	NA
1985	11/27	340300	3169800	5.55	0	NA
1986	2/1	340300	3165700	5.72	0	NA
1986	2/1	340300	3169800	5.45	0	NA
1986	3/8	343000	3176200	5.11	0	NA
1986	5/31	343000	3176200	6.42	0.217	0.0001
1986	6/1	340700	3171900	5.32	0	NA
1986	6/1	342000	3174000	6.15	0	NA
1986	6/1	343000	3176200	5.56	0	NA
1986	6/14	340300	3167700	5.14	0.150	0.002
1986	6/24	340700	3171900	5.20	0.098	0.001
1986	7/5	342000	3174000	5.46	0.061	NA
1986	7/12	339000	3183400	5.14	0.19	0.0002
1986	9/27	340300	3169800	5.35	0	NA
1986	9/27	340700	3171900	5.22	0	NA
1986	11/5	340700	3171900	5.54	0	NA
1986	11/5	342000	3174000	5.16	0	NA
1986	11/7	340300	3165700	5.26	0.008	NA
1986	11/11	343700	3178300	5.13	0	NA
1986	12/19	342000	3174000	5.20	0.065	NA
1986	12/19	343000	3176200	5.69	0.065	NA
3-Hour						
1986	11/17	341100	3183400	26.4	0.788	0.0002

Note: The 3-hour and 24-hour PSD Class I increments are 25 and 5 ug/m³, respectively.

- (a) Violations predicted by the ISCST2 model were for the 3-hour and 24-hour averaging times only. No annual violations were predicted.
- (b) MESOPUFF results generated only for events where ISCST2 model predicted the proposed facility to have impacts greater than the National Park Service Recommended Significance Levels for the 3-hour (0.48 ug/m³) and 24-hour (0.07 ug/m³) averaging periods.

Source: KBN, 1994.

Table 5.6.1-12. Summary of PSD Class I SO₂ Impacts for the Proposed Hardee Unit 3 and Other PSD Sources

ISCST2 Model Results									MESOPUFF Modeling for ISCST Periods(a) (Violations and Prop. Sig. Imp.) Proposed Only(b) (ug/m ³)		
Averaging Period	Exceedances		Violations		Violations with Sig. Impact from Proposed Unit				Total (ug/m ³)	Proposed (ug/m ³)	Proposed Only(b) (ug/m ³)
	Number	Periods	Number	Periods	Number	Periods					
24-hour											
1982	9	5	4	3	2	1	5.08	0.216	0.004		
							5.45	0.232	0.004		
1983	8	5	3	2	0	0	NA	NA	NA		
1984	9	5	3	2	0	0	NA	NA	NA		
1985	8	4	4	3	0	0	NA	NA	NA		
1986	30	14	19	13	4	4	6.42	0.217	0.0001		
							5.14	0.150	0.002		
							5.20	0.098	0.001		
							5.14	0.190	0.0002		
3-hour											
1982	2	1	0	0	0	0	NA	NA	NA		
1983	0	0	0	0	0	0	NA	NA	NA		
1984	0	0	0	0	0	0	NA	NA	NA		
1985	5	1	0	0	0	0	NA	NA	NA		
1986	4	3	1	1	1	1	26.4	0.79	0.0002		

(a) The periods in MESOPUFF included 3 days before and 2 days after the violation period identified in ISCST.

(b) For 1986, the proposed source was also modeled in MESOPUFF for the entire year.

The proposed source was predicted to have a significant impact for one 24-hour period (0.099 ug/m³) and no 3-hour periods.

By modeling all sources for that one 24-hour period, the highest impact was predicted to be -5.4 ug/m³

(modeling was based on ISCST2 model results for sources within 50 km, MESOPUFF results for sources beyond 50 km of the Class I area).

Table 5.6.1-13. Toxic Air Pollutant Impact Analysis for Hardee Unit 3--Maximum Concentrations

Constituent	Averaging Period	Predicted Impacts (ug/m³)						Florida NTL (ug/m³)
		Base Load		75 Percent Load		50 Percent Load		
		32 °F	95 °F	32 °F	95 °F	32 °F	95 °F	
Generic	Annual	6.50E-02	7.80E-02	8.80E-02	9.70E-02	1.03E-01	1.15E-01	NA
	24-hour	3.27E+00	7.03E+00	1.07E+01	1.46E+01	1.68E+01	2.17E+01	NA
	8-Hour	7.51E+00	1.60E+01	2.39E+01	3.15E+01	3.57E+01	4.44E+01	NA
Arsenic	Annual	1.58E-05	1.61E-05	1.73E-05	1.63E-05	1.45E-05	1.42E-05	2.30E-04
	24-hour	7.95E-04	1.45E-03	2.10E-03	2.45E-03	2.37E-03	2.68E-03	4.80E-01
	8-Hour	1.83E-03	3.31E-03	4.70E-03	5.28E-03	5.04E-03	5.48E-03	2.00E+00
Beryllium	Annual	8.07E-06	8.24E-06	8.80E-06	8.30E-06	7.44E-06	7.24E-06	4.20E-04
	24-hour	4.06E-04	7.42E-04	1.07E-03	1.25E-03	1.21E-03	1.37E-03	4.80E-03
	8-Hour	9.33E-04	1.69E-03	2.39E-03	2.69E-03	2.58E-03	2.80E-03	2.00E-02
Fluoride	Annual	1.05E-04	1.07E-04	1.14E-04	1.08E-04	9.68E-05	9.43E-05	NA
	24-hour	5.27E-03	9.65E-03	1.39E-02	1.62E-02	1.58E-02	1.78E-02	6.00E+00
	8-Hour	1.21E-02	2.20E-02	3.10E-02	3.50E-02	3.36E-02	3.64E-02	2.50E+01
Mercury	Annual	2.84E-05	2.90E-05	3.09E-05	2.92E-05	2.62E-05	2.55E-05	3.00E-01
	24-hour	1.43E-03	2.61E-03	3.76E-03	4.40E-03	4.28E-03	4.81E-03	1.20E-01
	8-Hour	3.28E-03	5.95E-03	8.40E-03	9.49E-03	9.09E-03	9.85E-03	5.00E-01
Sulfuric acid	Annual	3.64E-02	3.71E-02	3.97E-02	3.74E-02	3.36E-02	3.27E-02	NA
	24-hour	1.83E+00	3.35E+00	4.83E+00	5.63E+00	5.48E+00	6.18E+00	2.40E+00
	8-Hour	4.21E+00	7.63E+00	1.08E+01	1.21E+01	1.16E+01	1.26E+01	1.00E+01
Antimony	Annual	7.06E-05	7.19E-05	7.69E-05	7.25E-05	6.50E-05	6.33E-05	3.00E-01
	24-hour	3.55E-03	6.48E-03	9.35E-03	1.09E-02	1.06E-02	1.19E-02	1.20E+00
	8-Hour	8.15E-03	1.48E-02	2.09E-02	2.35E-02	2.25E-02	2.44E-02	5.00E+00
Barium	Annual	6.31E-05	6.43E-05	6.87E-05	6.48E-05	5.81E-05	5.66E-05	5.00E+01
	24-hour	3.17E-03	5.79E-03	8.36E-03	9.75E-03	9.47E-03	1.07E-02	1.20E+00
	8-Hour	7.29E-03	1.32E-02	1.87E-02	2.10E-02	2.01E-02	2.18E-02	5.00E+00
Cadmium	Annual	3.39E-05	3.46E-05	3.70E-05	3.48E-05	3.12E-05	3.04E-05	5.60E-04
	24-hour	1.71E-03	3.12E-03	4.50E-03	5.24E-03	5.09E-03	5.74E-03	1.20E-01
	8-Hour	3.92E-03	7.10E-03	1.00E-02	1.13E-02	1.08E-02	1.17E-02	5.00E-01
Chlorine	Annual	8.21E-05	8.36E-05	8.95E-05	8.43E-05	7.56E-05	7.36E-05	4.00E-01
	24-hour	4.13E-03	7.54E-03	1.09E-02	1.27E-02	1.23E-02	1.39E-02	3.60E+00
	8-Hour	9.48E-03	1.72E-02	2.43E-02	2.74E-02	2.62E-02	2.84E-02	1.50E+01

Table 5.6.1-13. Toxic Air Pollutant Impact Analysis for Hardee Unit 3--Maximum Concentrations

Constituent	Averaging Period	Predicted Impacts (ug/m³)						Florida NTL (ug/m³)
		Base Load		75 Percent Load		50 Percent Load		
		32 °F	95 °F	32 °F	95 °F	32 °F	95 °F	
Chromium	Annual (a)	2.63E-05	2.68E-05	2.86E-05	2.70E-05	2.42E-05	2.36E-05	8.30E-05
	24-hour	7.72E-03	1.41E-02	2.03E-02	2.37E-02	2.30E-02	2.60E-02	1.20E-01
	8-Hour	1.77E-02	3.21E-02	4.54E-02	5.12E-02	4.90E-02	5.31E-02	5.00E-01
Cobalt	Annual	2.93E-05	2.98E-05	3.19E-05	3.01E-05	2.70E-05	2.63E-05	NA
	24-hour	1.47E-03	2.69E-03	3.88E-03	4.52E-03	4.40E-03	4.96E-03	1.20E-01
	8-Hour	3.38E-03	6.13E-03	8.67E-03	9.76E-03	9.34E-03	1.01E-02	5.00E-01
Copper	Annual	4.20E-03	4.28E-03	4.58E-03	4.31E-03	3.87E-03	3.77E-03	NA
	24-hour	2.11E-01	3.86E-01	5.57E-01	6.49E-01	6.31E-01	7.11E-01	4.80E-01
	8-Hour	4.85E-01	8.80E-01	1.24E+00	1.40E+00	1.34E+00	1.45E+00	2.00E+00
Formaldehyde	Annual	1.31E-03	1.33E-03	1.43E-03	1.34E-03	1.20E-03	1.17E-03	7.70E-02
	24-hour	6.58E-02	1.20E-01	1.73E-01	2.02E-01	1.96E-01	2.21E-01	2.88E+00
	8-Hour	1.51E-01	2.74E-01	3.87E-01	4.36E-01	4.18E-01	4.53E-01	1.20E+01
Manganese	Annual	1.10E-03	1.12E-03	1.20E-03	1.13E-03	1.01E-03	9.85E-04	4.00E-01
	24-hour	5.52E-02	1.01E-01	1.46E-01	1.70E-01	1.65E-01	1.86E-01	1.20E+01
	8-Hour	1.27E-01	2.30E-01	3.25E-01	3.66E-01	3.50E-01	3.80E-01	5.00E+01
Nickel	Annual (a)	6.63E-04	6.76E-04	7.23E-04	6.82E-04	6.11E-04	5.95E-04	4.20E-03
	24-hour	1.95E-01	3.56E-01	5.14E-01	6.00E-01	5.82E-01	6.56E-01	2.40E+00
	8-Hour	4.48E-01	8.11E-01	1.15E+00	1.29E+00	1.24E+00	1.34E+00	1.00E+01
Polycyclic Organic Matter	Annual	8.98E-07	9.15E-07	9.79E-07	9.22E-07	8.27E-07	8.06E-07	NA
	24-hour	4.52E-05	8.25E-05	1.19E-04	1.39E-04	1.35E-04	1.52E-04	NA
	8-Hour	1.04E-04	1.88E-04	2.66E-04	2.99E-04	2.87E-04	3.11E-04	NA
Selenium	Annual	7.56E-05	7.71E-05	8.25E-05	7.77E-05	6.97E-05	6.79E-05	NA
	24-hour	3.81E-03	6.95E-03	1.00E-02	1.17E-02	1.14E-02	1.28E-02	2.00E+00
	8-Hour	8.74E-03	1.58E-02	2.24E-02	2.52E-02	2.41E-02	2.62E-02	4.80E-01
Vanadium	Annual	2.24E-04	2.29E-04	2.45E-04	2.31E-04	2.07E-04	2.01E-04	2.00E+01
	24-hour	1.13E-02	2.06E-02	2.98E-02	3.47E-02	3.37E-02	3.80E-02	1.20E-01
	8-Hour	2.59E-02	4.70E-02	6.65E-02	7.49E-02	7.16E-02	7.78E-02	5.00E-01
Zinc	Annual	5.10E-03	5.20E-03	5.57E-03	5.24E-03	4.70E-03	4.58E-03	NA
	24-hour	2.57E-01	4.69E-01	6.77E-01	7.89E-01	7.66E-01	8.64E-01	NA
	8-Hour	5.89E-01	1.07E+00	1.51E+00	1.70E+00	1.63E+00	1.77E+00	NA

(a) Based on firing fuel oil for 1,500 hours (for other pollutants, fuel oil was assumed to be fired for entire year).

Table 5.6.1-14. Examples of Lowest Observed Effect Levels of Air Pollutants

Pollutant	Reported Effect	Concentration ($\mu\text{g}/\text{m}^3$)	Exposure
Sulfur Dioxide	Respiratory stress in guinea pigs	427 to 854	1 hour
	Respiratory stress in rats	267	7 hours/day ^a ; 5 day/week for 10 weeks
	Decreased abundance in deer mice	13-157	continually ^b for 5 months
Nitrogen Dioxide	Respiratory stress in mice	1,917	3 hours
	Respiratory stress in guinea pigs	95 to 950	8 hr/day for ^a 122 days

^a Used to compare as a range between 3-hour and 24-hour averaging times.

^b Used to compare with annual averaging times.

Source: Adapted from Newman (1981) and Newman and Schreiber (1988)

Table 5.6.1-15. NO₂ Doses Reported to Affect Plant Species Similar to Vegetation in the Region of Hardee Unit 3

Species	Dose and Effect	Reference
Ryegrass	39.5 $\mu\text{g}/\text{m}^3$ for 6 minutes had no effect on shoot weight	Lane and Bell, 1984
Citrus	470 $\mu\text{g}/\text{m}^3$ for 290 days injured trees	Thompson <i>et al.</i> , 1970
Sphagnum	11.7 $\mu\text{g}/\text{m}^3$ averaged over 18 months compared with control of 4.8 $\mu\text{g}/\text{m}^3$ (exceeded 15 $\mu\text{g}/\text{m}^3$ 4 times) reduced growth	Press <i>et al.</i> , 1986

Source: KBN, 1994.

Table 5.6.1-16. Summary of Maximum Predicted Impacts for Hardee Unit 3 at PSD Class I Area for the AQRV Analysis

Pollutant	Averaging Period	Maximum Predicted Impacts (µg/m³)		
		Project Only	Background Concentration	Total
<u>Combined Cycle</u>				
Sulfur Dioxide	1-Hour	2.9	335	337.9
	3-Hour	1.9	335	336.9
	8-Hour	1.0	335	336.0
	24-Hour	0.30	67	67.3
	Annual	0.012	7	7.0
Nitrogen Dioxides	Annual	0.042	NA	NA
Particulate Matter	24-Hour	0.20	NA	NA
	Annual	0.008	NA	NA

Source: KBN, 1994.

5.6.2 MONITORING PROGRAMS

5.6.2.1 POST-CONSTRUCTION AMBIENT AIR QUALITY MONITORING

Post-construction ambient air quality monitoring is not anticipated to be required for this project since the air quality analyses demonstrate that the proposed project will comply with all applicable ambient standards.

5.6.2.2 CONTINUOUS AIR EMISSIONS MONITORING

The Hardee Unit 3 Project will be subject to 40 CFR 60, GG. Continuous monitoring of fuel consumption and ratio of water to fuel oil being fired in the turbines will be conducted as requested by Subpart GG, Section 60.334(b). Initial performance testing of the CTs for NO_x and SO₂ emissions will be conducted as stipulated by Subpart GG, Section 60.335.

Initial and periodic performance testing of pollutants emitted by the facility will be conducted pursuant to FDEP and federal requirements. FDEP test methods are specified in Chapter 17-297, F.A.C.

Continuous emission monitoring for NO_x and SO₂ is required for the project because the combustion turbines are defined as new units in EPA's Acid Rain Program. The Acid Rain Program was delineated in Title IV of the CAA Amendments and required EPA to develop the program. EPA's final regulations were promulgated on January 11, 1993, and included permit provisions (40 CFR Part 72), allowance system (Part 73), continuous emission monitoring (Part 75), excess emission procedures (Part 77), and appeal procedures (Part 78).

Under 40 CFR Part 75, specific provisions for monitoring SO₂ emissions (Part 75.11) and NO₂ emissions (Part 75.12) are identified for gas-fired and oil-fired (nonpeaking) units. When an SO₂ CEM is selected to determine mass SO₂ emissions, a flow monitor is also required. Alternatively, SO₂ emissions may be determined using procedures established in Appendix D, Part 75 (flow proportional oil sampling or manual daily oil sampling). For determining NO_x emission, a diluent gas monitor in the NO_x monitoring system may measure either O₂ or CO₂ concentration in the flue gases. CO₂ emissions must also be determined either through a continuous emission monitoring (as a diluent for NO_x monitoring) or calculation. Alternate procedures, test methods, and quality assurance and control procedures are specified in Part 75, Appendices A through I. New units are required to meet the requirements by January 1, 1995, or not later than 90 days

after the unit commences commercial operation. The expected inservice date for Hardee Unit 3 is January 1, 1999.

5.7 NOISE IMPACTS

5.7.1 IMPACTS TO ADJACENT PROPERTIES

The noise monitoring data collected during the onsite field sampling effort were utilized in the noise impact analysis at the proposed property boundaries. The impact analysis was performed using NOISECALC (NYDPS, 1986), a sound propagation computer program. (See Appendix 11.7 for a brief discussion of NOISECALC's modeling criteria and data output.)

EPA has developed indoor and outdoor noise level criteria for various land use categories that were promulgated as a guideline for protecting public health and welfare (Table 5.7.1-1). These criteria are related to short-term sound pressure level (SPL) measurement periods, i.e., 24-hour equivalent SPL [$L_{eq}(24)$] and day-night average SPL (L_{dn}). The L_{eq} is the equivalent constant SPL that would be equal in sound energy to the varying SPL over the same period of time. The L_{dn} is the 24-hour average SPL calculated for the two daily time periods, i.e., day and night, with a 10 dBA weighting added to the nighttime SPL. The equation for L_{dn} is:

$$L_{dn} = 10 \log 1/24 [15 \times 10^{(L_d/10)} + 9 \times 10^{(L_n + 10)/10}]$$

where: L_d = daytime L_{eq} for the period from 0700 to 2200 hours, and

L_n = nighttime L_{eq} for the period from 2200 to 0700 hours.

EPA recommends an outdoor $L_{eq}(24)$ of 70 dBA for general unpopulated lands and an outdoor L_{dn} of 55 dBA for residential areas. As stated in Section 2.3.8, neither Polk County nor Hardee County has a noise standard applicable to the receiving lands adjacent to the Hardee Unit 3 site.

Table 5.7.1-2 presents the proposed facility's octave band input data, based upon preliminary engineering design information, that was used in the NOISECALC program. Noise impacts were predicted at each of the receiver sites depicted in Figure 5.7.1-1. The program calculated SPLs due to the proposed facility, utilizing the onsite background and minimum L_{eq} noise levels, (Tables 5.7.1-3 and 5.7.1-4, respectively). As indicated, the maximum calculated SPL impact with the background levels taken into account was 64.6 dBA at Receiver Site B for background L_{eq} and 64.5 dBA at Receiver Site B for minimum background. The minimum predicted SPL impacts occurred at Receiver Site F (residences) with a value of 47.2 dBA for minimum and L_{eq} background.

The overall predicted noise impacts of the proposed facility at the property boundary are below the EPA guideline value of 70 dBA. Since attenuation factors, such as ground cover, foliage, etc., were not used in determining the noise impacts, the actual impact of the proposed facility at the property boundary will most likely be less than predicted by the model.

Predicted noise levels at the nearest residential area are expected to be slightly above background levels. Assuming a noise level of 47.2 dBA for daytime and nighttime, the corresponding calculated L_{dn} value is 53.6 dBA, which is below the EPA guideline of 55 dBA for residential areas.

Table 5.7.1-1. EPA-Recommended Noise Criteria

	Measure ^a	Indoor			Outdoor		
		Activity Interference	Hearing Loss Consideration	To Protect Against Both Effects (b)	Activity Interference	Hearing Loss Consideration	To Protect Against Both Effects (b)
Residential With Outside Space and Farm Residences	L_{dn}	45		45	55		55
	$L_{eq}(24)$		70			70	
Residential With No Outside Space	L_{dn}	45		45			
	$L_{eq}(24)$		70				
Commercial	$L_{eq}(24)$	(a)	70	70(c)	(a)	70	70(c)
Inside Transportation	$L_{eq}(24)$	(a)	70	(a)			
Industrial	$L_{eq}(24)(d)$	(a)	70	70(c)	(a)	70	70(c)
Hospitals	L_{dn}	45		45	55		55
	$L_{eq}(24)$		70			70	
Educational	$L_{eq}(24)$	45		45	55		55
	$L_{eq}(24)(d)$		70			70	
Recreational Areas	$L_{eq}(24)$	(a)	70	70(c)	(a)	70	70(c)
Farmland and General Unpopulated Land	$L_{eq}(24)$				(a)	70	70(c)

Notes:

- Since different types of activities appear to be associated with different levels, identification of a maximum level for activity interference may be difficult except in those circumstances where speech communication is a critical activity.
- Based on lowest level.
- Based only on hearing loss.
- An $L_{eq}(8)$ of 75 dB may be identified in these situations so long as the exposure over the remaining 16 hours per day is low enough to result in a negligible contribution to the 24-hour average, i.e., no greater than an L_{eq} of 60 dB.

^a L_{dn} is the day-night average A-weighted equivalent sound level, with a 10-decibel weighting applied to nighttime levels.
 $L_{eq}(24)$ is the equivalent A-weighted sound level over 24 hours.

Source: EPA, 1974.

Table 5.7.1-2. Summary of Sound Power Levels of Major Noise Sources for Use in the Noise Impact Analysis

Source	Source Location ^a		Source Height ^b (m)	Sound Power Level (dB) for Octave Band Center Frequency (Hz)									Overall Sound Power Level (dBA)
	X (m)	Y (m)		31.5	63	125	250	500	1K	2K	4K	8K	
Transformer (North CT)	70.8	47.7	3.1	102	108	110	105	107	99	94	89	82	106.4
Transformer (Steam Turbine)	70.1	0.0	3.1	102	108	110	105	107	99	94	89	82	106.4
Transformer (South CT)	70.1	-29.8	3.1	102	108	110	105	107	99	94	89	82	106.4
HRSO (North)	-12.5	40.8	13.3	140	134	132	125	121	114	113	117	108	124.3
HRSO (South)	-12.9	-37.5	13.3	140	134	132	125	121	114	113	117	108	124.3
CT Air Inlet (North)	52.8	30.5	12.2	116	114	112	102	106	108	107	103	105	113.1
CT Air Inlet (South)	52.9	-46.0	12.2	116	114	112	102	106	108	107	103	105	113.1
Generator (North CT)	55.2	48.0	1.5	107	115	122	109	101	108	103	99	98	112.1
Generator (Steam Turbine)	45.7	0.0	1.5	107	115	122	109	101	108	103	99	98	112.1
Generator (South CT)	52.8	-30.5	1.5	107	115	122	109	101	108	103	99	98	112.1
CT Enclosure (North)	32.6	40.3	8.8	111	109	102	96	102	92	95	105	98	107.7
CT Enclosure (South)	34.7	-38.5	8.8	111	109	102	96	102	92	95	105	98	107.7
Mechanical Package (North CT)	38.4	47.4	1.5	110	109	111	102	100	97	97	98	92	104.9
Mechanical Package (South CT)	38.4	-30.0	1.5	110	109	111	102	100	97	97	98	92	104.9
Steam Turbine	33.5	0.0	4.6	113	117	118	115	114	116	114	114	113	121.4
Water Treatment Building	121.3	81.8	6.1	91	99	89	95	87	71	69	60	49	88.7
Circulating Water Pump	-562.5	109.3	4.9	98	103	102	101	100	99	101	97	92	105.9

Note: Data based on representative values for base design equipment.

^a Relative to a grid center location at the general services building.^b Represents the noise source height used for noise modeling purposes.Sources: Black & Veatch, 1994.
KBN, 1994.

Table 5.7.1-3. Impact Results Using Average L_{eq} Background Values (all values dBA)

Receiver Site	Description	Background ^a	Proposed Facility w/o Background	Proposed Facility w/Background
A	North Boundary of Proposed Site	47.2	64.2	64.3
B	East Boundary of Proposed Site	48.7	64.5	64.6
C	Southeast Boundary of Proposed Site	48.7	56.5	57.2
D	South Boundary of Proposed Site	42.0	54.7	55.0
E	West Boundary of Proposed Site	42.0	57.5	57.6
F	South of Proposed Site (@ Residences)	43.9 ^b	44.4	47.2

^a Average values of collected data.

^b Background value based on a previous analyses for predicted noise levels due to the existing Hardee Power Station.

Source: KBN, 1994.

Table 5.7.1-4. Impact Results Using Average Minimum Background Values (all values dBA)

Receiver Site	Description	Background ^a	Proposed Facility w/o Background	Proposed Facility w/Background
A	North Boundary of Proposed Site	44.4	64.2	64.3
B	East Boundary of Proposed Site	45.8	64.5	64.5
C	Southeast Boundary of Proposed Site	45.8	56.5	56.9
D	South Boundary of Proposed Site	39.6	54.7	54.9
E	West Boundary of Proposed Site	39.6	57.5	57.6
F	South of Proposed Site (@ Residences)	43.9 ^b	44.4	47.2

^a Average values of collected data.

^b Background value based on a previous analyses for predicted noise levels due to the existing Hardee Power Station.

Source: KBN, 1994.

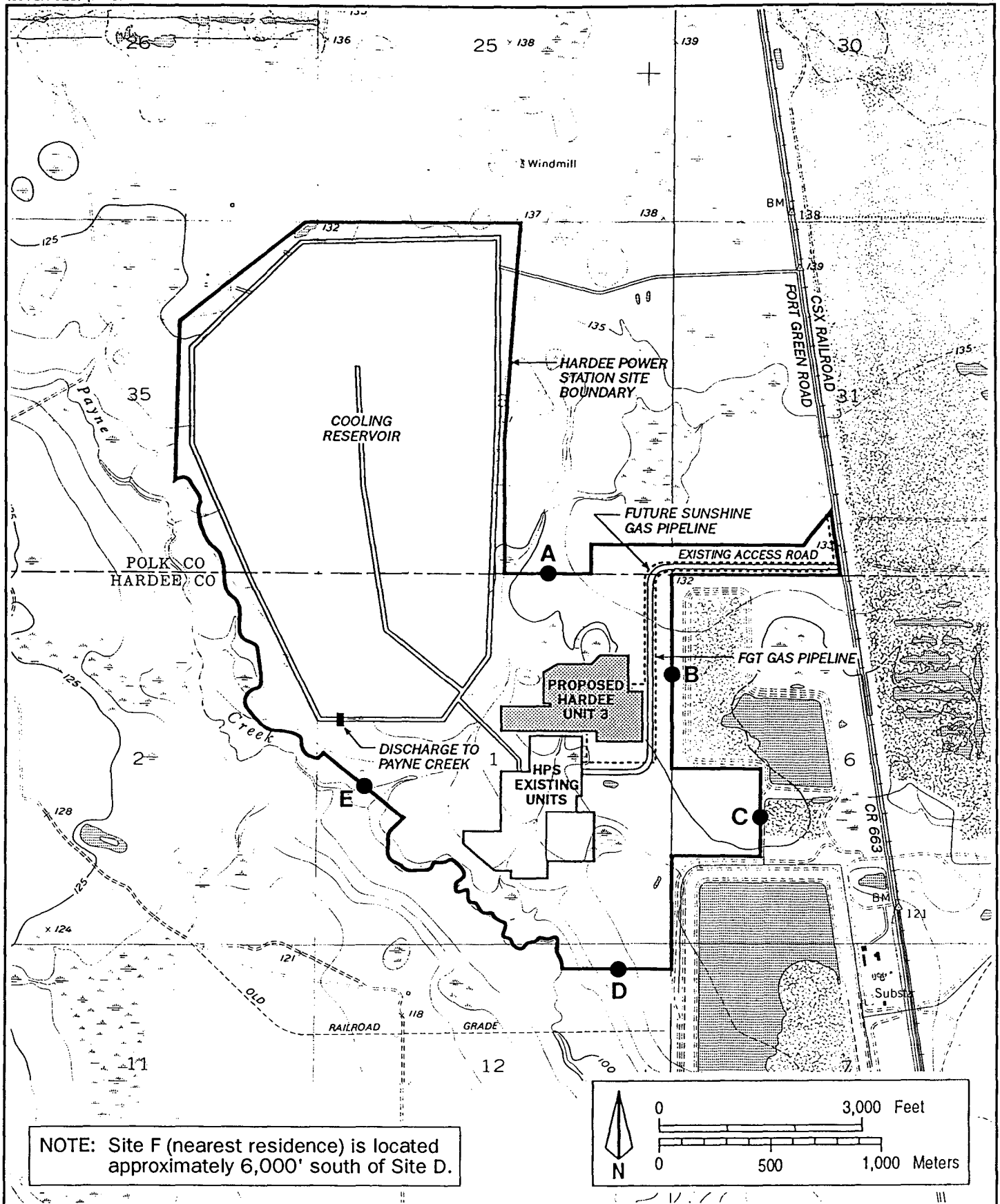


Figure 5.7.1-1
Receiver Sites Used for the Operational Noise Impact Analysis

Sources: USGS, 1987; KBN, 1994.



5.7.2 IMPACT TO BIOTA

The projected noise from plant operation will not have any effect on surrounding biota. Wildlife species in the area have been exposed to similar noise conditions from mining, from operation of the HPS facility, and from other industrial activities in this region for years.

5.8 CHANGES TO NON-AQUATIC SPECIES POPULATION

5.8.1 FLORA

Potential impacts to onsite and regional vegetation due to plant operation are limited since the proposed facility will use the existing cooling reservoir for condenser cooling and the facility will be constructed on previously impacted and cleared land.

Operation of the condenser cooling system for the proposed facility will not require any significant changes in the current operational procedures for the existing cooling reservoir. The frequency and duration of discharges from the cooling reservoir will not be altered as a result of the Hardee Unit 3 Project. No additional impacts to onsite or regional vegetation or wetlands will result from the condenser cooling system for the proposed facility. The circulation water pipeline will cross the unnamed tributary immediately west of the proposed facility but will be elevated above ground level and will not significantly impede water flow. Vegetation immediately adjacent to the circulating water pipelines will be maintained at a maximum height of 46 cm (18 inches) in the wetland.

Non-contact stormwater runoff from the Hardee Unit 3 facility will be directed to the stormwater detention pond for treatment prior to discharge to the unnamed wetland tributary to Payne Creek. The point of discharge from the detention pond will be constructed (e.g., weir, riprap, etc.) and operated in a manner that controls erosion and scouring of the adjacent wetlands. Impacts to the unnamed tributary and adjacent wetlands associated with the discharge of non-contact stormwater runoff will be minimal. This tributary will serve as a drainageway during preconstruction activities and will continue to function in the same manner following construction of the proposed facility. Offsite wetlands will not be affected by operation of the Hardee Unit 3 facility.

The temperature of the cooling reservoir will increase slightly as a result of the thermal input from the proposed facility. Average temperatures on the cool side of the reservoir will not change significantly from current conditions. The maximum worst-case monthly discharge condition is predicted to be 35.4°C (95.7°F). Levitt (1972) reported that many species can endure temperatures of 35 to 45°C (96 to 113°F) but are killed by a temperature of 45 to 46°C (113 to 115°F). The effects of heated effluent on wetland vegetation have been reported by researchers at the Savannah River Plant in South Carolina. *Ludwigia leptocarpa*, a herbaceous

semi-aquatic species, exhibited higher seed production and shoot height in thermally altered sites than in a control site. Under controlled temperatures in a growth chamber, shoot height and plant biomass were higher at 32°C (89.6°F) and lower at 42°C (107.6°F) than the 22°C (71.6°F) control plants (Christy and Sharitz, 1980). Donovan *et al.* (1988) studied growth of bald cypress, water tupelo, black willow, and button bush seedlings under various water temperature and flooding regimes. Growth with water temperatures about 5°C (9°F) higher than ambient temperatures was similar to growth with ambient water temperatures. However, growth in saturated or flooded conditions with water temperatures about 10°C (18°F) higher than ambient temperatures [ranging from 28 to 45°C (82 to 113°F) throughout the year] resulted in detrimental effects to all species. Since the water temperature in a limited section (mixing zone) of Payne Creek during high-flow conditions is not expected to exceed 35.4°C (95.7°F) even under worst-case conditions, no damage to floodplain vegetation is expected from the discharge from the cooling reservoir.

Discharge pipes crossing the unnamed tributary will transport circulating water to and from the condenser cooling system and treated low-volume plant wastewater. Both the circulating water pipes and the low-volume wastewater pipes will be elevated above the tributary and associated wetland and will not restrict water flow.

The circulating water pipes are planned to consist of 84-inch-diameter prestressed concrete cylinder pipe. The concrete cylinder pipe will be provided with a concrete-encased 16-gage steel cylinder core. Individual segments of the concrete pipe will be joined using O-rings and then grouted to ensure the integrity of the joint. Studies of the reliability of the proposed prestressed concrete pipe show this material to be very durable and the potential for failure to be extremely low. The practice of grouting the joints will provide sufficient protection against corrosion, and the placement of the pipes aboveground at the tributary crossing will allow for visual inspection on a regular basis.

The wastewater piping will be constructed of 10-inch-diameter fiberglass reinforced pipe (FRP), "Bondstrand 2000" or equivalent. This material was specifically selected to eliminate the possibility of corrosion and is the same material used for the wastewater piping for the HPS existing units. The wastewater piping for the Hardee Unit 3 facility will be installed aboveground and will be provided with expansion joints at required intervals to account for thermal expansion.

The aboveground placement of the wastewater pipes will allow visual inspection on a regular basis.

The selection of the noncorrosive FRP construction material for the wastewater piping, combined with the use of expansion joints and the ability for visual inspection of the pipe, effectively eliminates the potential for a significant impact to the onsite wetland crossing. All wastewater will be treated prior to being routed to the cooling reservoir. In the unlikely event a leak is detected in one of the circulating pipes or the low-volume wastewater pipe, appropriate measures will be taken to stop the leak and prevent damage to the tributary and its associated wetlands.

5.8.2 FAUNA

The existing cooling reservoir is used for foraging and resting habitat by wading birds and other avian species as well as mammals, reptiles, and amphibians. No adverse impacts will occur to fauna utilizing the cooling reservoir as a result of the additional thermal loading from Hardee Unit 3.

Operational activities within the fenced area of the Hardee Unit 3 facility will preclude wildlife from the immediate area. Wildlife associated with the unnamed tributary to Payne Creek will have access to the tributary from the north since all facilities associated with the Hardee Unit 3 Project will be located south of the tributary.

5.9 TRANSPORTATION IMPACTS AND OTHER PLANT OPERATION EFFECTS

The construction activities associated with the Hardee Unit 3 site are expected to be completed in early 1999, and the commencement of the plant operation activities will take place immediately thereafter. The analysis of transportation impacts on the surrounding roadway network was conducted to reflect 1999 conditions.

Operation of Hardee Unit 3 will require approximately 35 employees working three shifts daily. Similar to the construction effort, it is anticipated that most of the operating jobs will be filled by people residing within commuting distance of the plant. Eighty-five percent of the operational workforce is expected to reside in areas north of the plant with the remaining 15 percent commuting from areas south of the plant site.

For determining the operational traffic impact area (TIA), a vehicle occupancy rate of 1 employee per vehicle was assumed. It was also assumed that two shifts were arriving and departing simultaneously during the p.m. peak hour. The total number of vehicles arriving or departing the site is estimated to be 24. The same methodology as identified in Section 4.6.3 was used to determine the project TIA. The results of the analysis are listed in Table 5.9.0-1. Only two roadway links are located in the operational TIA:

Fort Green Road

Polk County Line (HPS Site Entrance) to CR 630

CR 663

Hardee County Line (HPS Site Entrance) to SR 62

To analyze the affected links, existing traffic counts were projected to reflect 1999 traffic volumes. As discussed in Section 4.6.3, a 2.1 percent annual growth rate compounded annually was added to the current traffic counts to reflect the 1999 estimates. After the background traffic was calculated, traffic expected to use these links as identified in the TECO and FPC project documents was added to the background traffic. The project's operational workforce traffic was subsequently added to the background traffic to obtain the 1999 projected conditions with project traffic. The results of this analysis are listed in Table 5.9.0-2. The affected links are expected to operate at LOS A.

The two intersections associated with these links were also analyzed as previously described in Section 4.6.3, and the results are provided in Table 5.9.0-3. Both intersections are expected to operate at an acceptable LOS (i.e., LOS C or higher).

In addition to the peak-hour evaluation, total project operational trip generation data were calculated for the Hardee Unit 3 Project. Table 5.9.0-4 identifies the total number of daily trip ends associated with the project.

As previously identified in Section 2.2.2, only Polk County currently has a formal concurrency determination review process. A copy of the completed minor traffic review application required in Polk County Ordinance 92-10 is included in Appendix 10.13 for informational purposes. Since no formal review process exists in Hardee County at the current time, this discussion in conjunction with FPPSA will demonstrate compliance with Hardee County's concurrency requirements.

Table 5.9.0-1. Percent of Project Traffic on the Operation Traffic Impact Area

Roadway	Hardee County ^a LOS C	Polk County LOS C	FDOT LOS C	Project Traffic	Percent of LOS C Impact
CR 663					
HPS Entrance to SR 62	460	NA	NA	4	0.9
Fort Green Road					
HPS Entrance to CR 630	NA	540	NA	24	4.4

^a For peak-hour roadway capacities, Hardee County uses FDOT's Generalized Roadway Planning Capacities.

Sources: FDOT, 1992.
Polk County, 1992.
KBN, 1994.

Table 5.9.0-2. Peak-Hour p.m. Link Analysis for Operation Traffic

Link	1999 Background Traffic	FPC Traffic	TECO Traffic	Project Traffic	Total Traffic	Level of Service
POLK COUNTY						
Fort Green Road						
HPS to CR 630	72	0	4	24	100	A
HARDEE COUNTY						
CR 663						
HPS to SR 62	126	0	0	4	130	A

Sources: TECO, 1992.
FPC, 1992.
HCS, 1985.
KBN, 1994.

Table 5.9.0-3. 1999 Operation--p.m. Peak-Hour Intersection Analysis

Intersection	Lowest LOS per Intersection Movement	
	1999 Background Level of Service	1999 Project Level of Service
POLK COUNTY		
CR 630 and Fort Green Road	B	C
HARDEE COUNTY		
CR 663 and SR 62	A	A

Note: All intersections were analyzed using non-signalized intersection methodology.

Sources: Transportation Research Board/National Research Council, 1985.
KBN, 1994.

Table 5.9.0-4. Estimated Operation Project Average Daily Traffic

Traffic Type	Trip Rate	Daily Trip Ends
Employees (35)	2.35 trips per Employee ^a	83
Fuel Oil Trucks (13)	2.0 trips per Truck	<u>26</u>
TOTAL		109

^a Trip generation rate obtained from FPC and TECO studies referencing a Kimley-Horn Report for FPL power plant in Martin County, Florida.

Source: KBN, 1994.

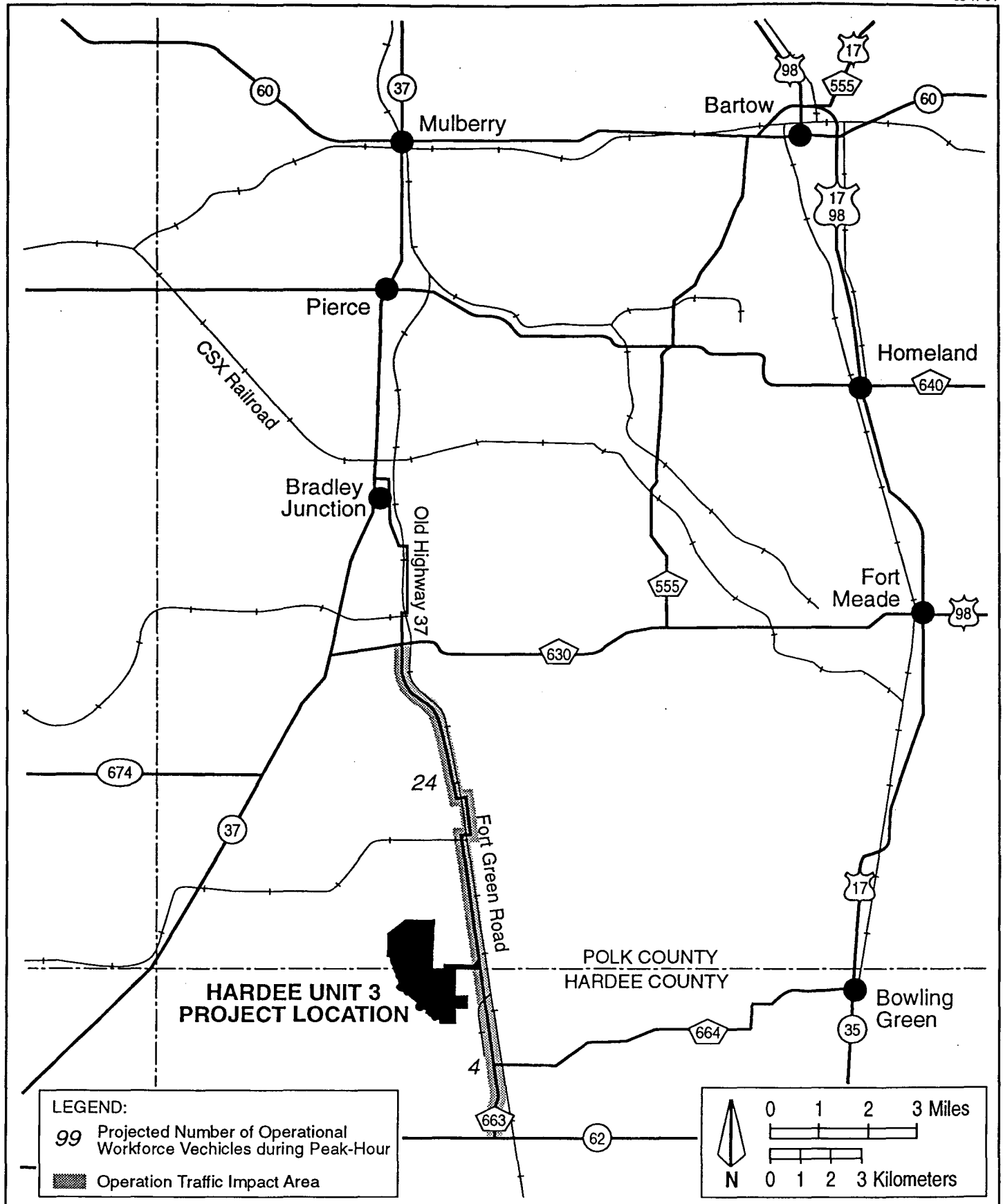


Figure 5.9.0-1
Hardee Unit 3 Peak-Hour Operation Traffic

Source: KBN, 1994.



5.10 ARCHAEOLOGICAL SITES

No significant archaeological and historic site or sites recommended for preservation occur on the HPS site (see Section 2.2.6). In addition, DHR has been contacted regarding this project and concluded that the project can proceed without any further involvement with DHR and no additional studies are required (see Appendix 10.6).

Because of the lack of archaeological sites within the HPS site and the opinion of DHR, no active, onsite post-construction monitoring is planned. However, if any cultural resources are discovered, the Applicant will implement the "chance-find" procedures described in Section 4.8.

5.11 RESOURCES COMMITTED

The major irreversible and irretrievable commitments of national, state, and local resources due to operation of Hardee Unit 3 are the use of land and the consumption of water, natural gas, and fuel oil.

The land areas used by the Hardee Power Station have mostly been mined and reclaimed to pasture. The Hardee Unit 3 project will use those previously mined lands for energy production.

Some groundwater and surface water will be consumed (i.e., evaporated) in the operation of the cooling reservoir (see Section 5.3). However, no additional groundwater allocation will be required for operation of Hardee Unit 3. No short- or long-term impacts to local surface water and groundwater resources or water users are anticipated from the proposed water use by the Hardee Unit 3 Project.

Natural gas and fuel oil will be consumed as fuel. The amounts are described in Chapter 3.0. This is an irreversible and irretrievable commitment of national energy resources for the production of electricity for the state of Florida.

5.12 VARIANCES

A mixing zone and zone of discharge will be required for specific surface water and groundwater parameters, as discussed in Sections 5.1.1 and 5.2.1, consistent with the previously approved mixing zone and zone of discharge for the HPS site. No variances will be required for the operation of Hardee Unit 3.

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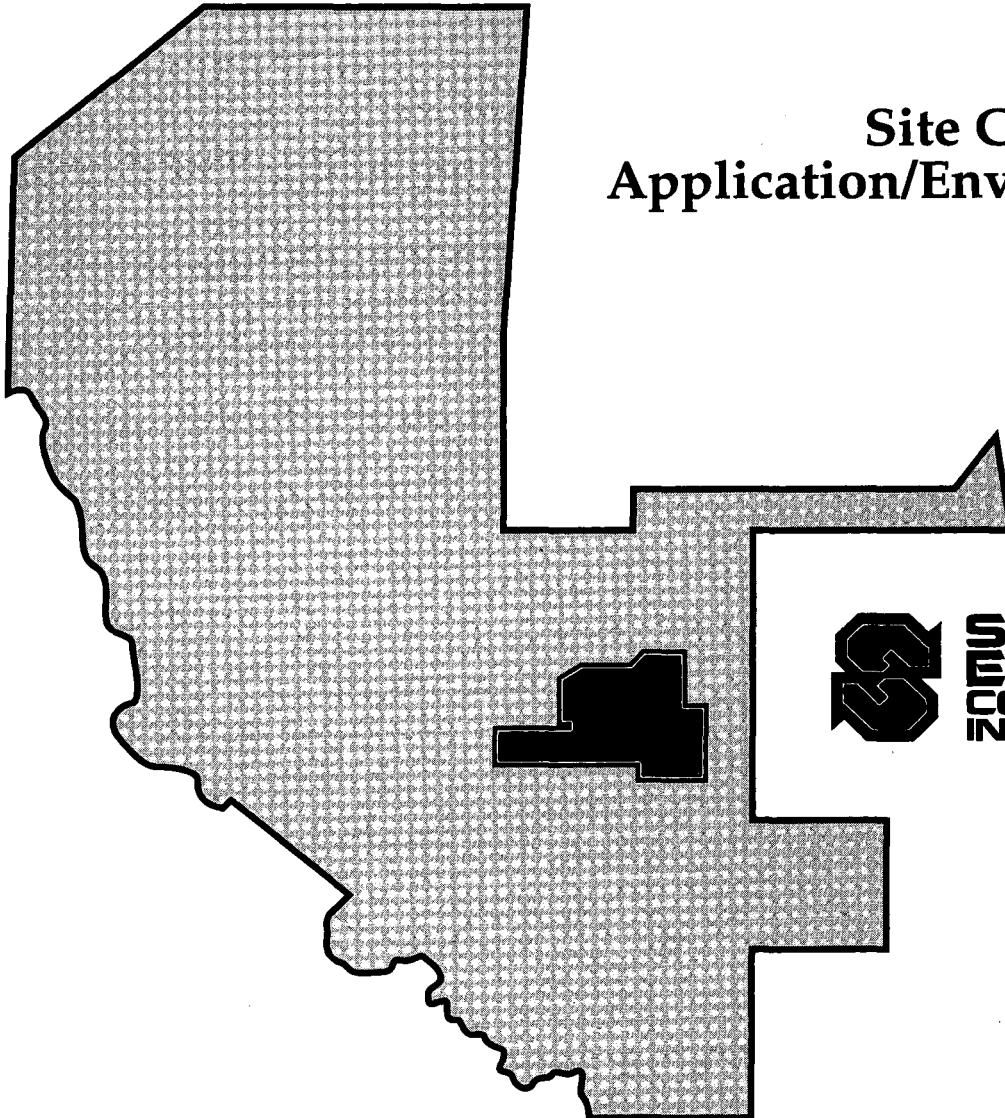
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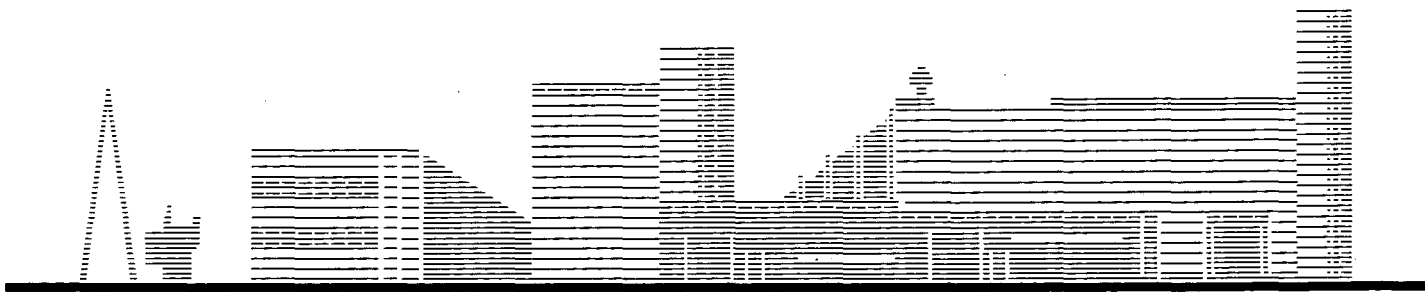
HARDEE UNIT 3

Site Certification
Application/Environmental
Analysis

Chapter 6.0



**SEMINOLE
ELECTRIC
COOPERATIVE
INCORPORATED**

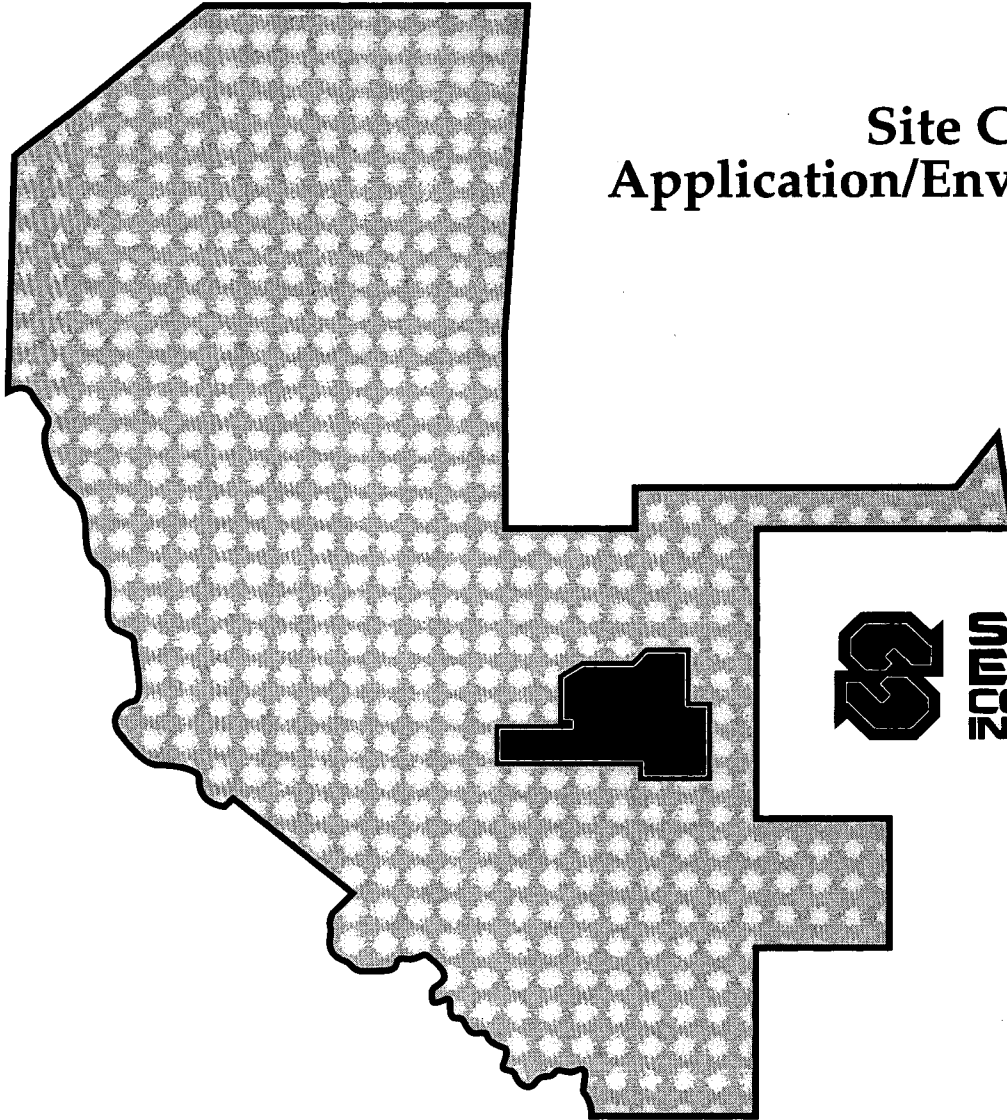


6.0 TRANSMISSION LINES AND OTHER LINEAR FACILITIES

There are no transmission lines or other linear facilities associated with Hardee Unit 3.

HARDEE UNIT 3

Site Certification
Application/Environmental
Analysis



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7.0 ECONOMIC AND SOCIAL EFFECTS OF PLANT CONSTRUCTION AND OPERATION

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7.1 SOCIO-ECONOMIC BENEFITS

The purpose of this chapter is to:

1. Identify the economic and social effects of construction and operation of the addition to the existing Hardee Power Station (HPS); and
2. Quantify the project benefits and costs to the groups affected in the area surrounding Hardee Unit 3 as well as other people and businesses in Hardee County, the Central Florida Region, and the state.

The Central Florida Region, as defined in Section 2.2.7-1, includes DeSoto, Hardee, Highlands, Okeechobee, and Polk counties.

Socio-economic effects can be classified as either direct or indirect effects. Direct effects are those affecting primarily the owners, operators, and customers of the facility; in this case, the costs of constructing and operating a generating plant and the customers who purchase the electrical energy. Indirect costs and benefits affect people and interests in the vicinity of the project who, because of their proximity to the site, may experience changes in their local environment, such as increased spending by project construction and operation personnel. Many of these effects are difficult to measure, and qualitative assumptions must be made to assess the relative values of expected costs and benefits.

This chapter is divided into two parts. Section 7.1 deals with socio-economic costs and benefits and consists of an analysis of the monetary values of the power generated and sold and plant construction and operational expenditures. Section 7.2 addresses temporary and long-term indirect costs and benefits involving the construction and operation personnel's use of private and public services in the vicinity of the site. Baseline data supporting this section are contained in Section 2.2.

For purposes of the economic analysis, a 30-year operating life for the 440-MW generating unit was assumed. However, it is recognized that the actual operating life may be longer, thereby extending the economic benefits as well.

7.1.1 DIRECT SOCIO-ECONOMIC BENEFITS

7.1.1.1 TAX REVENUES

Both direct and indirect tax benefits will accrue as a result of the construction and operation of the Hardee Unit 3 Project. Local revenues will be derived from property taxes paid on the property and the onsite facilities. State taxes will accrue in the form of taxes levied on the construction and operating supplies required to construct the facility.

Assuming a 30-year life for operation, it is estimated that approximately \$82 million (nominal dollars) in ad valorem property taxes will be paid to Hardee County over the life of the facility. These taxes will be split between the Hardee County general fund (52.6 percent of total), the Hardee County school district (44.9 percent), and the Southwest Florida Water Management District (SWFWMD) and Peace River Basin Taxing Authority (2.6 percent).

Direct benefits of plant construction will result from the purchase of materials and equipment and construction contracts. Materials, equipment, and contracts for construction of the additional unit will cost about \$189.8 million (1997 dollars), with 9.5 percent, or about \$18 million, for goods purchased regionally.

7.1.1.2 EMPLOYMENT

Among the primary direct benefits of the facility will be the increase in job opportunities within the region associated with both plant construction and operation. As noted in Section 2.2.7.1, Polk and Hardee counties are labor surplus areas: a situation which is reflected in unemployment rates that are among the highest in the state and the country. While the region's population is expected to grow at a slower rate than employment opportunities over the next several years, many women and older persons are entering the labor market, thus increasing the workforce competing for the jobs. Employment opportunities provided at the proposed facility will not solve the unemployment problem in this area; however, they will directly contribute to lowering the unemployment rates.

An average of 229 workers will be employed over the 24-month construction period required for this facility. Employment is expected to peak at approximately 450 workers. The total construction payroll for this facility is estimated at \$70.2 million.

Operation of the additional unit will employ approximately 35 persons who will work in three shifts with an annual payroll of \$2.7 million.

Equal employment opportunities for all persons has been identified as a major priority of the Central Florida Regional Planning Council (CFRPC) Comprehensive Policy Plan. Seminole Electric Cooperative Incorporated (SECI) maintains full compliance with all applicable federal, state, and local regulations regarding equal employment opportunity and affirmative action.

7.1.2 INDIRECT SOCIO-ECONOMIC BENEFITS

7.1.2.1 EMPLOYMENT

The Central Florida Region employment will increase due to the Hardee Unit 3 Project for two reasons. First, there will be a direct employment increase of workers during construction and operation of the additional unit. Second, there will be induced employment from increased demand for goods and services in Hardee and Polk counties and, to a lesser extent, central Florida.

Employment increases resulting from the Hardee Unit 3 Project's construction and operation phase activities have been estimated using regional multipliers developed by the U.S. Department of Commerce Bureau of Economic Analysis's Regional Input-Output Modeling System (RIMS II). Indirect employment was forecasted with the RIMS II statewide multiplier of 35.1 total jobs per \$1 million in construction expenditures. Since the total construction budget including payroll is \$260.0 million (1997 dollars), the total number of jobs created statewide by the Hardee Unit 3 Project is estimated to be 9,126 (i.e., 35.1×260.0). Of these jobs, 7,696 are considered direct employment, and the remaining jobs (1,430) are indirectly related to the project's construction.

Indirect benefits, in the form of increased spending and sales taxes paid on goods and services purchased privately by members of both the construction and operating workforce for the facility, will also add to the state and local economy. Since construction and operations workers are expected to be hired from areas within commuting distance of the site and will not require relocation for this project, their spending patterns within stores and service facilities are already established. Direct and indirect income generated from the construction of the Hardee Unit 3 Project is expected to be \$98.8 million. Consequently, it is not anticipated that spending patterns in the local area will change to any noticeable extent or that this increase in local revenues will create any significant new demands on the local economy.

7.1.2.2 INCOME

Income in the Central Florida Region is expected to increase due to the Hardee Unit 3 Project for two reasons. First, there will be a direct income increase resulting from the wages paid directly to the labor force during the construction and operation phases of the Hardee Unit 3 Project. Second, there will be an induced component to the income increases. As the construction- and

ENHANCEMENT OF RECREATIONAL OR ENVIRONMENTAL VALUES

Construction and operation of this facility will utilize land previously mined for phosphate ore. The use of mined lands for the Hardee Unit 3 Project enhances land conservation by combining multiple industrial uses of the same land area. The site property will not be available for public use.

CREATION OR IMPROVEMENT OF LOCAL TRANSPORTATION FACILITIES

Offsite improvements to local roads, waterways, or other transportation facilities are not required.

7.2 SOCIO-ECONOMIC COSTS

7.2.1 TEMPORARY EXTERNAL COSTS

According to the Florida Department of Labor and Employment Security (FDLES), over 75,000 construction workers reside within the Central Florida Region. Since a more than adequate labor supply exists within commuting distance, and since a labor surplus exists within Hardee and Polk counties, it is anticipated that many workers will be hired from within the region, with minimal relocation required. Consequently, construction should have no effect on permanent housing or other public services within the region.

As is typical with longer construction projects, some workers commuting from the longer distances may choose to drive recreational vehicles to the area and reside temporarily near the site on a weekly basis, returning to their permanent homes and families on weekends. Several campgrounds providing various amenities and over 1,000 full hookups for recreational vehicles are located within the region which could serve these weekly commuters. Since commuting is not anticipated to be a problem, the number of workers who utilize the campground facilities is not expected to cause a change in usage patterns of normal users of these facilities.

Since workers will be commuting and not relocating permanently into the site region, it is not anticipated that construction workers will create any new or unusual impacts or demands on public facilities or services.

On-site construction activities should have no impact on area residents. The site is surrounded by mining operations on the north, east, southeast and west [(see Figure 2.2.3-1 for existing land use within 8 kilometers (km) (5 miles) of the site)]. That portion of the site boundary to the south and southwest not adjacent to the mines abuts Payne Creek and its associated wooded wetlands. Given the extensive buffers surrounding the site and the distance of more than 1.6 km (1 mile) to the nearest residences, onsite construction activities will not be generally visible and noise will be minimal at the property boundary (see Section 5.7.1).

7.2.2 LONG-TERM EXTERNAL COSTS

The facility impacts are minimal and localized. It is not on or near any public or private facilities utilized for recreational purposes. Consequently, Hardee Unit 3 will not cause any impairment to recreational values, result in any deterioration of aesthetic and scenic values, restrict access to areas of scenic or other values, displace persons from the land, cause loss of income, or result in significant costs to local government.

In addition, since the operational workforce is expected to be approximately 35 employees and all are assumed to be residing within commuting distance to the plant, impacts to local services (i.e., schools, police, fire, etc.) are expected to be minimal.

operation-phase employees and their dependents spend that income in the Central Florida Region, the demand for goods and services will increase.

Direct income increases are composed of construction wages, which total \$70.2 million. In addition to construction wages, there will be wages paid to operating personnel. These wages amount to \$1.3 million the first year of operation in 1999 and average \$2.7 million annually over the next 29 years for a total of \$79.6 million. The project workforce will likely be drawn from an area that includes Hillsborough County and the Central Florida Region. For construction and operational employees, due to current population characteristics it is assumed for this analysis that 85 percent reside in Polk and Hillsborough counties, with the remainder commuting from other counties in the Central Florida Region. With these workforce origin assumptions, the direct income increase from the project attributable to the Central Florida Region is estimated at \$14.2 million over the construction and operation periods.

Indirect income induced from construction was estimated using the RIMS II model's regional earnings multiplier for electric power plant construction. Based on a total construction budget of \$260 million and the RIMS II regional household earnings multiplier of 0.5669, the total indirect increase in income from construction of the project is estimated at \$147.4 million. By deducting the total direct construction income estimate of \$70.2 million for construction labor, the indirect income is estimated to be \$77.2 million over the construction period.

Indirect income induced from operation was also estimated using the RIMS II model's regional earnings multiplier for electric power plant operations. Based upon an average annual operation and maintenance (O&M) expenditure of \$5,237,000 and the RIMS II regional household earnings multiplier of 0.1789 for the Central Florida Region, the total induced income increase assignable to the operation of the additional unit is estimated to be about \$936,899 in 1999. By deducting the total direct operations income estimate of \$463,988 and assuming 30 percent of the induced income would occur in the Central Florida Region, indirect income increases are estimated at \$472,901 in 1999.

7.2.3 AESTHETICS

The Hardee Unit 3 site is located entirely within the existing HPS site which is approximately 1.6 km (1 mile) west of County Road (CR) 663 in Hardee County, just south of the Polk County line. Most of the site has been mined for phosphate and has recently been reclaimed as pasture. Adjacent industrial facilities include the HPS existing units and the IMC-Agrico phosphate facilities. The existing generating facilities are located southwest of the Hardee Unit 3 site. The 570-acre [230-hectares (ha)] cooling reservoir is located north and northwest of the Hardee Unit 3 site. The existing transmission lines exit the power station and follow Fort Green Road (CR 663) (east of the site) to the north and south, respectively. The site is located in a remote location away from areas of high viewer frequency and sensitivity.

The new generating facilities to be located onsite will include combustion turbines, steam turbines, and heat recovery steam generators (HRSGs) that will be located outside of an environmental enclosure (see Figure 3.2.0-2). The tallest structures located onsite will be the stacks associated with the HRSGs at 27 meters (m) [90 feet (ft)] and the bypass stack at 23 m (75 ft). The service building and warehouse will be at 11 m (36 ft) and 6 m (20 ft), respectively. The demineralizer and service/fire water tanks will be the tallest tanks at 14 m (45 ft) each, and the fuel oil storage tank will be 16 m (53 ft) high (see Table 3.2.0-1).

The exterior of the main plant buildings will be neutral colors to absorb and not reflect sunlight. The stacks will also be a neutral or dark color so as not to attract attention to the plant facilities.

To determine the potential visibility of the facility and the consequent visual impact, a series of "sight lines" were drawn from the center point of the stacks to locations of human habitation or visitation (roads). Because of the minimal area accessible to the general population in the vicinity of the Hardee Unit 3 site, site lines were drawn out to reasonably accessible locations within an approximate 8-km (5-mile) radius. Also, a windshield survey was conducted to determine the aesthetic impacts associated with the existing HPS facility.

The visual analysis found that from almost all accessible locations to the south, southwest, southeast, and east toward the facility (with the exception of Fort Green), area topography and vegetation will effectively block or screen views of the Hardee Unit 3 Project. The site is partially screened from traffic by dense stands of trees. Tree stands are present west, south, and

east of the proposed site. Highway plantings also cover a 0.5-mile (0.8-km) stretch on the west side of CR 663 east of the site. Mining reclamation activities are in progress north and northeast of the site. The project facilities should only be visible to persons in vehicles traveling south on Fort Green Road in Polk County, north of the site, through a southwesterly viewing corridor. Vegetation in this corridor consists only of brush and scattered trees. Persons traveling north on CR 663 in Hardee County, south of the site, will only see the upper portion of the stacks, and possibly some structural steel, due to a dense tree screen to the south and east and phosphate pond containment berms east of the site.

In the small community of Fort Green a portion of the stacks may be visible. The stacks will be viewed from a distance of about 3.2 km (2 miles). In addition, they will be viewed through a mix of mining activities in the middleground of the view. The effect of the inclusion of the mined areas and the existing HPS facilities in the view will minimize the importance of the stacks and they should appear as just another industrial structure on the horizon. Once mining is completed the stacks will be a more dominant feature of the landscape. However, while some views of the tops of the stacks may be possible from Fort Green, the new structures will be in conformance with the previously established industrial character (existing HPS facility).

No views of the facility should be possible from the unincorporated community of Fort Green Springs which is located among citrus groves and on the back side of gently sloping ground leading to the Shirttail Branch of Payne Creek. Between the site and Fort Green Springs is Payne Creek and its associated wooded wetlands. The location of Fort Green Springs' residences among groves and the location of a considerable area of wooded wetlands in the middleground of the view will serve to effectively block views.

The only other areas likely to observe the plant on a regular basis are the county roads. With minor exceptions, the Hardee Power Station will be either blocked or screened from view by area vegetation and natural and manmade (berms around tailing ponds) topography. In addition, from those few location where views of the facility will be possible, the distance between the stacks and the viewer will minimize its importance and will also allow for the inclusion of numerous mining areas which will play a more dominant role in the view. In conclusion, like the Hardee Power Station, the Hardee Unit 3 Project is ideally located from a visual perspective. It is in

conformance with the already dominant use of the area and will be screened or blocked from a large majority of the areas within 8 km (5 miles) which are accessible to the public.

The facility is not on or near any areas of noted scenic, historic, cultural, natural, or archaeological value. Consequently, Hardee Unit 3 will have no visual effect on such properties.

7.3 REFERENCES

The following references were used in developing data for Chapter 7.0:

1992 Florida Statistical Abstract. University of Florida Press: Gainesville, 1992.

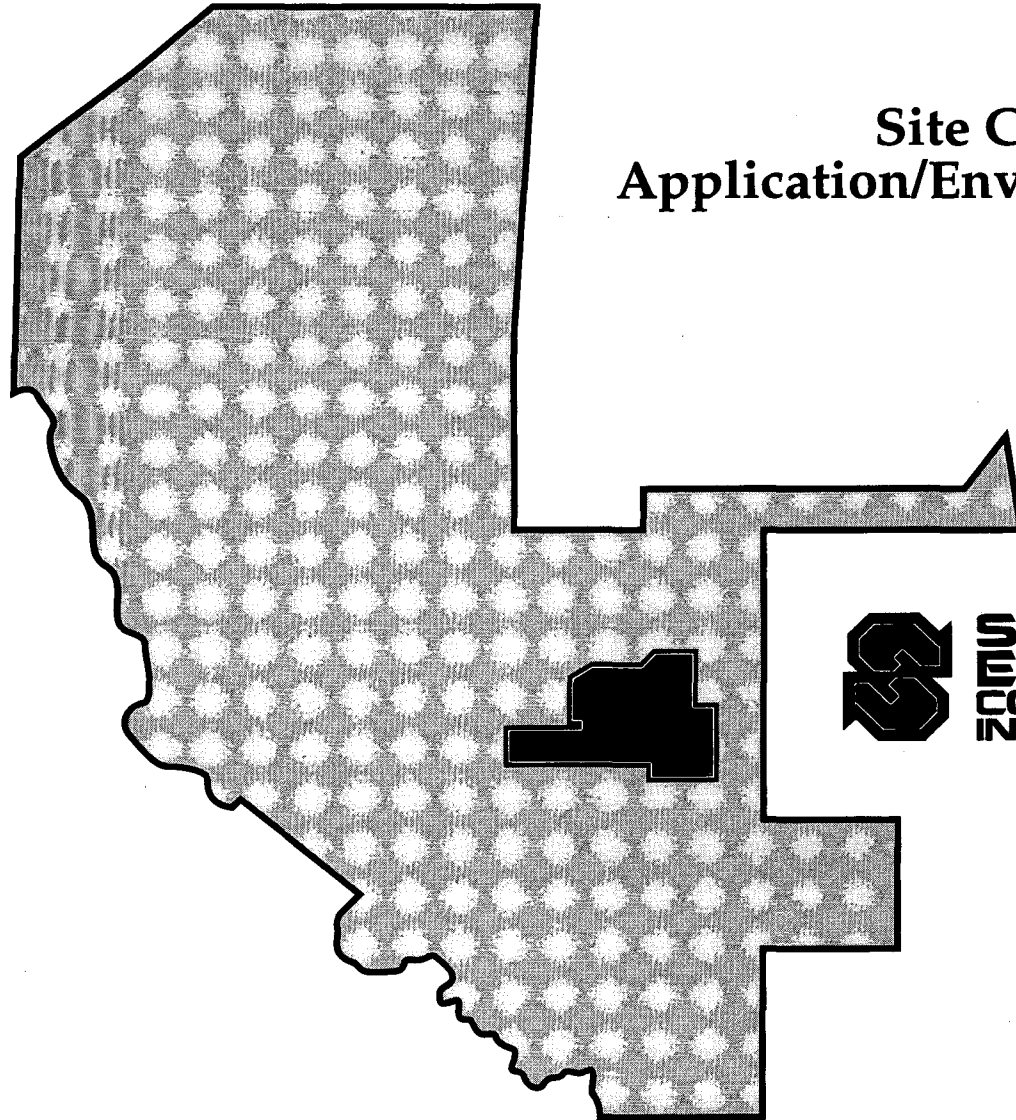
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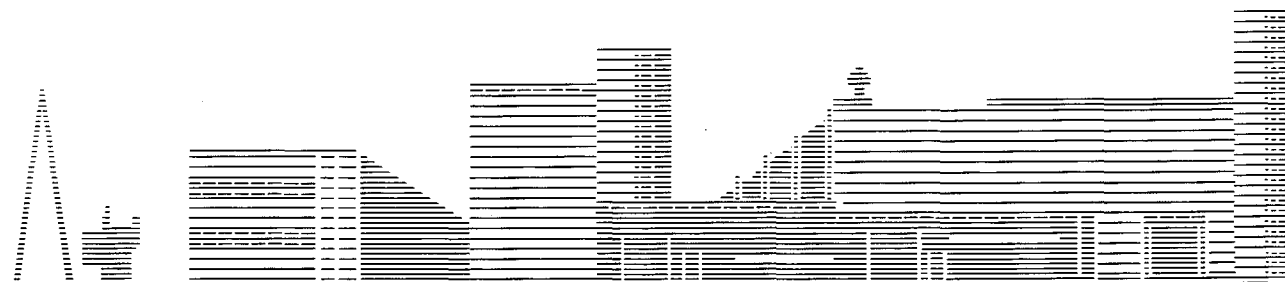
HARDEE UNIT 3

Site Certification
Application/Environmental
Analysis



 **SEMINOLE
ELECTRIC
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Chapter 8.0



8.0 SITE AND DESIGN ALTERNATIVES

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8.1 ALTERNATIVE SITES

The following section is provided for compliance with National Environmental Policy Act (NEPA) regulations; the analysis is intended for use in the environmental analysis and supplemental environmental impact statement (EIS) to be prepared by Rural Electrification Administration (REA) and other cooperating federal agencies.

The Hardee Unit 3 Project represents an incremental increase in the overall generating capacity of the previously certified Hardee Power Station (HPS). The HPS site was selected based on the results of a site selection study to locate, evaluate, and recommend areas that were suitable for the construction and operation of an electric-generating facility. The site selection study was conducted to comply with the regulatory provisions of NEPA, REA requirements and guidelines for the siting and assessment of environmental impacts of power-generating facilities, and Florida Electric Power Plant Siting Act (FEPPSA). This study, referred to as the Combined Cycle Plant Site Selection Study [Environmental Science and Engineering, Inc., (ESE) 1988] was summarized in the original Site Certification Application/Environmental Assessment (SCA/EA) for the HPS [TECO Power Services/Seminole Electric Cooperative Inc. (TPS/SECI), 1989].

Because the proposed facility is an incremental increase to the previously sited HPS, a formal siting study was not conducted for the Hardee Unit 3 Project. Construction and operation of the Hardee Unit 3 facility at the existing HPS site ensures the beneficial use of the resources at the site and minimizes overall environmental and land use impacts associated with development of the additional generating capacity.

Specific benefits of locating the Hardee Unit 3 facility at the HPS site include:

1. Use of a previously impacted area. The HPS site has been used for both phosphate mining and power plant development.
2. Use of potentially shared facilities. The Hardee Unit 3 project will share a number of facilities with the HPS existing units including the existing cooling reservoir, transmission lines, access road, Floridan aquifer wells, and switchyard.
3. Construction of the Hardee Unit 3 project at a previously developed site, such as the HPS site, will result in fewer impacts than development of a green-field site.

4. Additional transmission lines will not be required to support the Hardee Unit 3 facility.
5. Utilization of existing facilities, such as the cooling reservoir, will increase the overall beneficial use of dedicated resources.

8.2 PROPOSED SITE DESIGN ALTERNATIVES

One of the most significant design alternative decisions relating to the steam portion of the proposed combined cycle unit is the selection of the preferred heat rejection system. This system is fundamental in the transfer and/or rejection to the atmosphere of waste heat from the condensation of the turbine exhaust steam. Optimization of the heat rejection system can serve to minimize plant capital and operation costs and environmental impacts.

HPS was originally certified for the construction and operation of a 230-hectare (ha) (570-acre) cooling reservoir with makeup from the Floridan aquifer for once-through condenser cooling. A Water Alternatives Study (see Appendix 10.11) was conducted for the Hardee Unit 3 Project to identify and evaluate all reasonable water sources within a 10-mile [16-kilometer (km)] radius of HPS. Results of this study showed that all condenser cooling needs for the Hardee Unit 3 Project could be met by the existing cooling reservoir. Furthermore, the previously certified groundwater allocation for both the reservoir makeup water and plant process water are adequate to meet the requirements of the entire 880-megawatt (MW) facility, including the incremental increase due to Hardee Unit 3.

Other potential water sources, including treated wastewater and water cropping, were identified by the Water Alternative Study, but none were found to be superior to the previously certified use of groundwater from the Floridan aquifer. A detailed description of all water sources evaluated and the ranking system used to identify the optimum water source is presented in Appendix 10.11.

Other project systems including fuel, generating technology, and disposal options proposed for the Hardee Unit 3 project are consistent with those described in the original HPS certification.

8.3 ALTERNATIVE FUELS

The primary fuel for the combustion turbines will be natural gas with No. 2 fuel oil being used as a secondary fuel when natural gas is unavailable. If these fuels become either uneconomical or unavailable, alternative fuels such as synthetic gas may serve as fuel sources. The Hardee Unit 3 will have the ability to utilize medium-British-thermal-unit (Btu) gas derived from advanced coal gasification technologies. The plant layout has been designed to allow the potential construction of a coal gasification plant. If fuel supplies or prices made this type of facility economical, a gasification plant could be separately permitted and constructed as an associated facility of HPS. Recent design enhancements of coal gasification processes allow the environmentally acceptable use of medium-Btu synthetic gas in combustion turbines.

This section briefly describes gasification technologies available to the project and potential environmental impacts of these technologies. Where possible, the environmental impacts were performed using quantitative assessment techniques; however, qualitative techniques were used as necessary.

8.3.1 GASIFICATION OVERVIEW

8.3.1.1 GENERAL STATEMENT

Several gasification technologies exist at various levels of development and demonstration to convert coal to medium-Btu synthetic gas (syngas). Three basic designs exist: fixed-bed, fluidized-bed, and entrained-flow gasifiers. Coal gasification is, simply, reacting coal in a reducing (oxygen-deficient) atmosphere with steam or water and oxygen or air to produce a product syngas composed primarily of hydrogen (H_2) and carbon monoxide (CO). The sulfur in the coal is converted to hydrogen sulfide (H_2S) and carbonyl sulfide (COS). Although the gasification process affects the overall plant design, the gasification step is only one part of the overall gasification plant. Other steps include syngas cooling and cleanup.

The gasifier most widely used throughout the world is a fixed-bed design. Most recent research and development of gasifiers for electrical power generation in the United States, however, has focused on the entrained-flow designs (i.e., those by Texaco, Shell, and Destec). The following section briefly describes features, advantages, and disadvantages of each of the three basic designs (fixed-bed, fluidized-bed, entrained-flow). Following the description of the basic designs, the processes of coal gasification are defined and potential impacts are discussed.

8.3.1.2 TYPES OF GASIFIERS

Fixed-Bed Gasifiers

Fixed-bed gasification is typically represented by the Lurgi gasifier, first successfully operated over 40 years ago and widely proven commercially. Coal is fed into the top of the gasifier while air or oxygen plus steam are added from the bottom.

Fixed-bed gasifiers have several advantages:

- High thermal efficiency by counter current mode of operation,
- High direct methane yield for high-Btu syngas production, and
- Low oxygen requirement.

Disadvantages of fixed-bed gasifiers include:

- Strict feed coal requirements in size and caking tendency,
- Excessive steam requirement for control of ash clinkering,

- Extensive wastewater treatment required by formation of coal tar and other hydrocarbons, and
- Relatively low throughput per gasifier.

Fluidized-Bed Gasifiers

In a fluidized-bed gasifier, a stationary bed of coal is suspended by oxygen and steam moving through the bed at a rate sufficient to lift the coal particles. This fluidizing action allows the coal, oxidant, and combustion gases to mix thoroughly. Temperature control is important in a fluidized bed gasifier to prevent bed slumping due to ash fusion. This type of gasifier is best suited to highly reactive coals (lignites or brown coals).

Advantages of fluidized-bed gasification are:

- Wide range of coal quality and fines can be used,
- Throughput is high compared to the fixed bed gasifiers,
- Operation is flexible,
- Reliability and safety are good because of simplicity and high solid inventory,
- Mixing of bed material alleviates local overheating,
- Gasifier configuration and operation is simple,
- Introduction and withdrawal of solids from gasifier are easy, and
- Raw gas contains no tars.

Disadvantages of fluidized-bed gasification are:

- High sensible heat loss due to high exit gas temperature,
- High fines carry over,
- High carbon content in ash,
- Large volume of fluidizing media is required, and
- Caking coal must be pretreated.

Entrained-Flow Gasifiers

Coal particles fed into an entrained-flow gasifier are entrained (carried away) by the reacting gases. Partial oxidation occurs faster and at higher temperatures and pressures than in the other two major types of gasifiers. Hence, the entrained-flow gasifiers are small in size. Combustion efficiency in terms of carbon conversion can be substantially increased when pure oxygen is used

as the oxidant instead of air. The high operating temperature in an entrained-flow gasifier yields good carbon conversion. Due to high operating temperatures, heavy tars, oils, and phenols are not produced, reducing concern for byproduct storage and wastewater treatment. The ash material melts to form a glass-like slag which is collected and removed from the bottom of the gasifier. Gasification is followed by heat recovery to increase efficiency of the process.

Raw syngas exits the gasifier and is cooled and cleaned of particulate matter. Particulates entrained in the raw syngas stream leaving the gasifier are removed by either scrubbing with a wet spray-type scrubber or by filtering with ceramic filters. Following cooling and particulate removal, the syngas passes to an acid-gas removal unit where gaseous sulfur compounds, primarily H_2S and COS , are absorbed from the syngas by a solvent. The clean syngas is transferred to the gas turbine combustors. The sulfur compounds absorbed by the solvent pass to a Claus unit which converts them to elemental sulfur to be stored or sold as a byproduct. Tail gas from the Claus unit passes to a tail gas treatment system for further sulfur recovery. Treated tail gas is then routed to a tail gas incinerator.

Entrained flow coal gasifiers have been demonstrated to be the most technologically advanced method of coal gasification applicable to the power industry for electrical generation. This type of gasifier design has also been proven to be the most environmentally sound with the least amount of byproduct generation.

8.3.1.3 PROCESS DESCRIPTION--ENTRAINED FLOW

This subsection discusses processes associated with coal gasification which are applicable to entrained flow coal gasifiers. Figure 8.3.1-1 presents a simplified block diagram of a typical entrained flow coal gasification plant coupled with a combined cycle power plant.

Coal is delivered to the gasifier by the coal-water slurry or as dry pulverized coal through a pneumatic feed system. The gasifier design and operation varies between the Texaco, Shell, and Destec Company processes. Basically, the gasifier is a vessel with combustion burners where coal, oxygen, and steam are injected in controlled proportions. Partial combustion with oxygen occurs at pressures of 25 to 42 kilograms per square centimeter (kg/cm^2) (375 to 600 pounds per square inch) gauge and high temperatures [1,260 to 1,540 degrees celsius ($^{\circ}C$) (2,300 to 2,800 degrees Fahrenheit ($^{\circ}F$))] to produce a medium-Btu raw syngas consisting mainly of CO ,

H₂, some carbon dioxide (CO₂), and methane (CH₄). Oxygen must be supplied to the gasifier in relatively pure form. For purposes of reliable purity of product, as well as economics, a cryogenic air separation plant is utilized for oxygen production. Typically, gasifiers require 95 percent pure oxygen. Hot raw syngas produced during coal gasification is cooled to facilitate conventional syngas cleaning prior to combustion. The syngas is cooled by generating steam in syngas coolers which can be used for the gasification process and to generate power through a steam turbine generator.

The effluent water from the gasification process consists of purge streams removed from the process to limit the buildup of dissolved gases (particularly ammonia) and suspended solids. Major sources of wastewater from coal gasification include the gray waste stream from the wet particulate removal system and ammonia-laden condensate produced during syngas cooling. Minor sources of process wastewater are the acid-gas removal system and the Shell-Claus Offgas Treatment (SCOT) system.

Gaseous compounds present as various acid or sour gases [H₂S, COS, hydrocyanic acid (HCN)] are removed from the raw syngas prior to being sent to the combustion turbine using readily available commercial processes. These processes rely on chemical or physical absorption to remove these gases from the raw syngas. The acid gases are directed to a sulfur recovery unit, which converts the sulfur compounds to liquid elemental sulfur that can be stored or sold as a byproduct. Remaining unconverted sulfur compounds in the tail gas from the sulfur recovery unit are further cleaned in the SCOT tail gas treatment system. Vent gas from the SCOT unit are routed to an incinerator and burned. Overall sulfur removal rates from raw syngas by the desulfurization process generally range from 95 to 99 percent.

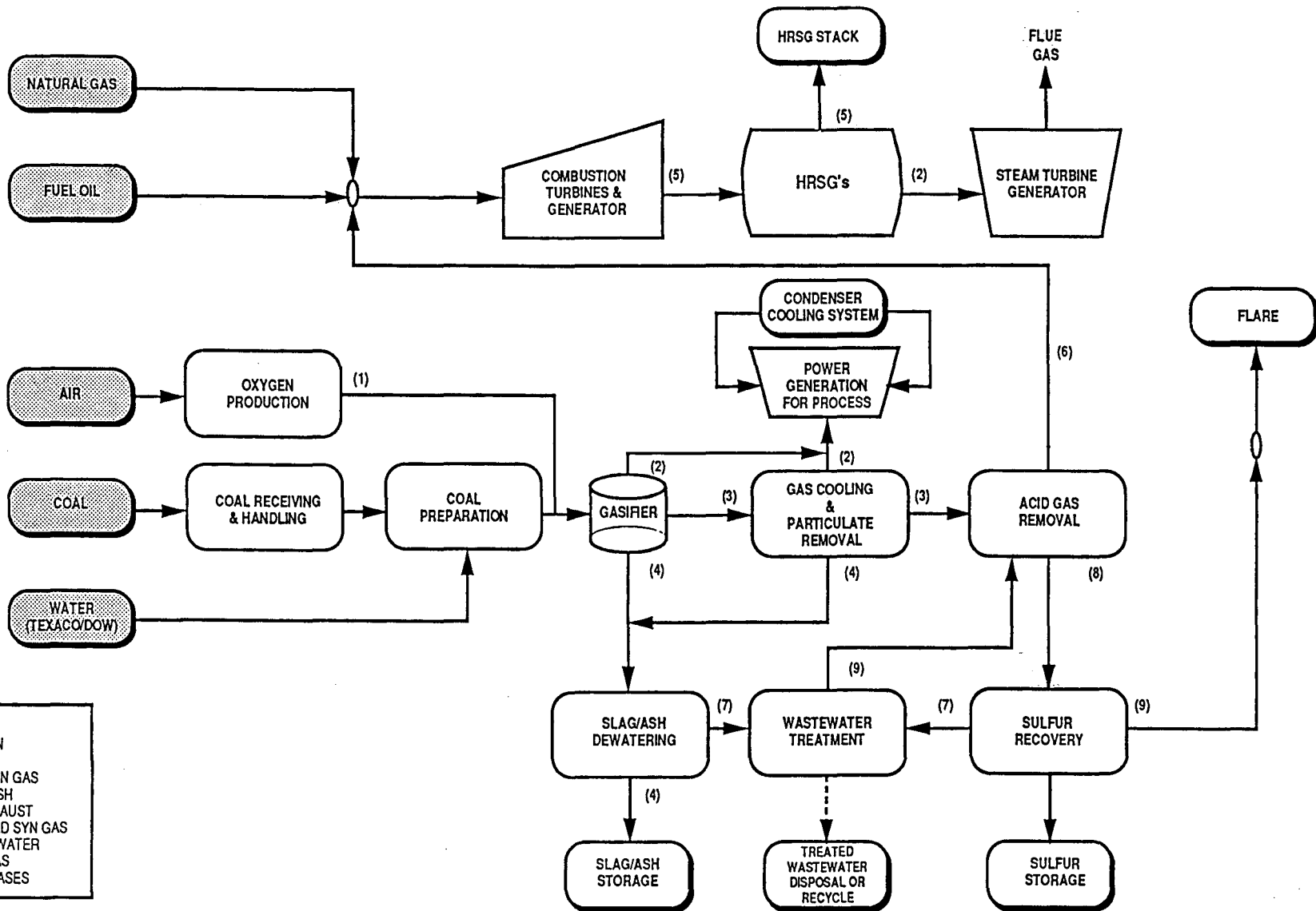


Figure 8.3.1-1
Block Diagram of Entrained Flow Coal Gasification Plant
and Combined Cycle Power Plant

Source: KBN, 1994.

8.3.2 DESIGN AND ENVIRONMENTAL CHARACTERISTICS

8.3.2.1 DESIGN BASIS

Several coal gasification technologies could be utilized for the project. As discussed previously, recent research and development, as well as demonstration projects, for electric power production using combustion turbines has focused on entrained flow designs, which are offered by Texaco, Shell and Destec. Such designs provide quality combustion turbine fuel, flexibility in using a wide variety of coals, high thermal efficiency, and acceptable environmental discharge. For the purpose of this characterization, it was assumed that an entrained flow gasification process would be constructed.

Preliminary design and environmental parameters are presented in Table 8.3.2-1 and are based on data published by the Electric Power Research Institute (EPRI) and the Cool Water Coal Gasification Program (CWCGP). The data sources are the most currently available and represent the approximate characteristics of a gasification plant that would be constructed. Details of actual design analysis will be presented at the time of submission of the permit application to construct and operate the coal gasification facility. Figure 8.3.2-1 presents a conceptual layout of the coal gasification facility at the site.

8.3.2.2 AIR EMISSIONS

Sources of air emissions for a coal gasification plant would include the plant flare stack, tail gas incinerator stack, process fugitive gas emissions, and fugitive dust emissions. Typical emission estimates from these sources have been quantified in Table 8.3.2-1.

The tail gas incinerator is used to oxidized the treated gas from the tail gas treatment system. The plant flare would be used during start-up, shutdown, emergency relief, and upset conditions. Start-up and shutdown experience at CWCGP indicate that flare operation is intermittent and of short duration (i.e., 1 to 4 hours about 8 to 12 times a month). If a process upset or emergency condition arises the flare would incinerate any gas remaining in the process trains; meanwhile, the gasifier would be shut down under such conditions.

Process fugitive gas emissions would result from numerous albeit small leaks from equipment (i.e., valves, pumps, compressors, and connections). Fugitive dust emissions would result from coal unloading, storage and preparation, and from slag/ash handling and storage.

Air emissions would continue to be emitted from the combustion turbines when firing clean synthetic gas. Sulfur dioxide (SO₂) emissions would be about the same or less than when firing No. 2 fuel oil. The sulfur removal efficiencies of the unit process typically range from 95 to 99 percent. Other emissions would be typical of natural gas firing.

8.3.2.3 WASTEWATER

The wastewater streams of a gasification plant primarily consist of gray water from slag/ash quenching and particulate removal, and condensates from the gasification process, raw gas cooling process, and sulfur recovery processes. Typical contaminants reported in wastewaters include ammonia, sulfide, chloride, fluoride, formate (high oxygen demand), cyanide and trace metals. A summary of the raw wastewater characteristics observed at CWCGP are presented in Table 8.3.2-2.

8.3.2.4 BYPRODUCTS

The physical and chemical characteristics of the gasifier slag will be a function of the type of coal selected and the gasification process. Insight into the physical and chemical characteristics of these byproducts can be acquired from the results obtained CWCGP existing data.

The physical characteristics of the slag suggest that the slag can be used for various road and building applications. The general chemical characteristics of CWCGP slag from trace element and leachate analyses show that the slag and the leachate are non-hazardous.

The Hardee Power Station would require a byproduct storage facility of approximately 22 ha (54 acres) based on a capacity factor of 100 percent over 30 years. Ideally, the applicant would attempt to sell the byproduct. Byproduct material would be placed in a storage area using the best management practices for utility solid byproducts storage sites.

Table 8.3.2-1. Typical Design Data for Gasification Plant Potentially Constructed at the Hardee Power Station (Page 1 of 2)

Design Category	Design Data	Basis for Estimate
UNIT SIZE & FUEL USE		
Net Generation (kW)	440,000	See Note 1
Heat Input (MMBtu/hr)	3,960	See Note 2
Coal Utilization (TPD)	4,320	See Note 3
Coal Delivery (rail cars/week)	288	See Note 4
COAL CHARACTERISTICS		
Heat Content HHV (Btu/lb)	11,000	Reference 1
Ash Content (%)	10.00	Reference 1
Sulfur Content (%)	4.50	Reference 1
PERFORMANCE		
Net Plant Heat Rate (Btu/kW)	9,000	See Note 5
AIR EMISSIONS		
1. Tail Gas Incinerator Stack		
NO _x (lb/hr)	6.3	Reference 2
CO (lb/hr)	5.32	Reference 2
SO ₂ (lb/hr)	31.75	See Note 6
H ₂ SO ₄ Mist (lb/hr)	0.49	See Note 7
Particulate Matter (lb/hr)	1.30	Reference 2
Hg (lb/hr)	0.0079	Reference 2
Be (lb/hr)	0.0004	Reference 2
Pb (lb/hr)	0.0025	Reference 2
2. Process Fugitive Emissions		
H ₂ S (lb/day)	5.50	Reference 3
SO ₂ (lb/day)	11.01	Reference 3
CO (lb/day)	52.30	Reference 3
H ₂ SO ₄ Mist (lb/hr)	2.75	Reference 3
Hydrocarbons (lb/day)	11.01	Reference 3
Hg (lb/hr)	2.75E-07	Reference 3
Be (lb/hr)	5.50E-05	Reference 3
Pb (lb/hr)	1.10E-03	Reference 3
3. Fugitive Dust		
Coal Handling & Storage - TSP (lb/day)	172	See Note 8
Coal Handling & Storage - PM10 (lb/day)	129	See Note 8
Slag/Ash Handling & Storage - TSP (lb/day)	112	See Note 8
Slag/Ash Handling & Storage - PM10 (lb/day)	96	See Note 8

Table 8.3.2-1. Typical Design Data for Gasification Plant Potentially Constructed at the Hardee Power Station (Page 2 of 2)

Design Category	Design Data	Basis for Estimate
WATER MAKEUP REQUIREMENTS		
Cooling System (gpd)	529,800	See Note 12
Process (gpd)	518	Reference 4
WASTEWATER DISCHARGE		
Treated Effluent (gpm)	288	Reference 3
Demineralizer Regenerant (gpm)	36	Reference 3
Misc. (gpm)	11	Reference 3
SOLID WASTE BY-PRODUCTS		
Slag/Ash (acre ft/yr)	72	See Note 9
Sulfur (TPD)	191	See Note 10
Water Treatment Sludges (acre ft/yr)	0.3	See Note 11

References: 1. ESE, 1988.
2. EPRI, December 1990.
3. EPRI, March 1989.
4. EPRI, January 1989.

Notes:

1. Assumes net plant output does not change when combined cycle plant is converted to a coal gasification combined cycle plant.
2. Calculated based on net generation and net plant heat rate.
3. Calculated based on heat input and coal heat content.
4. Calculated based on 105 tons/rail car.
5. Assumed heat rate based on References 3 and 4.
6. Calculated based on 98 percent sulfur removal and 99.9 percent sulfur recovery.
7. Calculated based on assuming 1 percent of the SO_2 is converted to H_2SO_4 .
8. Calculated from maximum coal utilization and site layout.
9. Calculated based on ash content, a 90% slag/10% fly ash split, a density for slag and fly ash of 110 lb/ft³ and 55 lb/ft³ respectively, and a 100% capacity factor.
10. Calculated based on 98 percent sulfur removal.
11. Calculated based on 1 ton per day (Reference 3), or sludge density of 60 lb/ft³ and a 100% capacity factor.
12. Calculated based on gasification plant size and cooling water use.

Sources: TPS/SECI, 1989.
Black & Veatch, 1994.
KBN, 1994.

Table 8.3.2-2. Summary of Raw Wastewater Characteristics from CWCGP

Chemical Parameter	Concentration by Wastewater Stream (mg/L)			
	Grey Water	Gasification Condensate	SCOT Condensate	Selexol Condensate
Alkalinity	990	39,000	9,545	19,900
Ammonia	721	13,630	3,325	7,815
COF	677	160	852	17,200
Cyanide	6	36	25	302
Sulfide	ND	170	644	3,254
Fluoride	9	4	3	24
Phenolics	<5	<5	<5	<5
TOC	448	447	107	2,809
Inorganic Carbon	15	6,313	1,919	3,186
Chloride	135	2	2	6
TDS	1,500	68	225	71
Calcium	150	<0.5	<0.5	<0.5
Sodium	200	7	13	1
Boron	58	<1.0	<1.0	<1.0
Arsenic	0.026	<0.02	<0.02	<0.02
Barium	0.63	<0.001	0.056	<0.02
Cadmium	<0.001	<0.001	<0.001	<0.001
Chromium	<0.005	0.038	<0.005	<0.005
Lead	0.0066	<0.005	<0.005	0.0059
Mercury	<0.001	0.001	0.008	0.008
Selenium	0.15	0.053	<0.008	0.13
Silver	<0.05	<0.05	<0.05	<0.05

Source: Zeien et al., 1986

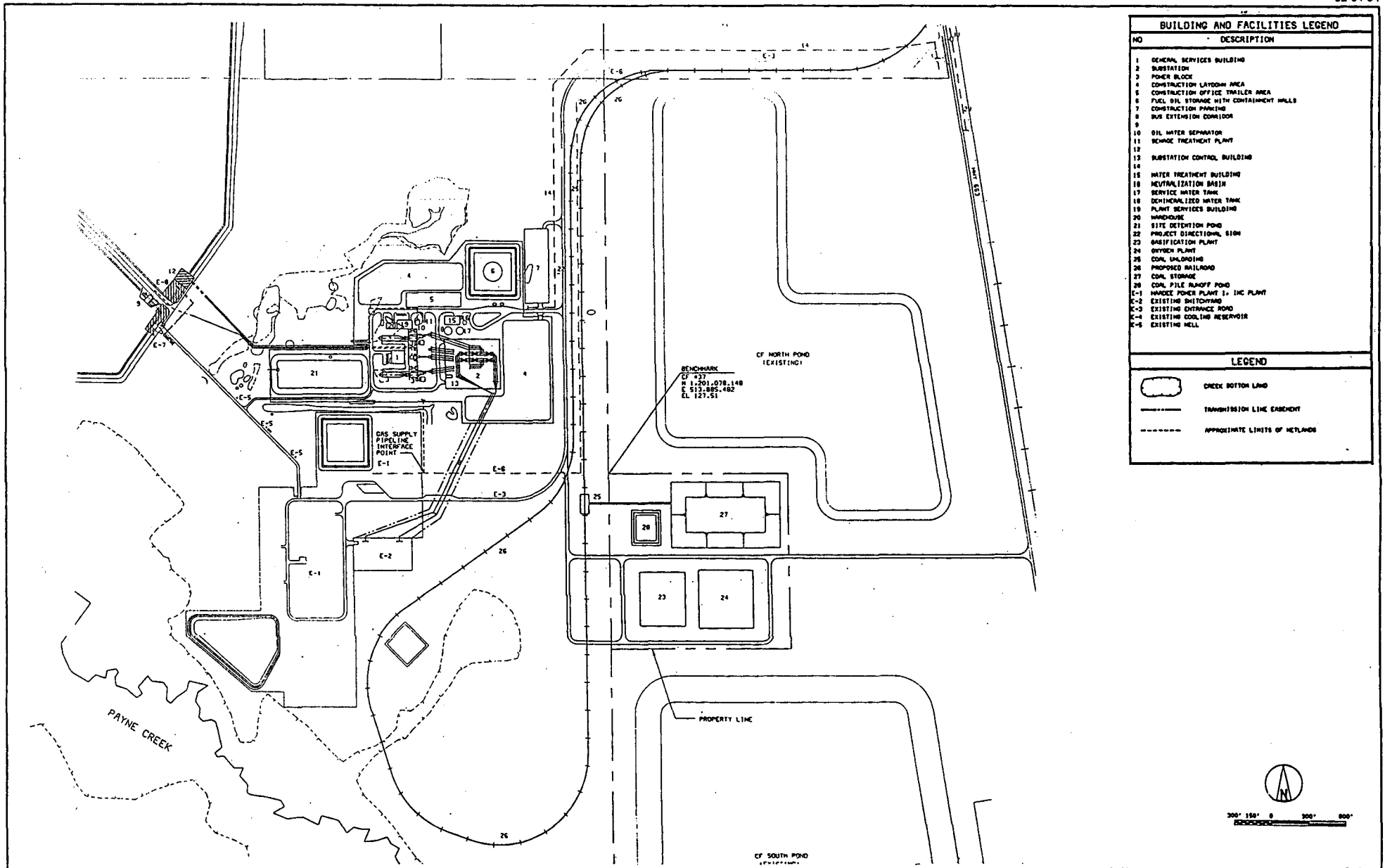
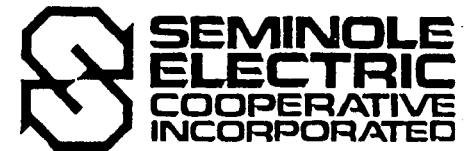


Figure 8.3.2-1
Conceptual Layout of a Coal Gasification Facility at the Site

Source: Black & Veatch, 1994.



8.3.3 POTENTIAL ENVIRONMENTAL IMPACTS

The potential environmental impacts associated with a gasification plant are related to the air emissions, cooling water requirements, wastewater generated, and byproducts storage. The subsections that follow discuss the potential impacts of these factors, as well as control technologies that would likely be installed. These subsections present potential impacts in general terms since a specific coal and gasification process has not been made.

8.3.3.1 AIR EMISSIONS IMPACTS

The potential air quality impacts from a coal gasification plant are primarily associated with the tail gas incinerator. The plant also produces an intermittent source of air emissions which results from start-up and emergency conditions where raw synthetic gas would be incinerated by the plant flare. Air pollutant emissions from the combined cycle plant using medium-Btu coal gas would be similar to using distillate fuel oil; therefore, these impacts were previously addressed in Section 5.6.

The maximum potential impacts are predicted to occur during start-up and emergency conditions. As previously discussed in Subsection 8.3.2.2 these conditions are infrequent. Availability data for the acid-gas removal and sulfur recovery processes were stated by EPRI (1989) to be 99.17 percent and 99.13 percent, respectively. Thus, flaring of raw synthetic gas or acid gas having high sulfur contents would be unlikely during normal operations.

The maximum predicted impacts for those sources which operate continuously are expected to be less than the Prevention of Significant Deterioration (PSD) increments and ambient air quality standards (AAQS). Indeed, the majority of the impacts are less than the promulgated significant impact levels.

8.3.3.2 COOLING RESERVOIR PERFORMANCE WITH GASIFIER THERMAL LOADING

The thermal loading associated with cooling water from the coal gasification unit would increase the overall temperature and rate of evaporation in the existing cooling reservoir. Based on the results of the thermal modeling conducted for Hardee Unit 3 (see Section 5.1.1), additional heat dissipation and makeup water would be required for the coal gasification unit. Additional heat dissipation could be obtained through the use of cooling towers or supplemental cooling

techniques in the reservoir. Additional cooling water makeup could be obtained from one of the potential sources identified in the Water Alternatives Study (see Appendix 10.11).

8.3.3.3 WASTEWATER TREATMENT

There would be three major sources of process wastewater from the gasification process; gray water blow down, stripped condensate, and slag/ash sump water. The combined flow from these sources would be a maximum of 290 gallons per minute (gpm) or 0.42 million gallons per day (mgd). The quality of raw wastewater is not known but can be expected to be a function of both the coal source and the gasification process used.

Treatment of these wastewaters would likely be necessary. The class of parameters requiring treatment include oxygen demanding compounds (primarily formate), ammonia, inorganic suspended solids (with occasionally high concentrations of various metals), and the dissolved fraction of several metals. Examples of the alternative treatment systems which may be employed to treat the above constituents are discussed below.

Oxygen demanding compounds can be removed from wastewater streams either by biological or chemical processes. Given the probable nature of the gasifier wastewater, it is likely that a biological treatment unit (and, specifically an activated sludge unit) would be used at the HPS site. The activated sludge process will create an excess biological mass (i.e., sludge) which must be treated prior to disposal. Typical sludge treatment includes anaerobic digestion (for the removal of organic compounds) followed by dewatering and drying. The digested sludge will be disposed of either by land application or land filling (depending on sludge quality).

Removal of ammonia from wastewater streams is usually accomplished by air stripping. Removal of inorganic suspended solids is typically achieved through a physico-chemical treatment process (e.g., coagulation, flocculation and sedimentation). Removal of dissolved metals is accomplished using a process similar to the physico-chemical treatment used for inorganic suspended solids. The difference is that for dissolved metals, the dissolved fraction must be precipitated after which it can be coagulated and settled.

Treatment of the wastewater generated would likely include a series of several treatment processes. The final sequencing of the treatment units would be dependent on the waste stream

characteristics specific to the selected gasification process and coal characteristics. Such characteristics include oxygen demand, pH, and organic content of the settleable solids. Given the high degree of treatment, the quality of the treated effluent is expected to meet state and federal water quality standards and could be recycled in the process.

8.3.3.4 SOLID BYPRODUCT IMPACTS

Solid byproducts produced by the coal gasification plant would include slag, ash, and sulfur. Sulfur will be produced in liquid form by the Claus sulfur removal system. Sulfur will be sold as a marketable byproduct; however, it will need to be temporarily stored prior to transport from the site. Liquid sulfur will be stored in concrete-lined retention basins which will be enclosed with no potential for exposure to the environment.

Slag and ash are marketable byproducts for use as road building material and for other purposes. However, it was assumed that provisions would be required to store all slag and ash generated by the gasification of coal at or near the site. The byproduct storage facility will require a land area of approximately 22 ha (54 acres) over a lifetime expectancy of 30 years for the gasification facility. Roughly 392,100 kilograms (kg) (432 tons) per day of slag and ash would be generated, which translates to a maximum of 245 cubic meters (m³) [8,640 cubic feet (ft³)] per day. These calculations are based on anticipated plant syngas requirements and physical characteristics for maximum dry density and interconnected porosity of slag material.

EPA (1986) data have demonstrated that slag byproducts from entrained-flow coal gasifiers are non-hazardous based on Resource Conservation and Recovery Act (RCRA) criteria. In addition, results of leachate testing performed at CWCGP indicate that the leachate is also non-hazardous based on RCRA criteria.

8.3.4 ASSESSMENT OF TECHNOLOGY

Currently available gasification plant designs are technically feasible as an alternative fuel source for combustion turbines and can be constructed and operated at the HPS site in an environmental suitable manner. Any site specific environmental constraints could be overcome by proper design.

8.4 REFERENCES

The following references are cited in Chapter 8.

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Electric Power Research Institute (EPRI). 1989. Baltimore Gas and Electric Company's Study of a Shell-Based GCC Power Plant. Palo Alto, CA.

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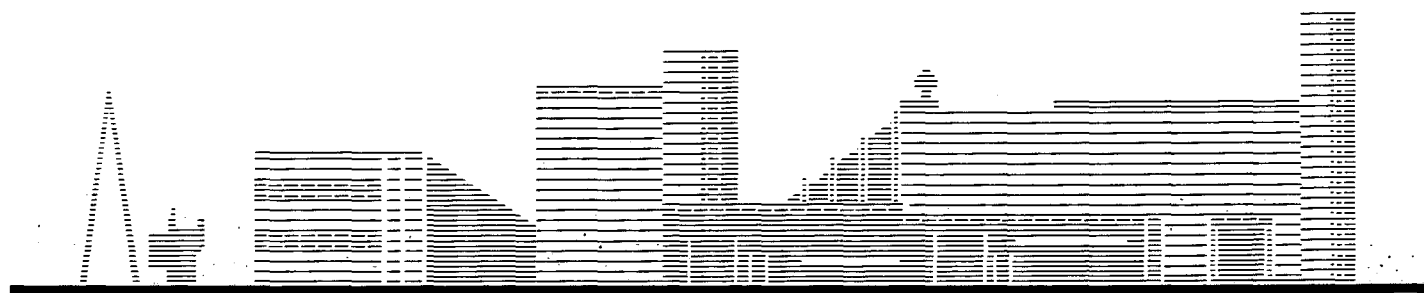
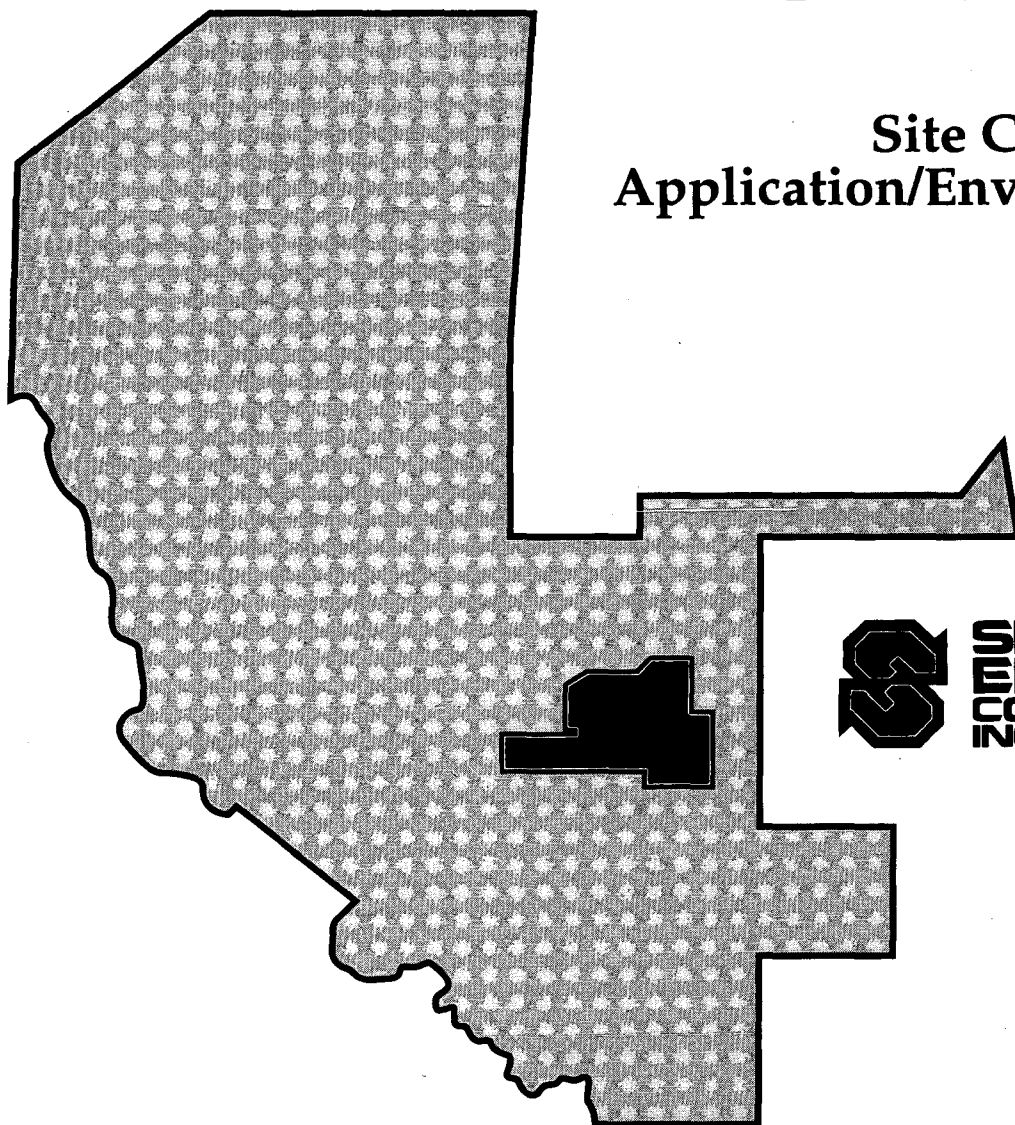
TECO Power Services/Tampa Electric Company/Seminole Electric Cooperative Inc. (TPS/SECI). 1989. Hardee Power Station Site Certification Application/Environmental Assessment.

U.S. Environmental Protection Agency (EPA). 1986. Coal Gasification Environmental Data Summary: Solid Wastes and By-Product Tars. Air and Energy Engineering Research Laboratory, Research Triangle Park, NC. EPA/600/57-86/015C.

Zeien, C.T. *et al.* 1986. Treatment Studies on Coal Gasification Waste Waters. Presented at 6th EPRI Coal Gasification Contractors Conference, 15-16 October 1986, Palo Alto, CA.

HARDEE UNIT 3

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9.0 COORDINATION

Federal, state, regional, and local agencies as well as the general public were contacted to provide input for the Hardee Unit 3 Project. These contacts involved both formal, multi-agency meetings and workshops, individual agency meetings and discussions, as well as meetings with public organizations. The following is a list of formal multiple-agency meetings and workshops.

- Florida Department of Environmental Protection (FDEP) Interagency Meeting:
December 17, 1993: Tallahassee, Florida
Purpose: To seek comment on proposed project, in particular, the Plan of Study.
- FDEP Interagency Meeting:
December 8, 1993: Wauchula, Florida
Purpose: To seek comment on proposed project, in particular, the Plan of Study.
- Public Workshops:
March 9 and 10, 1994: Wauchula and Fort Meade, respectively
Purpose: Provide information to local agency representatives and the public on the Hardee Unit 3 Project.

The following table presents an overall list of agency and public organization contacts.

Date	Agency	Purpose	Contact(s)
04/16/93	PSC	Introduce Hardee Unit 3 Project	Thomas Ballinger
04/29/93	Hardee County Commissioners	Introduce Hardee Unit 3 Project	V. Tomlinson
07/19/93	EPA	NPDES permitting requirements	Jim Patrick
10/08/93	Hardee County	Discussed zoning and land use designations for the site	R. Stauers
10/27/93	FDOT	Obtained FDOT traffic counts for local roadway network	J. Cranford
10/27/93	Hardee County	Obtained Hardee County traffic counts	Hardee County Staff
10/27/93	Polk County	Obtained Polk County traffic counts	Polk County Staff
10/28/93	USACE	Examined flagged USACE wetland line	Perry Horner
11/16/93	FDEP	Introduce Hardee Unit 3 Project	Mike Hickey
11/16/93	FDOT	Discussed turning movement counts for local roadway network	Steve Brown
11/22/93	CFRPC	Introduce Hardee Unit 3 Project	B. Sodt
11/22/93	FDOT	Discussed FDOT traffic counts	Joe Cranford

Date	Agency	Purpose	Contact(s)
12/07/93	DCA	Scoping meeting for POS	Paul Darst
12/07/93	FDEP	Scoping meeting for POS	Don Kell
12/07/93	FDEP	Scoping meeting for POS	Kevin Petrus
12/07/93	FDEP	Scoping meeting for POS	Scott Savery
12/07/93	FDEP	Scoping meeting for POS	Jan Mandrup-Poulsen
12/07/93	FDEP	Scoping meeting for POS and other communications	Buck Oven
12/07/93	FDEP	Scoping meeting for POS	Steve Partney
12/07/93	FDEP	Scoping meeting for POS	Doug Outlaw
12/07/93	FDEP	Scoping meeting for POS	Syed Arif
12/07/93	FDEP	Scoping meeting for POS	Craig Wiltz
12/07/93	FDEP	Scoping meeting for POS	Al Rushanan
12/07/93	FDEP	Scoping meeting for POS and other communications	Tom Rogers
12/07/93	FDEP	Scoping meeting for POS	Cleve Holladay
12/07/93	FDEP	Scoping meeting for POS	Steve Palmer
12/07/93	FDOT	Scoping meeting for POS	Sandra Whitmire
12/07/93	FDOT	Scoping meeting for POS	Cindy Price
12/07/93	FDOT	Scoping meeting for POS	Dawn Wolfe
12/07/93	REA	Scoping meeting for POS	Robert Quigel
12/08/93	EPA	Scoping meeting for POS	Ted Blisterfield
12/08/93	Polk County Planning	Scoping meeting for POS and other communications	Celeste Deardorff

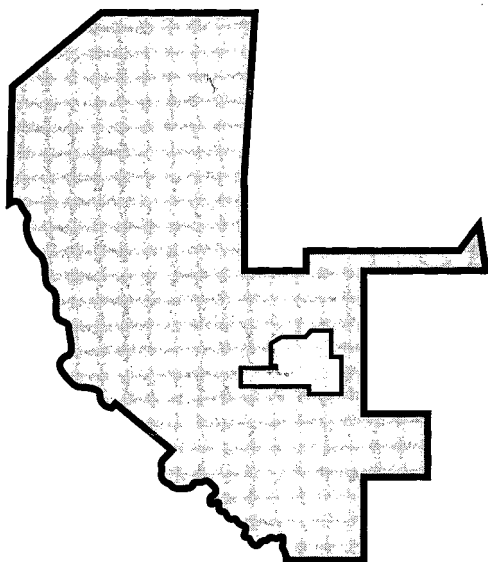
Date	Agency	Purpose	Contact(s)
12/13/93	Wauchula City Commission	Introduce Hardee Unit 3 Project	Commission Members
12/14/93	Bowling Green City Commission	Introduce Hardee Unit 3 Project	Commission Members
01/11/94	FDEP	Conversation to discuss adjacent reclamation project.	Vicki Sharpe
01/12/94	SWFWMD	Meeting to discuss POS	Brian Starford
01/12/94	SWFWMD	Meeting to discuss POS	Howard Knight
01/12/94	SWFWMD	Meeting to discuss POS	P. Scott Laidlaw
01/12/94	SWFWMD	Meeting to discuss POS	Dawn Turner
01/12/94	SWFWMD	Meeting to discuss POS	William A. Hartman
01/12/94	SWFWMD	Meeting to discuss POS	Bob Vertel
01/18/94	Wauchula Kiwanis Club	Introduce Hardee Unit 3 Project	Club Members
01/19/94	SWFWMD Tampa/Brooksville	Introduce Hardee Unit 3 Project	M. Farrell
01/20/94	Wauchula Lions Club	Introduce Hardee Unit 3 Project	Club Members
01/27/94	Hardee County School Board	Introduce Hardee Unit 3 Project	School Board
01/28/94	FDEP	Conversation to discuss permitting requirements.	Robin Trindell
02/02/94	Polk County Water Resource Division	Introduce Hardee Unit 3 Discuss water reuse	J. Spence

Date	Agency	Purpose	Contact(s)
02/04/94	City of Bowling Green	Police protection	B. Brown
02/04/94	Hardee County	Fire Protection	M. Choate
02/04/94	Hardee County Sheriff	Police Protection	C. Harris
02/04/94	Hardee County	Solid Waste	Hardee County Staff
02/04/94	Hardee County	Potable/Wastewater	Hardee County Staff
02/04/94	Hardee County	Police protection	J. Brock
02/04/94	Polk County	Potable/wastewater supply	Doug Allen
02/07/94	SWFWMD (Bartow)	Wetland delineation SHW determination	M. Hurst
02/07/94	SWFWMD	Examined flagged SWFWMD wetland line	Mark Hurst
02/08/94	SWFWMD	Contact for data base search for construction file and water use fee file	Renetta Thompson
02/10/94	City of Fort Meade	Potable/Wastewater	L. Messer
02/10/94	Polk County	Fire Protection	Monroe
02/10/94	Polk County	Solid Waste	Polk County Staff
02/14/94	FDEP	Preapplication meeting to discuss material needed for SCA submittal	Trudy Bell
02/15/94	FDEP	Examined flagged wetland line and proposed mitigation site	Greg Colianni

Date	Agency	Purpose	Contact(s)
02/25/94	Hardee County Planning, Zoning Department	Introduce Hardee Unit 3 Discuss zoning, Comprehensive Plan	R. Stauers J. Latch

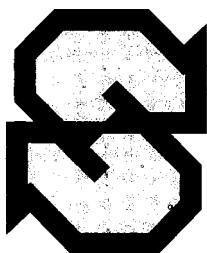
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UNIT 3



SITE CERTIFICATION APPLICATION/ ENVIRONMENTAL ANALYSIS

**Volume II
Appendices**



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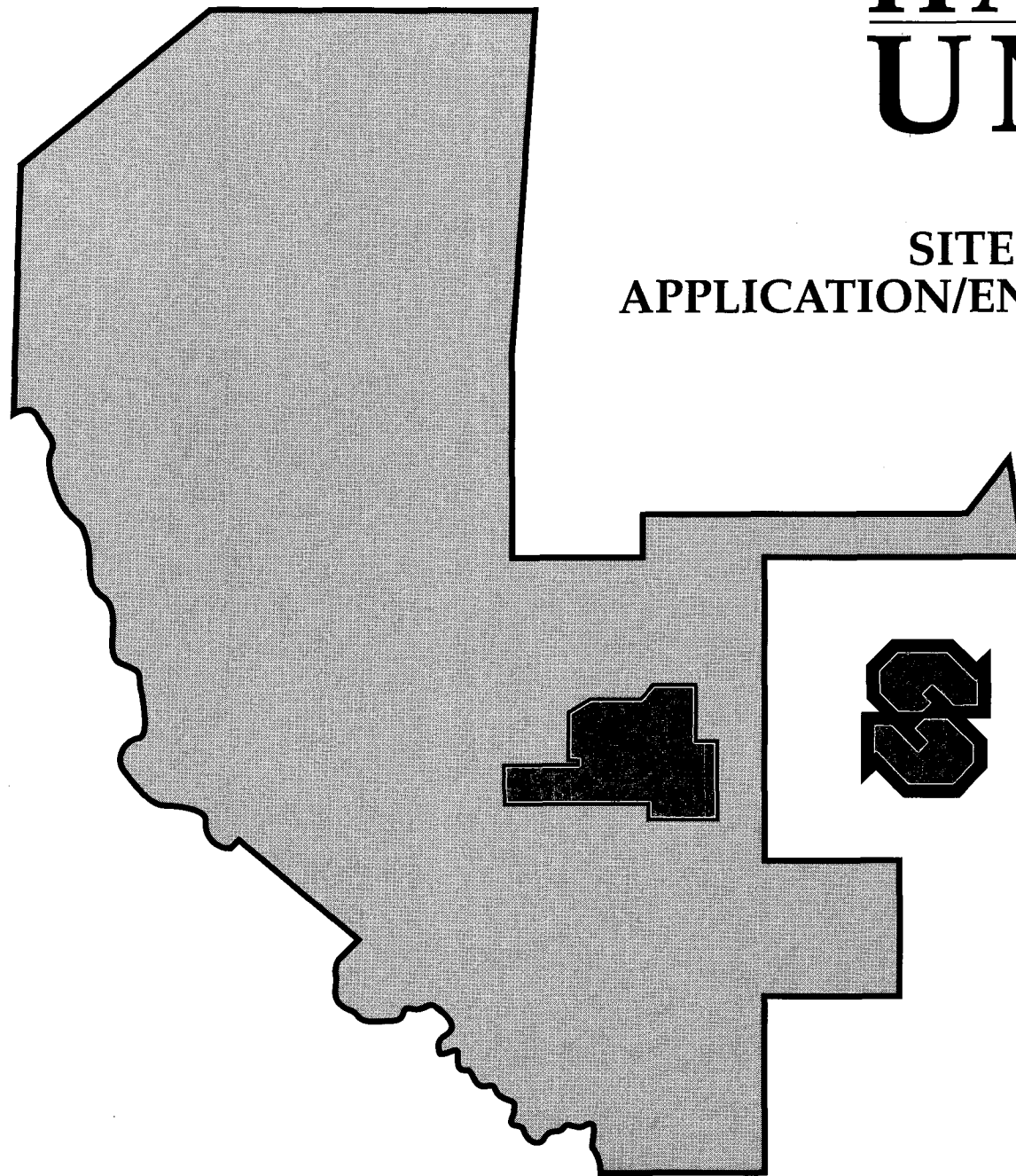
SITE CERTIFICATION APPLICATION/ENVIRONMENTAL ANALYSIS

**Volume II
Appendices**

Submitted by

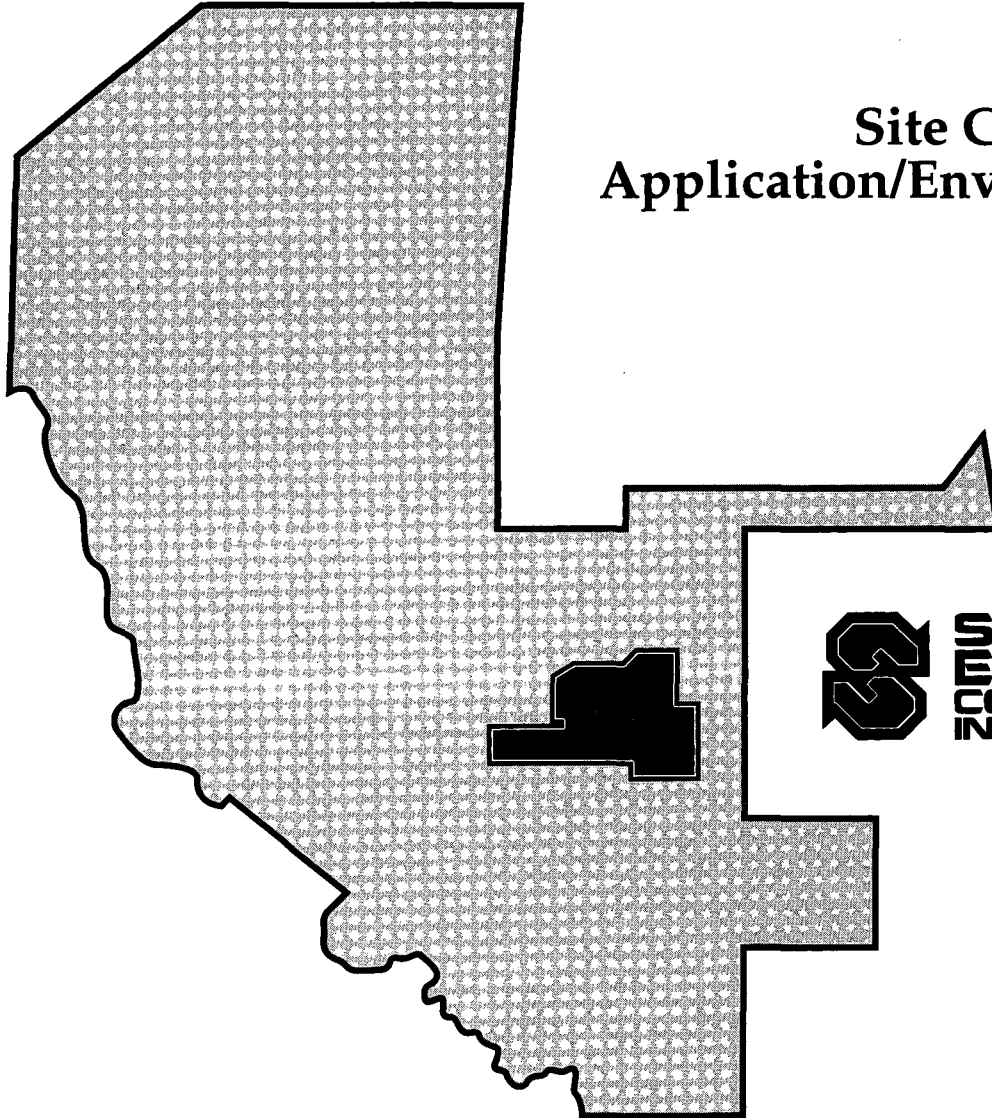


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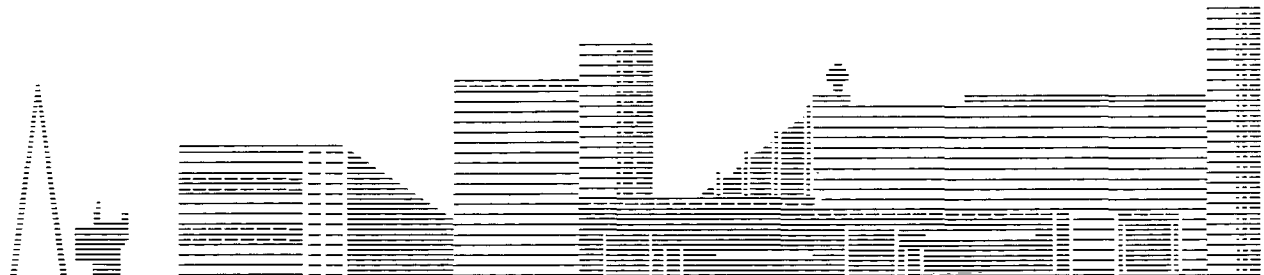


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- 10.1.3 Hazardous Waste Disposal Application/Permit
- 10.1.4 Joint Application - Department of the Army/
Florida Department of Environmental Regulation
and Wetland Mitigation Plan
- 10.1.5 Air Permit Application
- 10.1.6 Coastal Zone Management Certification
- 10.1.7 Notice of Proposed Construction or Alteration
(FAA Form 7460-1)
- 10.1.8 Spill Prevention Control and Countermeasure (SPCC) Plan

10.2 ZONING DESCRIPTIONS

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- 10.2.2 Polk County Zoning Description

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- 10.3.1 Hardee County Land Use Plan Description
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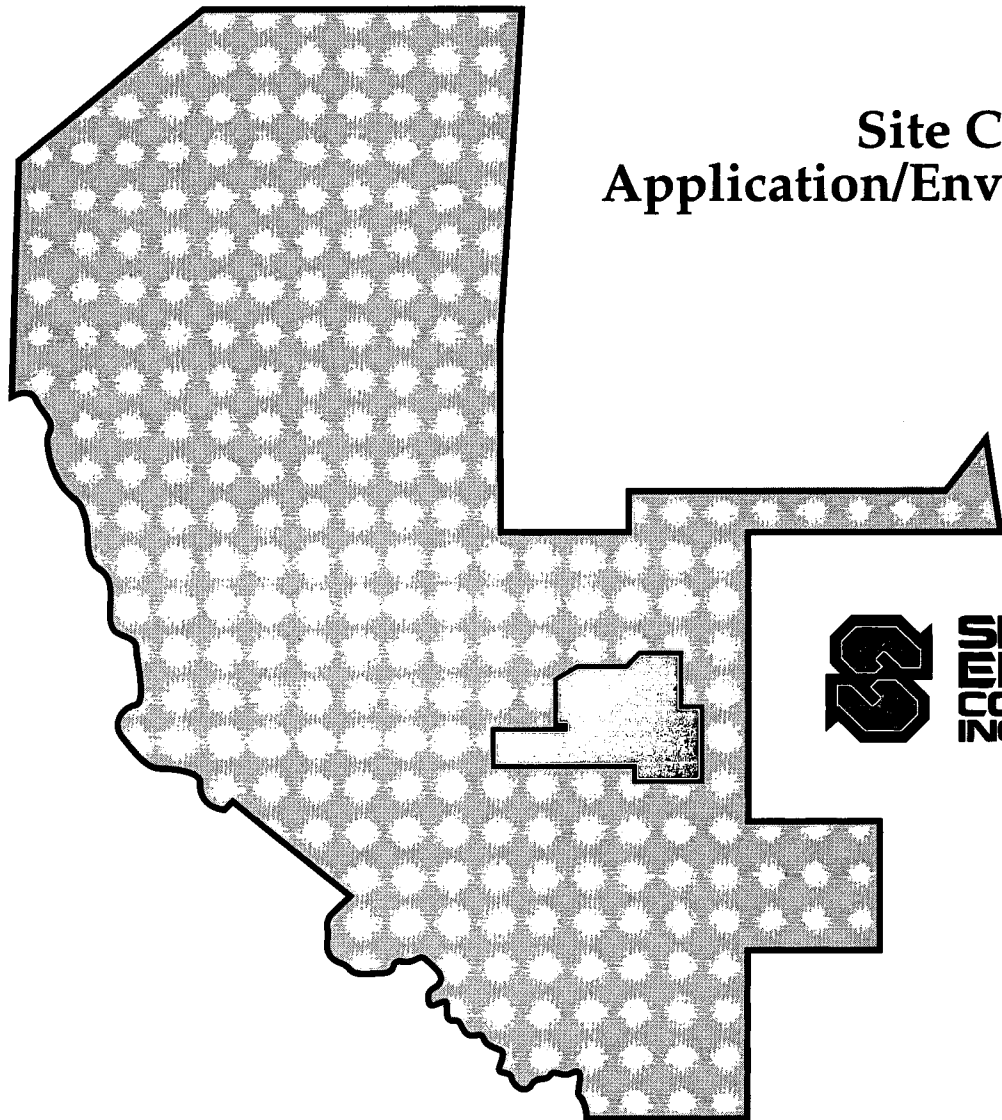
- 10.4.1 Final Certification Order PA89-25 for Hardee Power Station
- 10.4.2 Final Land Use Order PA89-25 for Hardee Power Station

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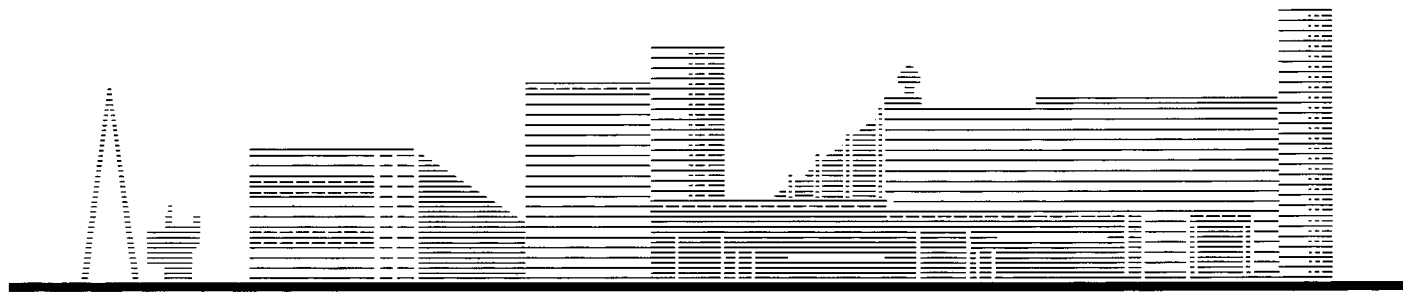
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Appendix 10.1



APPENDIX 10.1

**FEDERAL PERMIT APPLICATIONS
OR APPROVALS**

APPENDIX 10.1.1

316 DEMONSTRATIONS

316 Demonstrations are not required for this project.

APPENDIX 10.1.2

NPDES APPLICATION/PERMIT

Image Quality

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

U.S. ENVIRONMENTAL PROTECTION AGENCY GENERAL INFORMATION <i>Consolidated Permit Program</i> (Read the General Instructions before starting.)		EPA ID NUMBER	
FORM 1 GENERAL		GENERAL INSTRUCTIONS If a preprinted label has been provided, affix it in the designated space. Review the information carefully. If any of it is incorrect, cross through it and enter the correct data in the appropriate fill-in area below. Also, if any of the preprinted data is absent (the area to the left of the label space lists the information that should appear), please provide it in the proper fill-in area(s) below. If the label is complete and correct, you need not complete items I, III, V, and VI (except VI-B which must be completed regardless). Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected. VIA C D	
PLEASE PLACE LABEL IN THIS SPACE			
II. POLLUTANT CHARACTERISTICS INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also Section D of the instructions for definitions of bold-faced terms.			
SPECIFIC QUESTIONS		SPECIFIC QUESTIONS	
A. Is this facility a publicly owned treatment works which results in a discharge to waters of the U.S.? (FORM 2A)		B. Does or will this facility (either existing or proposed) include a concentrated animal feeding operation or aquatic animal production facility which results in a discharge to waters of the U.S.? (FORM 2B)	
YES NO FORM 2A ATTACHED		YES NO FORM 2B ATTACHED	
☒ ☐ ☐		☐ ☒ ☐	
C. Is this a facility which currently results in discharges to waters of the U.S. other than those described in A or B above? (FORM 2C)		D. Is this a proposed facility (other than those described in A or B above) which will result in a discharge to waters of the U.S.? (FORM 2D)	
☒ ☐ ☐		☒ ☐ ☒	
E. Does or will this facility treat, store, or dispose of hazardous wastes? (FORM 3)		F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing within one quarter mile of the well bore underground sources of drinking water? (FORM 4)	
☒ ☐ ☐		☐ ☒ ☐	
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)	
☒ ☐ ☐		☐ ☒ ☐	
I. Is this facility a proposed stationary source which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		J. Is this facility a proposed stationary source which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)	
☐ ☒ ☐		☒ ☐ ☒	
III. NAME OF FACILITY 1 HARDEE UNIT 3			
IV. FACILITY CONTACT A. NAME & TITLE (last, first, & title) 2 MIKE OPALINSKI MGR ENV AFFAIRS B. PHONE (area code & no.) 813 963 0994			
V. FACILITY MAILING ADDRESS A. STREET OR P.O. BOX 3 P.O. BOX 272000 B. CITY OR TOWN 4 TAMPA C. STATE FL D. ZIP CODE 33688			
VI. FACILITY LOCATION A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER 5 COUNTY ROAD 663 B. COUNTY NAME HARDEE C. CITY OR TOWN 6 FORT GREEN D. STATE FL E. ZIP CODE 33834 F. COUNTY CODE (if known)			

CONTINUED FROM THE FRONT

VII. SIC CODES (4 digit, in order of priority)

A. FIRST				B. SECOND			
7	4	9	1	7			
Electric Generation							
C. THIRD				D. FOURTH			
7				7			

VIII. OPERATOR INFORMATION

A. NAME										B. Is the name listed in Item VIII-A also the owner?	
SEMINOLE ELECTRIC COOPERATIVE INC										☒ YES ☐ NO	
C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box. If "Other," specify.)										D. PHONE (area code & no.)	
F - FEDERAL		M - PUBLIC (other than federal or state)		P (specify)		A		813		963	
S - STATE		O - OTHER (specify)								0994	
P - PRIVATE											
E. STREET OR P.O. BOX											
P O BOX 272000											
F. CITY OR TOWN										G. STATE	
T A M P A										FL	
H. ZIP CODE										I. INDIAN LAND	
3,368,8										Is the facility located on Indian lands?	
										☐ YES ☒ NO	

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES (Discharges to Surface Water)										B. PSD (Air Emissions from Proposed Sources)									
9 N F L 0 0 4 1 7 5 1										9 P P S D - E L - 1 4 0									
C. UIC (Underground Injection of Fluids)										D. OTHER (specify)									
9 U N O N E										9 N O N E									
E. RCRA (Hazardous Wastes)										F. OTHER (specify)									
9 R N O N E										9 N O N E									

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS (provide a brief description)

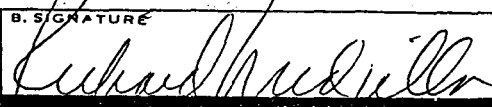
Proposed 440-MW Hardee Unit 3 Combined Cycle Electric Generating Facility at the Hardee Plant Site (HPS).

See Section 3.0 of the SCA/EA for project description, including information regarding the cooling reservoir and operation. The cooling reservoir will provide condenser cooling to both the existing TECO Power Services (TPS) Units 1A and 1B and the proposed Hardee Unit 3. TPS Units 1A and 1B will have a build-out capacity of 440 MW, which when combined with the SECI Unit 3 will result in a total build-out generating capacity at HPS of 880 MW.

The TPS Units 1A and 1B are permitted under NPDES Permit FL0041751.

XIII. CERTIFICATION (see instructions)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print)		B. SIGNATURE		C. DATE SIGNED	
Richard Midulla Vice President, Technical Division				4/28/94	
COMMENTS FOR OFFICIAL USE ONLY					
C					
19					

EPA Form 3510-1 (8-90)

Please type or print in the unshaded areas only			EPA ID Number (copy from Item 1 of Form 1)					
Form 2D NPDES			New Sources and New Dischargers Application for Permit to Discharge Process Wastewater					
I. Outfall Location								
For each outfall, list the latitude and longitude, and the name of the receiving water.								
Outfall Number (list)	Latitude			Longitude			Receiving Water (name)	
	Deg	Min	Sec	Deg	Min	Sec		
SECI 001	27	39	00	81	58	45	Payne Creek	
SECI 002	27	38	00	81	58	25	Payne Creek (via cooling reservoir)	
SECI 003	27	38	00	81	58	25	Payne Creek (via unnamed tributary to Payne Creek)	
II. Discharge Date (When do you expect to begin discharging?) January 1, 1997 (Outfall 003)								
III. Flows, Sources of Pollution, and Treatment Technologies								
A. For each outfall, provide a description of (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and stormwater runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.								
Outfall Number	1. Operations Contributing Flow (list)		2. Average Flow (include units)		3. Treatment (Description or List Codes from Table 2D-1)			
SECI 001	Recirculation cooling reservoir with makeup							
	from the following sources:							
	• Rainfall		2,224,900 gpd					
	• Well Water		2,602,000 gpd					
	• Surface Runoff		311,500 gpd					
	• Seepage		0 gpd					
	• SECI 002		0.093 mgd					
	• TPS 003		0.086 mgd					
SECI 002	Hardee Unit 3 Low-Volume Wastes:							
	• Demineralization Regeneration Basin Effluent		14,000 gpd		Neutralization and Sedimentation (2-K and 1-V)			
	• Oil Separator Effluent		24,000 gpd		Oil Flotation (1-H)			
	• Sanitary Effluent		2,000 gpd		Biological Treatment (3-A) Sedimentation (1-V)			
					Chlorine Disinfection (2-F)			
	• Plant Service Water Pretreatment System Backwash		7,000 gpd					
	• Steam Cycle Blowdown		40,000 gpd					
	Continued on next page							

[illegible]

B. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item III-A. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined (e.g., for certain mining activities), provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

C. Except for storm runoff, leaks, or spills, will any of the discharges described in item III-A be intermittent or seasonal?

☒ Yes (complete the following table)

☐ No (go to item IV)

Outfall Number	1. Frequency		2. Flow		
	a. Days Per Week (specify average)	b. Months Per Year (specify average)	a. Maximum Daily Flow Rate (in mgd)	b. Maximum Total Volume (specify with units)	c. Duration (in days)
SECI 001 - Cooling reservoir	Cooling reservoir will only discharge due to extreme or cumulative rainfall in excess of the 10-year 24-hour storm, where unavoidable to prevent loss of life, severe property damage, or damage to the physical integrity of the cooling reservoir or its structures.		0.213 mgd (see note 1)	2.3 acre-ft	7 days (see note 1)
			Note 1: Flow estimates are based on the 25-year 24-hour rainfall.		
SECI 003 - Hardee Unit 3 Stormwater Detention Pond Including Temporary Construction Dewatering	Temporary Activity During Construction; 7 days per week for 6 months during construction.		8.875 mgd	27.2 acre-ft	180 days during construction

IV. Production

If there is an applicable production-based effluent guideline or NSPS, for each outfall list the estimated level of production (projection of actual production level, not design), expressed in the terms and units used in the applicable effluent guideline or NSPS, for each of the first 3 years of operation. If production is likely to vary, you may also submit alternative estimates (attach a separate sheet).

Year	a. Quantity Per Day	b. Units of Measure	c. Operation, Product, Material, etc (specify)

[illegible]

CONTINUED FROM THE FRONT		EPA ID Number (copy from Item 1 of Form 1)	
C. Use the space below to list any of the pollutants listed in Table 2D-3 of the instructions which you know or have reason to believe will be discharged from any outfall. For every pollutant you list, briefly describe the reasons you believe it will be present.			
1. Pollutant		2. Reason for Discharge	
Outfall #001 Strontium		Trace amounts of naturally occurring strontium have been detected in upland surface runoff (100 µg/L) and Lower Floridan aquifer well makeup water (300 µg/L). Therefore, similar trace levels can be expected in the recirculation cooling reservoir. No strontium will be used in the operation of the proposed combined cycle power plant.	
VI. Engineering Report on Wastewater Treatment			
A. If there is any technical evaluation concerning your wastewater treatment, including engineering reports or pilot plant studies, check the appropriate box below. ☒ Report Available ☐ No Report <i>Engineering studies and evaluations are included as part of the Site Certification Application to the State of Florida.</i>			
B. Provide the name and location of any existing plant(s) which, to the best of your knowledge, resembles this production facility with respect to production processes, wastewater constituents, or wastewater treatments.			
Name		Location	
The HPS cooling reservoir is the first built on reclaimed phosphate mines.			

VII. Other Information (Optional)

Use the space below to expand upon any of the above questions or to bring to the attention of the reviewer any other information you feel should be considered in establishing permit limitations for the proposed facility. Attach additional sheets if necessary.

Please see attached "Outfall Descriptions" for other information.

VIII. Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A. Name and Official Title (type or print)
Richard Midulla, Vice President, Technical Division

B. Phone No.
(813) 963-0994

C. Signature

D. Date Signed

Table V-1. Estimated Water Quality for SECI Outfall 001

Parameter	Units	Estimated Cooling Reservoir Reservoir Quality		FDEP Water Quality Criteria	
		880 MW	660 MW	Class III Surface Water	Class G2 Ground Water
Calcium	mg/L as CaCO ₃	310	250		
Magnesium	mg/L as CaCO ₃	140	110		
Sodium	mg/L as CaCO ₃	210	190		696
Potassium	mg/L as CaCO ₃	20	20		
Total Hardness	mg/L as CaCO ₃	440	360		
Alkalinity	mg/L as CaCO ₃	360	280	>20	
Sulfate	mg/L as CaCO ₃	250	230		250
Chloride	mg/L as CaCO ₃	60	50		704
Silica	mg/L	70	60		
Fluoride	mg/L	5.4	4.4	10	2
Cyanide	mg/L	0.01	0.01	0.005	0.2
MBAS	mg/L	0.48	0.38		
Oil and Grease	mg/L	5	5	5	
Turbidity	mg/L	31	24	ambient + 29	
pH, units	std. units	7.5	7.5	6.0-8.5	6.5-8.5
Total Dissolved Solids	mg/L	1080	890		500
Specific Conductivity	µmho/cm	1240	1050	1275	
Total Kjeldahl Nitrogen	mg/L	1.2	1		
Ammonia Nitrogen	mg/L	0.5	0.4		
Unionized Ammonia	mg/L	0.017	0.014	0.02	
Organic Nitrogen	mg/L	0.7	0.6		
Nitrate + Nitrite - Nitrogen	mg/L	0.2	0.2		10
Total Nitrogen	mg/L	1.4	1.2		
Orthophosphorus	mg/L	0.6	0.5		
Total Phosphorus	mg/L	0.6	0.5		
Arsenic	µg/L	30	20	50	50
Barium	µg/L	200	160		2000
Beryllium	µg/L	1.6	1.3	0.13	4
Cadmium	µg/L	1.00	0.77	0.82	5
Chromium	µg/L	40	30	148	100
Copper	µg/L	9.95	7.90	8.3	1000
Iron	µg/L	990	770	1000	300
Lead	µg/L	6.8	4.6	1.9	15
Manganese	µg/L	63	48		50
Mercury	µg/L	0.097	0.072	0.012	2
Nickel	µg/L	60	50	111	
Selenium	µg/L	40	30	5	50
Silver	µg/L	0.14	0.08	0.07	100
Strontium	µg/L	800	640		
Zinc	µg/L	370	290	75	5000
Alpha, Gross	pCi/L	22.2	17.7	15	
Radium 226	pCi/L	7.9	6.3	5	

Table V-2. Estimated Water Quality for SECI Outfall 002

Parameter	Estimated Water Quality For SECI Outfall 002
Calcium, mg/L as CaCO ₃	265
Magnesium, mg/L as CaCO ₃	115
Sodium, mg/L as CaCO ₃	488
Potassium, mg/L as CaCO ₃	19
Total Hardness, mg/L as CaCO ₃	380
Alkalinity, mg/L as CaCO ₃	136
Sulfate, mg/L as CaCO ₃	701
Chloride, mg/L as CaCO ₃	49
Silica, mg/L	63
Fluoride, mg/L	5
Cyanide, mg/L	0.012
MBAS, mg/L	0.4
Oil and Grease, mg/L	<5
Turbidity, NTU	13
pH, units	6 - 9
Total Dissolved Solids, mg/L	1,317
Specific Conductivity, umhos/cm	2,082
Total Kjeldahl Nitrogen, mg/L	0.92
Ammonia Nitrogen, mg/L	0.47
Unionized Ammonia, mg/L ⁴	0.01
Organic Nitrogen, mg/L	0.45
Nitrate + Nitrite - Nitrogen, mg/L	0.07
Total Nitrogen, mg/L	0.99
Orthophosphorus, mg/L	0.47
Total Phosphorus, mg/L	0.47
Arsenic, ug/L	23
Barium, ug/L	176
Beryllium, ug/L	1.06
Cadmium, ug/L	0.82
Chromium, ug/L	31
Copper, ug/L	7.0
Iron, ug/L	357
Lead, ug/L	3.5
Manganese, ug/L	24
Mercury, ug/L	0.014
Nickel, ug/L	54
Selenium, ug/L	38
Silver, ug/L	0.082
Strontium, ug/L	704
Zinc, ug/L	331
Alpha, Gross (pC/L)	20
Radium 226 (pC/L)	7

Table V-3. Estimated Stormwater Detention Pond Discharge (Outfall 003) Water Quality (Page 1 of 2)

Parameter	Stormwater Detention Pond Discharge (Outfall 003) Quality
Biochemical Oxygen Demand (5-day), mg/L	<5
Chemical Oxygen Demand, mg/L	<50
Total Organic Carbon, mg/L	NA
Total Suspended Solids, mg/L	<100
Ammonia, mg/L	0.5
Flow, gallons/day	36,000
Temperature, Average Winter, °C	18
Temperature, Average Summer, °C	32
pH	6-9
Calcium, mg/L as CaCO ₃	63
Magnesium, mg/L as CaCO ₃	39
Sodium, mg/L as CaCO ₃	17
Potassium, mg/L as CaCO ₃	0
Alkalinity, mg/L as CaCO ₃	61
Sulfate, mg/L as CaCO ₃	37
Chloride, mg/L as CaCO ₃	21
Silica, mg/L	5.4
Fluoride, mg/L	1.0
Cyanide, mg/L	<0.004
Methylene Blue Active Substances, mg/L	0.040
Oil and Grease, mg/L	<5
Turbidity, NTU	1.7
pH, units	7
Total Dissolved Solids, mg/L	190
Specific Conductivity, µmho/cm	173
Total Kjeldahl Nitrogen, mg/L	0.74
Ammonia Nitrogen, mg/L	0.11
Organic Nitrogen, mg/L	0.65
Nitrate + Nitrite-Nitrogen, mg/L	0.50
Total Nitrogen, mg/L	1.24
Orthophosphorus, mg/L	0.41
Total Phosphorus, mg/L	0.44
Arsenic, µg/L	<5
Barium, µg/L	<10
Beryllium, µg/L	<3
Cadmium, µg/L	<0.4
Chromium, µg/L	<10

Table V-3. Estimated Stormwater Detention Pond Discharge (Outfall 003) Water Quality (Page 2 of 2)

Parameter	Stormwater Detention Pond Discharge (Outfall 003) Quality
Copper, $\mu\text{g/L}$	7
Iron, $\mu\text{g/L}$	293
Lead, $\mu\text{g/L}$	6.1
Manganese, mg/L	7.9
Mercury, $\mu\text{g/L}$	0.24
Nickel, $\mu\text{g/L}$	16
Selenium, $\mu\text{g/L}$	<5
Silver, $\mu\text{g/L}$	<0.08
Strontium, $\mu\text{g/L}$	100
Zinc, $\mu\text{g/L}$	7.4
Alpha, Gross, (pC/L)	1.7
Radium 226 (pC/L)	0.7

Note: All parameter concentrations were estimated based on engineering studies of Payne Creek water quality (Source Code 1) and Best Professional Estimates (Source Code 4).

OUTFALL DESCRIPTIONS

Introduction

Seminole Electric Cooperative, Inc. (SECI) is proposing to own and operate a new 440-megawatt (MW) combined cycle power plant [the Hardee Power Station Unit 3 (Hardee Unit 3) Project]. The Hardee Unit 3 Project will be located on the existing Hardee Power Station (HPS) site and will represent an incremental increase in the ultimate power-generating capacity of the HPS site from 660 MW to 880 MW. The HPS site was selected as the preferred location for the Hardee Unit 3 Project because this site has been previously certified for 660 MW of combined cycle power generation (Certification Number PA89-25) [TECO Power Services (TPS)/SECI, 1989]. Furthermore, the HPS site has adequate area to accommodate the proposed expansion from 660 MW to 880 MW. Locating the Hardee Unit 3 Project at the HPS site takes advantage of the existing infrastructure and onsite facilities, and minimizes potential environmental impacts that might otherwise be associated with the construction of a combined cycle power plant at a previously undeveloped site.

TPS currently operates Units 1A and 1B at HPS. These units have a generating capacity of 295 MW of which 70 MW is steam electric generating capacity. TPS uses the cooling reservoir for condenser cooling and discharges low-volume wastes to it. TPS operates HPS under National Pollutant Discharge Elimination System (NPDES) Permit Number FL0041751. The cooling reservoir will be jointly used by the SECI and TPS generating units at HPS.

Outfall SECI 001

Outfall SECI 001 is an emergency overflow from the 570-acre recirculating cooling reservoir constructed as part of the original HPS design. The existing cooling reservoir will be used without physical modification for the addition of Hardee Unit 3. The cooling reservoir has a current heat load of 70 MW from the TPS existing units. This recirculating cooling reservoir will function as water supply for use in condenser cooling of the steam cycle portion. The condenser cooling system for Hardee Unit 3 will add a 140-MW thermal load to the reservoir. The total heat rejected to the cooling reservoir will be from a 280-MW thermal load at the HPS 880-MW buildout.

Water makeup to the reservoir includes rainfall onto the reservoir; surface runoff and surficial aquifer seepage from the upland basin; treated sanitary and plant wastewaters discharged to the reservoir; and makeup water pumped from the lower Floridan aquifer wells. The reservoir may also receive discharge from temporary construction dewatering activities during plant construction. This water will be similar in quality to surficial aquifer quality. Water flows out of the reservoir include: evaporation; lateral seepage through the confining berm into the surficial aquifer; leakage down through the confining layers into deeper confined aquifers; and infrequent discharges to Payne Creek.

Based on long-term water balance modeling (37 years of data analysis) and HEC-1 hydraulic modeling, the cooling reservoir will discharge only in cases of extreme or cumulative rainfall in excess of the 10-year, 24-hour hydrologic event. Discharges from the reservoir during these extreme storm events are necessary to prevent loss of life, severe property damage, or damage to the physical integrity of the cooling reservoir or its structures.

It is noted that the proposed Outfall SECI 001 will be jointly used with TPS. TPS's permit reservoir outfall is NPDES Permit Number FL0041751, Outfall 001.

Outfall SECI 002

Outfall 002 will be the treated low-volume wastestreams from Hardee Unit 3. Individual wastestreams included are the demineralizer regenerant backwash, plant and floor drains, treated sanitary sewage effluent, and steam cycle blowdown. The demineralizer regenerant backwash will be neutralized and consist only of the concentrated minerals found in the raw water (e.g., Floridan aquifer). The plant and floor drain streams will consist of raw service water that may be contaminated with oil. This stream will be routed to an oil/water separator prior to release to the reservoir. Steam cycle blowdown will be a very low total dissolved solids (TDS) stream (i.e., $TDS < 20 \text{ mg/L}$) that may contain trace levels of anti-scaling chemicals. Detailed descriptions of these wastestreams are presented in Section 3.5 of the SCA/EA. SECI will monitor and report chemical discharges into the reservoir at the proposed Outfall SECI 002.

Outfall SECI 003

Outfall SECI 003 will be the overflow discharge from the plant site stormwater detention pond. This stormwater pond has been designed to meet all applicable Southwest Florida Water

Management District and Florida Department of Environmental Protection stormwater quality and quality control requirements.

During the construction, the pond will provide retention with biological filtration for runoff from a single 10-year, 24-hour rainfall event. Stored runoff may also be released via the outfall. After construction, the pond will operate as a wet detention system, providing retention with littoral zone treatment for the first 1 inch of runoff, and post-development peak flows not exceeding predevelopment peak flows for a single 25-year, 24-hour rainfall event.

The pond will also receive discharge from temporary construction dewatering activities during construction. After removal of suspended materials through sedimentation, this water will be similar in quality to surficial aquifer water quality.

Given the proposed fuels for the proposed combined cycle plant (i.e., gas or oil), no fuel-related stormwaters will be directed to this pond. Influent plant site stormwater is expected to be similar to stormwater from other light industrial sites.

APPENDIX 10.1.3

HAZARDOUS WASTE DISPOSAL APPLICATION/PERMIT

Please refer to the Instructions for Filing Notification before completing this form. The information requested here is required by law (Section 3010 of the Resource Conservation and Recovery Act).



EPA

Notification of Regulated Waste Activity

United States Environmental Protection Agency

Date Received
(For Official Use Only)

I. Installation's EPA ID Number (Mark 'X' in the appropriate box)



A. First Notification



B. Subsequent Notification
(complete item C)

C. Installation's EPA ID Number

II. Name of Installation (Include company and specific site name)

S E C I H A R D E E P O W E R S T A T I O N # 3

III. Location of Installation (Physical address not P.O. Box or Route Number)

Street

3. 5 M I L E S N O F S R 6 2 O N C R 6 6 3

Street (continued)

City or Town

F T G R E E N S P R I N G S

State

ZIP Code

F L

3 3 8 3 4 -

County Code

County Name

H A R D E E

IV. Installation Mailing Address (See Instructions)

Street or P.O. Box

P O B O X 2 7 2 0 0 0

City or Town

T A M P A

State

ZIP Code

F L

3 3 6 8 8 -

V. Installation Contact (Person to be contacted regarding waste activities at site)

Name (last)

D U R E N

(first)

J I M

Job Title

D I R P O W E R P R O D.

Phone Number (area code and number)

8 1 3 - - - - -

VI. Installation Contact Address (See Instructions)

A. Contact Address

Location: Mailing



B. Street or P.O. Box

P O B O X 2 7 2 0 0 0

City or Town

T A M P A

State

ZIP Code

F L

3 3 6 8 8 -

VII. Ownership (See Instructions)

A. Name of Installation's Legal Owner

S E M I N O L E E L E C T R I C C O O P E R A T I V E

Street, P.O. Box, or Route Number

P O B O X 2 7 2 0 0 0

City or Town

T A M P A

State

ZIP Code

F L

3 3 6 8 8 -

Phone Number (area code and number)

8 1 3 - 9 6 3 - 0 9 9 4

B. Land Type



C. Owner Type



D. Change of Owner Indicator

Yes



No

(Date Changed)

Month



Day



Year



Year



ID - For Official Use Only

VIII. Type of Regulated Waste Activity (Mark 'X' in the appropriate boxes. Refer to Instructions.)

A. Hazardous Waste Activity

1. Generator (See Instructions)
 - ☐ a. Greater than 1000kg/mo (2,200 lbs.)
 - ☒ b. 100 to 1000 kg/mo (220 - 2,200 lbs.)
 - ☐ c. Less than 100 kg/mo (220 lbs.)
2. Transporter (Indicate Mode in boxes 1-5 below)
 - ☐ a. For own waste only
 - ☐ b. For commercial purposes

Mode of Transportation

 - ☐ 1. Air
 - ☐ 2. Rail
 - ☐ 3. Highway
 - ☐ 4. Water
 - ☐ 5. Other - specify
3. Treater, Storer, Disposer (at installation) Note: A permit is required for this activity; see instructions.
4. Hazardous Waste Fuel
 - ☐ a. Generator Marketing to Burner
 - ☐ b. Other Marketers
 - ☐ c. Boiler and/or Industrial Furnace

Indicate Type of Combustion Device(s)

 - ☐ 1. Smelter Deferral
 - ☐ 2. Small Quantity Exemption
 - ☐ 1. Utility Boiler
 - ☐ 2. Industrial Boiler
 - ☐ 3. Industrial Furnace
5. Underground Injection Control

B. Used Oil Fuel Activities

1. Off-Specification Used Oil Fuel
 - ☐ a. Generator Marketing to Burner
 - ☐ b. Other Marketer
 - ☐ c. Burner - indicate device(s) Type of Combustion Device
 - ☐ 1. Utility Boiler
 - ☐ 2. Industrial Boiler
 - ☐ 3. Industrial Furnace
2. Specification Used Oil Fuel Marketer (or On-site Burner) Who First Claims the Oil Meets the Specification

IX. Description of Regulated Wastes (Use additional sheets if necessary)

A. Characteristics of Nonlisted Hazardous Wastes. Mark 'X' in the boxes corresponding to the characteristics of nonlisted hazardous wastes your installation handles (See 40 CFR Parts 261.20 - 261.24)

1. Ignitable (D001) ☐
 2. Corrosive (D002) ☒
 3. Reactive (D003) ☒
 4. Toxicity Characteristic (D000) ☐
- (List specific EPA hazardous waste numbers for the Toxicity characteristic contaminant(s))

B. Listed Hazardous Wastes. (See 40 CFR 261.31 - 33. See instructions if you need to list more than 12 waste codes.)

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

C. Other Wastes. (State or other wastes requiring a handler to have an I.D. number. See instructions.)

1	2	3	4	5	6

X. Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature <i>Mike Opalinski</i>	Name and Official Title (type or print) Mike Opalinski, Manager, Environmental Affairs	Date Signed April 29, 1994
------------------------------------	--	-------------------------------

XI. Comments

Note: Mail completed form to the appropriate EPA Regional or State Office. (See Section III of the booklet for addresses.)

ID - For Official Use Only

IX. Description of Regulated Wastes Continued (Additional sheet)

B. Listed Hazardous Wastes. (See 40 CFR 261.31 - 33. Use this page only if you need to list more than 12 waste codes.)

13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36
37	38	39	40	41	42
43	44	45	46	47	48
49	50	51	52	53	54
55	56	57	58	59	60
61	62	63	64	65	66
67	68	69	70	71	72
73	74	75	76	77	78
79	80	81	82	83	84
85	86	87	88	89	90
91	92	93	94	95	96
97	98	99	100	101	102
103	104	105	106	107	108
109	110	111	112	113	114
115	116	117	118	119	120

APPENDIX 10.1.4

**JOINT APPLICATION - DEPARTMENT OF THE ARMY/
FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION**

**JOINT APPLICATION FOR WORKS
IN THE WATERS OF FLORIDA**

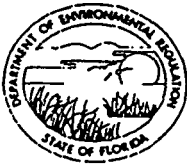
Prepared For:

**Seminole Electric Cooperative Incorporated
16313 North Dale Mabry Highway
Tampa, Florida 33688-2000**

Prepared By:

**KBN Engineering and Applied Sciences, Inc.
1034 NW 57th Street
Gainesville, Florida 32605**

**April 1994
13225D9**



Florida Department of Environmental Regulation

Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400

DER Form # 17-312-800(11)

Form Title Joint Ap. for Works in the Waters of Florida

Effective Date October 30, 1991

DER Application No. _____

Joint Application for Works in the Waters of Florida

Department of the Army (Corps)/Florida Department of Environmental Regulation (DER)/
Department of Natural Resources (DNR)/Delegated Water Management District (Delegated WMD)

Corps Application Number (official use only)	DER Application Number (official use only)						
1. Applicant's Name and Address Name <u>Seminole Electric Cooperative Incorporated</u> Last Name, First Name (if individual): Corporate Name; Name of Govt. Agency Street <u>P.O. Box 27200</u> City <u>Tampa</u> State <u>Florida</u> Zip <u>33688-2000</u> Telephone (<u>813</u>) <u>963-0994</u> (Day) (<u>813</u>) <u>963-0994</u> (Night)							
2. Name, Address, Zip Code, Telephone Number and Title of Applicant's Authorized Agent Name <u>Opalinski, Mike</u> Last Name, First Name Corporate Name; Name of Govt. Agency <u>Seminole Electric Cooperative Incorporated</u> Street <u>P.O. Box 27200</u> City <u>Tampa</u> State <u>Florida</u> Zip <u>33688-2000</u> Telephone (<u>813</u>) <u>963-0994</u> (Day) (<u>813</u>) <u>963-0994</u> (Night)							
3. Name of Waterway at Work Site: <u>Unnamed tributary wetland that flows to Payne Creek, Hardee County.</u>							
4. Street, Road or Other Location of Work: <u>County Road 663 3.5 miles North of State Road 62</u> Incorporated City or Town <u>Hardee County</u> Section <u>1</u> Township <u>33S</u> Range <u>23E</u> Section _____ Township _____ Range _____ Section _____ Township _____ Range _____ County(ies) <u>Polk and Hardee</u> Coordinates in Center of Project: _____ Federal Projects Only: _____ x _____ y _____ Latitude <u>27</u> ° <u>38</u> ' <u>43</u> " Longitude <u>81</u> ° <u>58</u> ' <u>10</u> " Lot _____ Block _____ Subd _____ Plat Bk _____ Pg _____ Directions to Locate Site: <u>Approximately 5 miles south of CR 630 on Fort Green Road. Turn west off of Fort Green Road at the entrance to the existing HPS facilities. Site is located on the north side of the existing facility (Figure 2).</u>							
5. Names, Addresses, and Zip Codes of Adjacent Property Owners Whose Property Also Adjoins the Water (Excluding Applicant). Show Numbers or Names of These Owners on Plan Views. If More Than Six (6) Owners Adjoin the Project, You May Be Required to Publish a Public Notice for the DER. <table style="width:100%"><tr><td style="width:33%">1. <u>IMC-Agrico</u> <u>P.O. Box 2000</u> <u>Mulberry, FL 33860-1100</u></td><td style="width:33%">2. <u>CF Industries</u> <u>P.O. Box 1549</u> <u>Wauchula, FL 33873</u></td><td style="width:33%">3. _____ _____ _____</td></tr><tr><td>4. _____ _____ _____</td><td>5. _____ _____ _____</td><td>6. _____ _____ _____</td></tr></table>		1. <u>IMC-Agrico</u> <u>P.O. Box 2000</u> <u>Mulberry, FL 33860-1100</u>	2. <u>CF Industries</u> <u>P.O. Box 1549</u> <u>Wauchula, FL 33873</u>	3. _____ _____ _____	4. _____ _____ _____	5. _____ _____ _____	6. _____ _____ _____
1. <u>IMC-Agrico</u> <u>P.O. Box 2000</u> <u>Mulberry, FL 33860-1100</u>	2. <u>CF Industries</u> <u>P.O. Box 1549</u> <u>Wauchula, FL 33873</u>	3. _____ _____ _____					
4. _____ _____ _____	5. _____ _____ _____	6. _____ _____ _____					

Northwest District
160 Governmental Center
Pensacola, Florida 32501-5794
904-436-8300

Northeast District
Suite B200, 7826 Baymeadows
Way
Jacksonville, Florida 32256-7577
904-448-4300

Central District
3319 Maquire Blvd., Suite 232
Orlando, Florida 32803-3767
407-894-7555

Southwest District
4520 Oak Fair Blvd.
Tampa, Florida 33610-
7347
813-623-5561

South District
2269 Bay St.
Fort Myers, Florida 33901-2886
813-332-8975

Southeast District
1900 S. Congress Ave., Suite A
West Palm Beach, Florida
33406
407-433-2650

DER Form # 17-312-800(1)

Form Title Joint Ap. for Works in the Waters of Florida

Effective Date October 30, 1991

DER Application No. _____

6. Proposed Use (Check one or more as applicable) Private Single Family ☐ Multi Family ☐
 Public ☐ Commercial ☐ New Work ☒ Alteration of Existing Works ☐ Maintenance ☐ Other(Explain) Industrial

7. Desired Permit Duration (see Fee Schedule) Energy Facility
 5 Yr ☒ 10 Yr ☐ Other (Specify) _____

8. General Permit or Exemption Requested
 DER General Permit FAC Rule 17-312. _____ DER Exemption FAC Rule 17-312. _____ Section 403. _____ F.S.

9. Total Extent of Work in Jurisdictional Open Waters or Wetlands: (Use additional sheets and provide complete breakdown of each category if more space is needed). See Table 1 for breakdown of wetland impact.

a. Within Corps Jurisdiction:

Fill:	<u>218,840</u>	Sq. Ft.	<u>5.03</u>	Acres	<u>31.505</u>	Cu. Yds.
Excavation:	<u>17,340</u>	Sq. Ft.	<u>0.40</u>	Acres	<u>1.264</u>	Cu. Yds.

b. Within DER Jurisdiction:

Fill:	<u>13,850</u>	Sq. Ft.	<u>0.32</u>	Acres	<u>758</u>	Cu. Yds.
Excavation:	<u>1,650</u>	Sq. Ft.	<u>0.04</u>	Acres	<u>85</u>	Cu. Yds.
Excavation Waterward of MHW <u>1,264</u> cu. yds. (Information needed for DNR)						

c. DER Jurisdictional Area Severed (Area Landward of Fill Structures which will be Severed):

<u>0</u>	Sq. Ft.	<u>0</u>	Acres
----------	---------	----------	-------

d. DER Jurisdictional Area Created (New Excavation from Uplands, Exclusive of Mitigation):

<u>0</u>	Sq. Ft.	<u>0</u>	Acres
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e. Docks, Piers, and Over Water Structures: N/A

Total Number of Slips _____		Total Number of Mooring Pilings _____	
Length _____	Width _____	Height above MHW _____	
Length _____	Width _____	Height above MHW _____	
Number of Finger Piers _____	Length _____	Width _____	Height _____
Number of Finger Piers _____	Length _____	Width _____	Height _____
Total area of structure over waters & wetlands _____			sq. ft.
Use of structure _____			

Will the docking facility provide:	No	Yes	Number
Liveaboard Slips	☐	☐	_____
Fueling Facilities	☐	☐	_____
Sewage Pump-out Facilities	☐	☐	_____
Other Supplies or Services Required for Boating (Excluding refreshments, bait and tackle)	☐	☐	_____

f. Seawall length N/A ft. Seawall material _____

Riprap revetment length _____ ft.	Slope _____ H: _____ V	Toe width _____ ft.
Riprap at toe of seawall length _____ ft.	Slope _____ H: _____ V	Toe width _____ ft.
Size of riprap _____		
Type of riprap or seawall material _____		

g. Other (See Item 10). N/A

DER Form # 17-312-900(1)
Form Title <u>Joint Ap. for Works in the Waters of Florida</u>
Effective Date <u>October 30, 1991</u>
DER Application No. _____

10. Description of Work (be specific; use additional sheets as necessary).

See Attachment A, Supplemental Information

11. Turbidity, Erosion, and Sedimentation Controls Proposed:

Turbidity control devices are described in the Erosion and Sedimentation Control Plan in Appendix 10.10 of the Site Certification Application and in Section 3.6 in Attachment A, Supplemental Information.

12. Date Activity is Proposed to Commence January 1997; to be Completed January 1999

Total Time Required to Construct 24 months maximum

13. Previous Applications for this Project have been: N/A

DER No.

Corps No.

A. Denied (date) _____

B. Issued (date) _____

C. Other (please explain) DER Permit No. 251224079 was issued to Agrico in 1987 to mine wetlands.

Differentiate between existing work and proposed work on the drawings.

14. Certification. Application is hereby made for a permit or permits to authorize the activities described herein.

A. I Certify That: (Please check appropriate space)

1. I am the record owner ☒, lessee ☐, or the record easement holder ☐ of the property on which the proposed project is to be undertaken, as described in the attached legal document.

2. I am not ☐ the record owner, lessee, or record easement holder of the property on which the proposed project is to be undertaken, as described in the attached legal document, but I will have, before undertaking the proposed work, the requisite property interest. (Please explain what the interest will be and how it will be acquired.)

Attach legal description of property or copy of deed to the property on which project is to occur (must be provided)

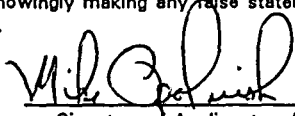
B. I understand I may have to provide any additional information/data that may be necessary to provide reasonable assurance or evidence that the proposed project will comply with the applicable State Water Quality Standards or other environmental standards both before construction and after the project is completed.

C. In addition, I agree to provide entry to the project site for inspectors with proper identification or documents as required by law from the environmental agencies for the purpose of inspecting the site. Further, I agree to provide entry to the project site for such inspectors to monitor permitted work, if a permit is granted.

D. This is a Joint Application and is not a Joint Permit. I hereby acknowledge the obligation and responsibility for obtaining all of the required state, federal or local permits before commencement of construction. I also understand that before commencement of this proposed project, I must be granted separate permits or authorizations from the U.S. Corps of Engineers, the U.S. Coast Guard, the Department of Environmental Regulation, the Delegated Water Management District (where applicable), and the Department of Natural Resources, as necessary.

DER Form # 17-312-900(1)
Form Title <u>Joint Ap. for Works in the Waters of Florida</u>
Effective Date <u>October 30, 1991</u>
DER Application No. _____

E.I am familiar with the information contained in this application, and that to the best of my knowledge and belief, such information is true, complete and accurate. I further certify that I possess the authority to undertake the proposed activities or am acting as the duly authorized agent of the applicant. I understand that knowingly making any false statement or representation in this application is a violation of Section 403.161, F.S. and Chapter 837, F.S.

<u>Mike Opalinski</u> Typed/Printed Name of Applicant or Agent <u>Manager of Environmental Affairs</u> (Corporate Title if applicable)	 Signature of Applicant or Agent	<u>April 29, 1994</u> Date
---	---	-------------------------------

AN AGENT MAY SIGN ABOVE IF APPLICANT COMPLETES THE FOLLOWING:

I hereby designate and authorize the agent listed above to act on my behalf as my agent in the processing of this permit application and to furnish on request, supplemental information in support of the application.

_____ Typed/Printed Name of Applicant _____ (Corporate Title if applicable)	_____ Signature of Applicant	_____ Date
--	---------------------------------	---------------

15. For your information: Section 370.034, Florida Statutes, requires that all dredge and fill equipment owned, used, leased, rented or operated in the state shall be registered with the Department of Natural Resources. Before selecting your contractor or equipment you may wish to determine if this requirement has been met. For further information, contact the Chief of the Bureau of Saltwater Licenses and Permits, Department of Natural Resources, 3900 Commonwealth Boulevard, Tallahassee, Florida 32399. Telephone No. (904) 487-3122. This is not a requirement for a permit from the Department of Environmental Regulation.

18 U.S.C. Section 1001 provides that, Whoever, in any manner within the jurisdiction of any department or agency of The United States knowingly and willfully falsifies, conceals, or covers up by any trick, scheme, or device a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statement or entry, shall be fined not more than \$10,000 or imprisoned not more than five years, or both.

16. Please submit this completed form, with attached drawings and the complete DER processing fee (see Fee Schedule in Rule 17-4.050, F.A.C., copy attached) to the appropriate DER or Delegated WMD office with jurisdiction over the project site.

LEGAL DESCRIPTION

**The Legal Description has been Provided to the
Florida Department of Environmental Protection
and the Southwest Florida Water Management District
and is Available upon Request from SECI**

ATTACHMENT A
SUPPLEMENTAL INFORMATION

1.0 INTRODUCTION

Seminole Electric Cooperative Incorporated (SECI) proposes to build a 440-megawatt (MW) (net capacity) combined cycle unit on a 1,300-acre site in Hardee and Polk counties (Figure 1). The site is approximately 9 miles northwest of Wauchula and roughly 0.67 mile west of County Road 663, and will be built adjacent to the Hardee Power Station (HPS) existing units (Figure 2).

The Hardee Unit 3 Power Plant (Hardee Unit 3) will be a combined cycle electric generating facility with a net capacity of 440 MW. The proposed facility will utilize dry low nitrogen oxide (NO_x) combustors and will burn natural gas as the primary fuel with low sulfur fuel oil as a backup. Hardee Unit 3 will share a number of existing onsite facilities with the HPS existing units, including the cooling reservoir and existing transmission lines.

The project site is located in an area that was recently mined and reclaimed. The mined areas have been reclaimed predominantly to upland pasture by Agrico Chemical Company (now IMC-Agrico) under the provisions of their phosphate mine reclamation plan. A Dredge and Fill Permit was issued to Agrico Chemicals for mining an onsite unnamed tributary wetland [Florida Department of Environmental Regulation (FDER) permit No. 251224079; U.S. Army Corps of Engineers (USACE) permit No. 871PB-20211]. Although the entire unnamed tributary wetland was permitted to be mined, only a portion of it was actually mined. Mitigation for this mining project was approved and has been completed.

2.0 WETLAND COMMUNITIES

Four wetland systems are present onsite: an unnamed tributary wetland; an IMC-Agrico wetland reclamation area; two small low-lying areas that were unintentionally created during the reclamation process; and two drainage ditches that form the west, south, and east boundary of the project site. A description of each wetland system follows.

The unnamed tributary wetland forms the northern and western boundary of the Hardee Unit 3 project site (Figure 3). This wetland was partially mined and reclaimed by IMC-Agrico (see permit numbers above). The entire tributary wetland except the headwater was slated to be reclaimed as upland pasture after mining, however, the tributary wetland remains as a partially mined and reclaimed system. The headwaters of this remnant tributary wetland are fringed by a thick band of primrose-willow (*Ludwigia peruviana*). Scattered Carolina willow (*Salix*

caroliniana), groundsel bush (*Baccharis halimifolia*), wax-myrtle (*Myrica cerifera*), and dogfennel (*Eupatorium capillifolium*) contribute to this vegetation zone. The headwaters were historically a forested wetland as suggested by the existing dead trees.

The unnamed tributary wetland extends southwest and grades into an open water system. Although the wetland is void of plants in the center, it is lined with different species, including water-hyacinth (*Eichhornia crassipes*), pickerel-weed (*Pontederia cordata*), soft-stem bulrush (*Scirpus validus*), cat-tail (*Typha* species), fireflag (*Thalia geniculata*), mild water-pepper (*Polygonum hydropiperoides*), buttonbush (*Cephalanthus occidentalis*), primrose willow, and Carolina willow. Small duckweed (*Lemna valdiviana*), few-root duckweed (*Spirodela punctata*), and common water-meal (*Wolffia columbiana*) cover the water surface in many areas.

A forested segment of the tributary wetland occurs adjacent to the northwest section of the project site. Live oaks (*Quercus virginiana*) surround the forested segment, and blackgums (*Nyssa sylvatica* var. *biflora*) occupy the inner section. Saw palmettos (*Serenoa repens*) form clumps around the base of live oak trees. Although this segment represents an unmined segment of the wetland, the overall health is declining as evidenced by several dead trees. It appears that the natural hydroperiod has changed so the water level remains high and is affecting the trees. Weedy wetland species are encroaching into this forested segment.

The second wetland system located on the Hardee Unit 3 site is an IMC-Agrico wetland reclamation area which runs north-south from the HPS property boundary, intersecting with the tributary wetland (Figure 3). Reclamation was required by the former Florida Department of Natural Resources (FDNR) for mining the site (Program No. AGR-PC-PC1). Additionally, several large reclamation areas are presently being constructed directly north of the HPS site. These reclamation areas will be connected to the unnamed tributary wetland by summer of 1994.

Native trees were planted approximately 2 years ago at the onsite reclamation areas to reestablish the floodplain around the unnamed tributary wetland, and to connect the reclamation areas north of the site to the unnamed tributary wetland. Species planted include slash pine (*Pinus elliotii*), live oak, swamp laurel oak (*Quercus laurifolia*), American elm (*Ulmus americana*), dahoon holly

(*Ilex cassine*), sweet bay (*Magnolia virginiana*), sweetgum (*Liquidambar styraciflua*), ash (*Fraxinus* species), and red maple (*Acer rubrum*).

The third onsite wetland system consists of one large depressional area contiguous with the unnamed tributary wetland and one small depressional area on the south side of the unnamed tributary wetland (Figure 3). These depressional areas were to have been reclaimed to upland pasture but were unintentionally created as depressional pockets during the reclamation process. They were presumably historical uplands as suggested by a remaining live oak in the vicinity and photographs taken prior to mining. These depressional wetlands are very poor quality and are colonized primarily by primrose-willow, cat-tail, and carolina willow. Hemp vine (*Mikania scandens*) covers many plants. Based on field meetings with the Florida Department of Environmental Protection (FDEP), the Southwest Florida Water Management District (SWFWMD), and USACE, these unintentionally created wetlands are under the jurisdiction of only the USACE.

The fourth onsite wetland system consists of two drainage ditches. One ditch runs along the western and southern boundaries of the project site and facilitates drainage from both the Hardee Unit 3 Project site and the existing power plant to Payne Creek (Figure 3). This drainage ditch is jurisdictional by FDEP, SWFWMD, and USACE. The second drainage ditch runs parallel to the entrance road and forms the eastern boundary of the project site. This ditch flows under the road and connects to Payne Creek. The ditch is FDEP jurisdictional only.

3.0 CONSTRUCTION IMPACTS

3.1 CIRCULATING WATER LINES

Wetland impacts are summarized on Table 1 for both FDEP- and USACE-jurisdictional wetlands. Circulating water lines will be constructed across IMC-Agrico's wetland reclamation area (Area No. 1 in Figure 4). To minimize wetland impacts, the pipes will be placed above the 100-year storm elevation, and be supported by concrete structures. A 40-foot (ft) wide swatch will be cleared across the reclaimed wetland for construction and maintenance of the pipes. A few small trees planted by IMC-Agrico as well as a few larger oak trees located along the upland/wetland boundary will be removed for constructing the circulating water pipes.

Two and one-fourth support structures will be constructed in the FDEP-jurisdictional wetland, and 13 structures will be located within the USACE-jurisdictional wetland (Figures 5 and 6). The dimensions of each reinforced concrete footing for the pipe supports will be approximately 18 ft by 3 ft, with an embedment depth of approximately 2 ft.

Construction for each pipe support will require excavating 26 ft by 11 ft, with an assumed slope excavation of 2 to 1. A backhoe or clamshell machine will excavate each pipe-support area. To provide suitable access for the construction equipment, temporary fill pads will be placed just inside the wetlands adjacent to the supports. Approximately 4.7 cubic yards of fill will be required, with an average fill depth of less than 6 inches. Geotextile fabric will be placed in the fill area to help stabilize the existing subgrade. Upon completion of the excavation, any required fill material will be placed in the excavation. Depending on the current hydrologic conditions during the construction period, some dewatering may be required to keep the excavated area dry. Since the excavated hole is only approximately 2 to 3 ft deep, dewatering could be accomplished using a single pump for each hole. During construction, sediment control fences will be installed both upstream and downstream of the pipe crossing site. Turbidity monitoring in the reclamation wetland will also be conducted during pipe construction.

Pipes crossing the unnamed tributary will transport circulating water to and from the condenser cooling system and treated low-volume plant wastewater. Both the circulating water pipes and the low-volume wastewater pipes will be elevated above the tributary and associated wetland and will not restrict water flow.

The circulating water pipes are planned to consist of 84-inch-diameter prestressed concrete cylinder pipe. The concrete cylinder pipe will be provided with a concrete-encased 16-gage steel cylinder core. Individual segments of the concrete pipe will be joined using O-rings and then grouted to ensure the integrity of the joint. Studies of the reliability of the proposed prestressed concrete pipe show this material to be very durable and the potential for failure to be extremely low. The practice of grouting the joints will provide sufficient protection against corrosion, and the placement of the pipes aboveground at the tributary crossing will allow for visual inspection on a regular basis.

The wastewater piping will be constructed of 10-inch-diameter fiberglass reinforced pipe (FRP), "Bondstrand 2000" or equivalent. This material was specifically selected to eliminate the possibility of corrosion and is the same material used for the wastewater piping for the HPS existing units. The wastewater piping for the Hardee Unit 3 facility will be installed aboveground and will be provided with expansion joints at required intervals to account for thermal expansion. The aboveground placement of the wastewater pipes will allow visual inspection on a regular basis.

The selection of the noncorrosive FRP construction material for the wastewater piping, combined with the use of expansion joints and the ability for visual inspection of the pipe, effectively eliminates the potential for a significant impact to the onsite wetland crossing. All wastewater will be treated prior to being routed to the cooling reservoir. In the unlikely event a leak is detected in one of the circulating pipes or the low-volume wastewater pipe, appropriate measures will be taken to stop the leak and prevent damage to the tributary and its associated wetlands.

After the pipes are constructed, the cleared wetland area will be returned to original grade, planted, and maintained as a herbaceous wetland (more detail on restoration can be found in the attached wetland mitigation plan). Upon construction of the pipes, the only fill to remain in the reclaimed wetland will be concrete support structures, each 18 ft by 3 ft in size.

3.2 RETAINMENT BERM

A retainment berm will be constructed along the south side of the unnamed tributary wetland to prevent runoff from the power plant to the wetland. Most of the retainment berm will be outside FDEP-jurisdictional wetlands; however, a small portion of the berm will impact 0.01 acre of a highly disturbed portion of the unnamed tributary wetland (Area No. 2 in Figure 4). This proposed impact area is herbaceous in nature and has been extensively disturbed by feral hog activity.

The retainment berm will measure 2 ft high by 5 ft wide and contain 3:1 sideslopes (Figures 7 and 8). A total of 25 cubic yards to fill will be placed in jurisdictional wetlands for construction of the retainment berm. A small ditch, 1 ft deep by 4 ft wide with a 3:1 sideslope, will be constructed next to the retainment berm. This ditch will impact only 0.003 acre of wetland and require 4 cubic yards of excavation.

3.3 POWER BLOCK AREA

Construction of the power block area will impact 4.69 acres of USACE-jurisdictional wetlands (Area No. 3 in Figure 4). The wetlands to be impacted are low-lying areas that were to have been reclaimed to upland pasture, but were unintentionally graded as low pockets during reclamation. The soil in the reclaimed area contains a high clay content as a result of overburden material from the mining process. Thus, water retention is high and has resulted in colonization of weedy species such as cat-tail, primrose-willow, and Carolina willow. Impacting these wetlands is not expected to result in a loss of significant wildlife habitat.

The average existing grade elevation is 124.0 ft and the proposed elevation of the power block area is 128.0 ft. Therefore, the average fill height in the power block area is 4 ft. The total fill for the power block area is 30,300 cubic yards in USACE-jurisdictional wetlands (Figure 7).

3.4 DETENTION BASIN

A stormwater detention basin will be constructed on the west side of the proposed site. A portion of a small isolated wetland (0.47 acre of the 0.55-acre wetland) will be impacted (Area No. 4 in Figure 4). This wetland is USACE-jurisdictional, and, like the 4.69-acre wetland described above, this wetland was unintentionally created during the reclamation process. It is colonized by weedy wetland species.

The existing grade elevation in the area of the stormwater basin is approximately 120.5 ft. Fill in this area is required for the detention basin containment berm. A 180 ft long section of the berm cuts through the USACE wetland limits and will impact 0.17 acre of the wetland (Figures 9 and 10). The containment berm has a top elevation of 125.0 ft. The top of the berm is 10 ft wide with 4:1 sideslopes on the inside of the basin and 3:1 sideslopes on the outside. The total fill in this USACE-jurisdictional wetland is 780 cubic yards.

The excavation in this area is for detention basin capacity requirements. The average elevation inside the detention basin, within the wetland limits, is 118.5 ft. The area of the wetland located inside the actual detention basin is 0.30 acre. Therefore, the total excavation in this area will be 970 cubic yards.

The stormwater detention basin will serve as a wet detention pond in accordance with the requirement of SWFWMD. The basin will retain the first 1 inch of runoff from the plant site and will release it through a bleed down pipe. A sedimentation area is provided where the runoff enters the basin. The runoff will flow through a littoral zone for biological treatment and removal of pollutants before being discharged. Runoff from the basin will be discharged to the unnamed tributary wetland. An energy dissipation system will be designed and constructed in the uplands to minimize the possibility of erosion in the unnamed tributary wetland.

3.5 DITCH CROSSINGS

Two drainage ditches are proposed to be crossed. An access road is proposed to be constructed in the southwest corner of the site and will cross an existing FDEP and USACE jurisdictional drainage ditch (Area No. 5 in Figure 4). This drainage ditch is a roadside ditch that is frequently mowed and maintained. The road is necessary to assure access from the plant facilities to the cooling reservoir.

Two 24-inch culverts will be placed in the drainage ditch and will ensure passage of the 25-year storm peak (Figures 9 and 11). The access road will be an aggregate surfaced road. It will be 18 ft wide with 3 ft wide shoulders. The elevation of the road at the ditch is 119.0 ft. The invert of the two 24-inch diameter culverts is 115.75 ft. Therefore, the total fill in this area is 125 cubic yards. The only excavation required is under the culverts for pipe bedding. The total excavation is 15 cubic yards.

A second drainage ditch, which forms the east boundary of the project site, will be crossed by two entrance roads (Areas No. 6 and 7 in Figure 4). These crossings are necessary to provide access to the power plant from the existing entrance road. Two culverts will be placed in the drainage ditch (C-12 and C-13; Figure 12 and 13). To install both culverts will require excavating 0.01 acre of FDEP-jurisdictional wetland and filling 0.22 acre of wetland. The roads will be constructed in a manner similar to that described above for the first drainage ditch crossing.

3.6 SEDIMENTATION PLAN

Temporary measures will be used during construction to control erosion and sediment transfer from the site. Silt fences will be used to filter sediments washed from grading areas where the

ground slopes away from the site. Areas disturbed during grading operations will be seeded to establish a vegetative cover to reduce erosion on the site. A more detailed description of sedimentation measures is provided in the Erosion and Sedimentation Control Plan in Appendix 10.10 of the Site Certification Application.

3.7 DEWATERING PLAN

Groundwater dewatering will be used primarily for excavation, installation, and backfill of underground utilities. Dewatering effects will be shallow and will not impact existing facilities or wetlands. A silt screen will be used to minimize the transport of suspended solids in the dewatering flow. Discharge from dewatering operations will be directed to the runoff detention basin where the filtration system will provide suspended solid sedimentation and removal.

Table 1. Summary of Wetland Impacts									
Wetland Impact		Permanent Clearing		Permanent Filling		Temporary Filling		Excavation	
		FDEP	USACE	FDEP	USACE	FDEP	USACE	FDEP	USACE
Circulating Water Line	sf	2,600	9,400	650	3,720	255	255	650	3,720
	acre	0.06	0.22	0.015	0.085	0.006	0.006	0.015	0.085
	cyd	—	—	48	275	4.7	4.7	48	275
Retainment Berm	sf			450	450			150	150
	acre			0.01	0.01			0.003	0.003
	cyd			25	25			4	4
Power Block Area	sf				204,200				
	acre				4.69				
	cyd				30,300				
Stormwater Detention Basin	sf				7,470				13,070
	acre				0.17				0.30
	cyd				780				970
Road Across Drainage Ditch (C14)	sf			3,000	3,000			400	400
	acre			0.07	0.07			0.01	0.01
	cyd			125	125			15	15
Road Across Drainage Ditch (C12 and C13)	sf			9,750				450	
	acre			0.22				0.01	
	cyd			560				18	
Total	sf	2,600	9,400	13,850	218,840	255	255	1,650	17,340
	acre	0.06	0.22	0.32	5.03	0.006	0.006	0.04	0.40
	cyd			758	31,505	4.7	4.7	85	1,264



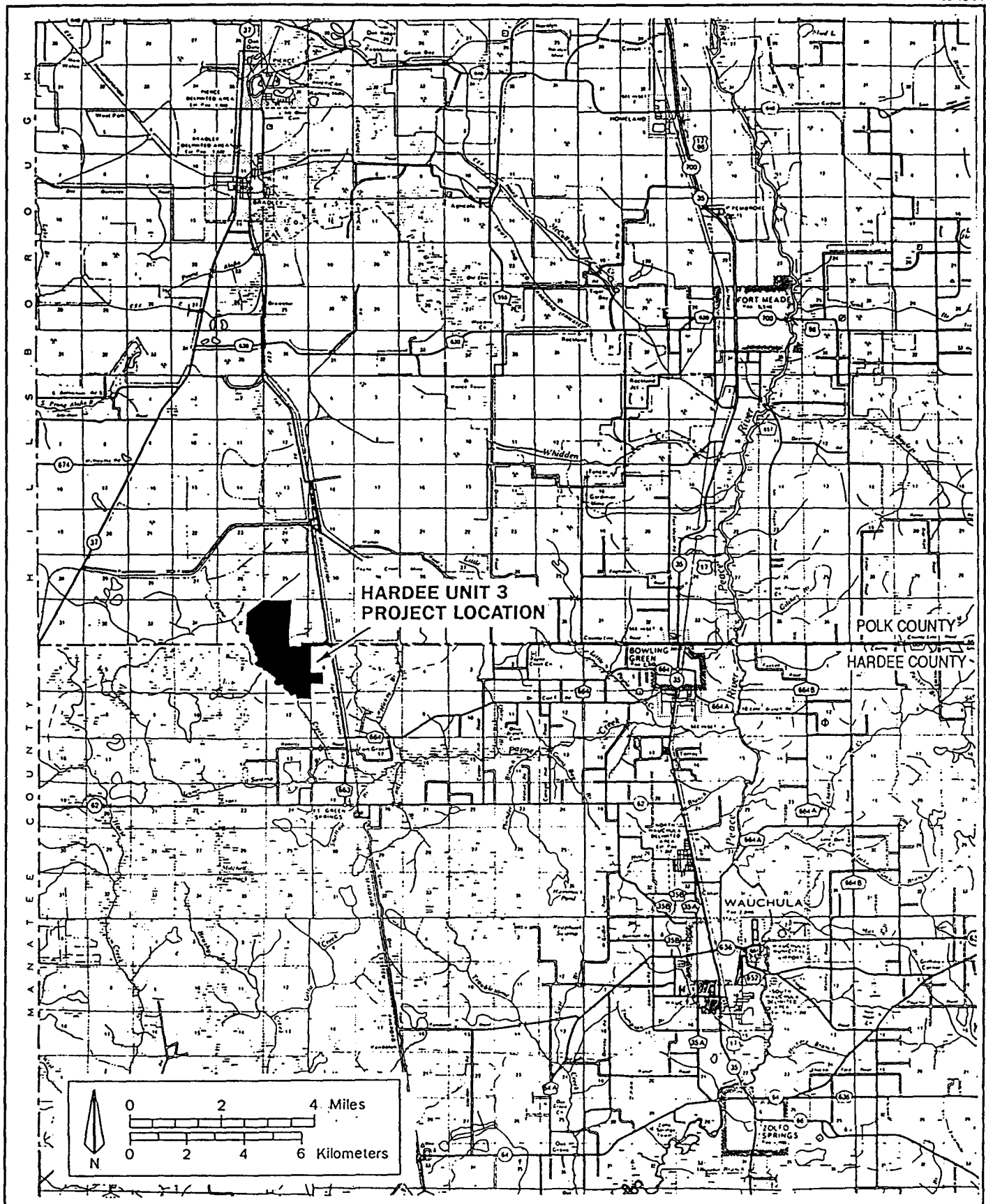


Figure 1
Location of Hardee Unit 3 Project

Sources: FDOT, 1990; 1992; KBN, 1994.



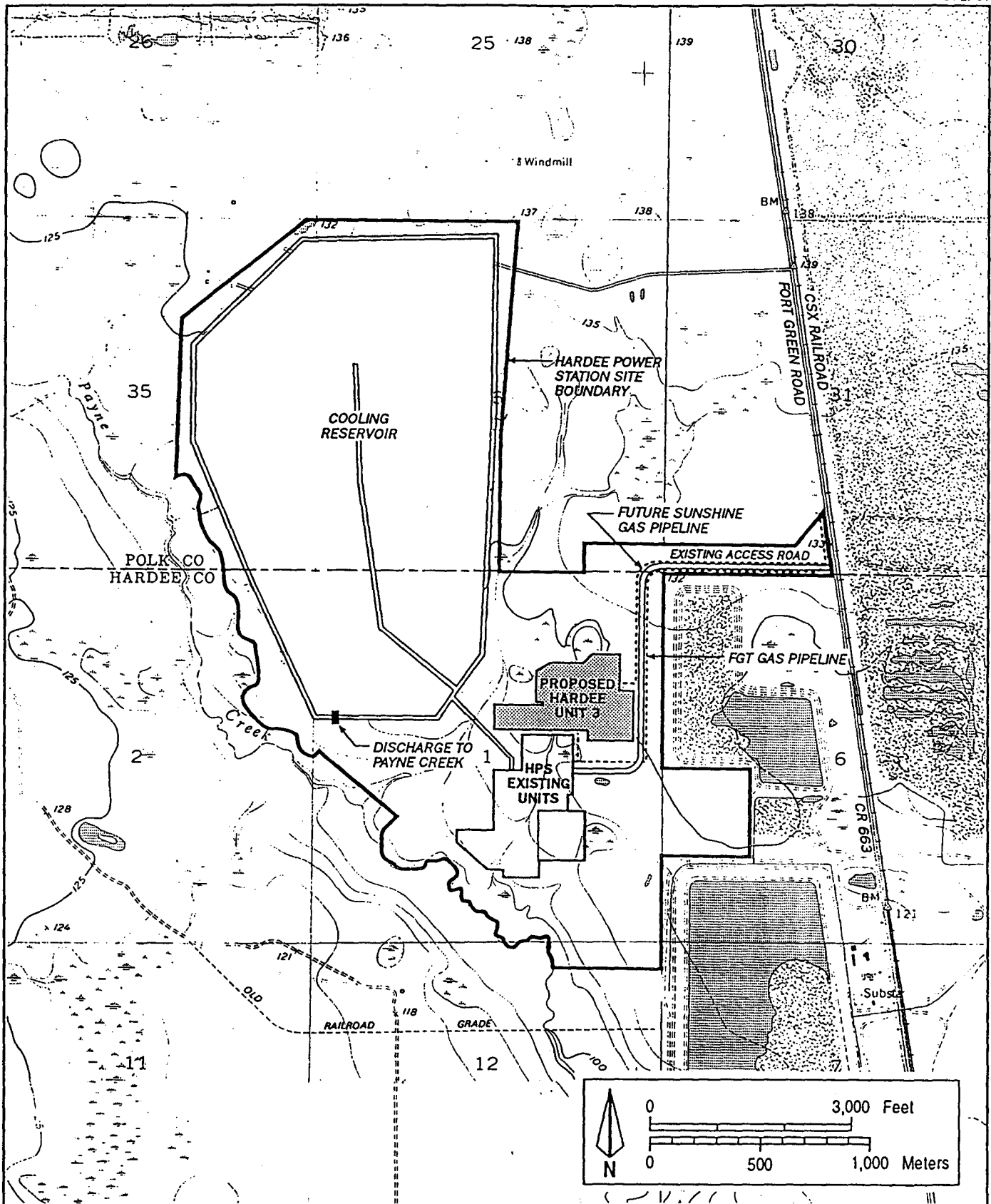
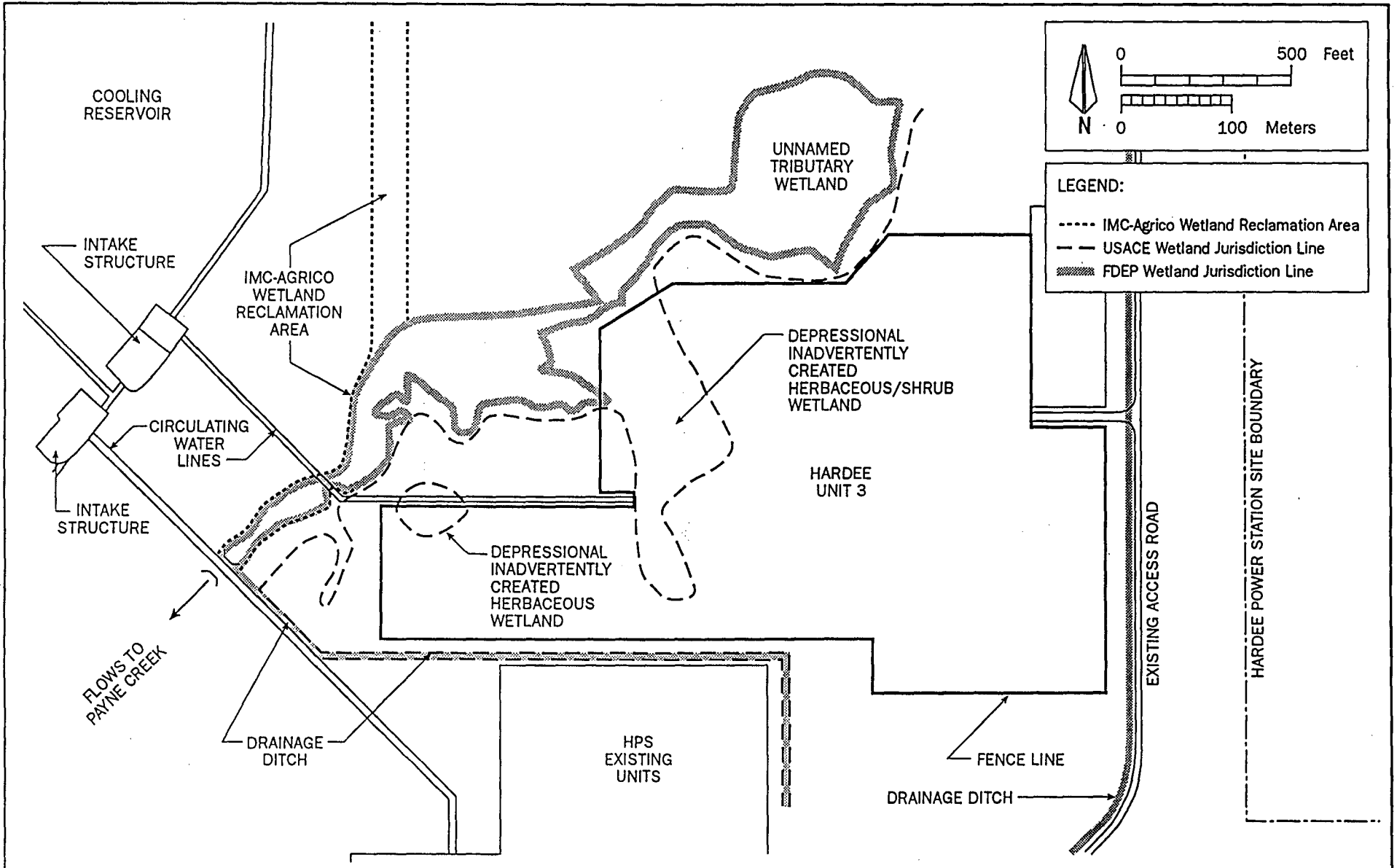


Figure 2
Hardee Unit 3 Site in Relation to Existing Facilities

Sources: USGS, 1987; KBN, 1994.





10.1.4-23

Figure 3
Location of Jurisdictional Wetlands

Source: KBN, 1994.

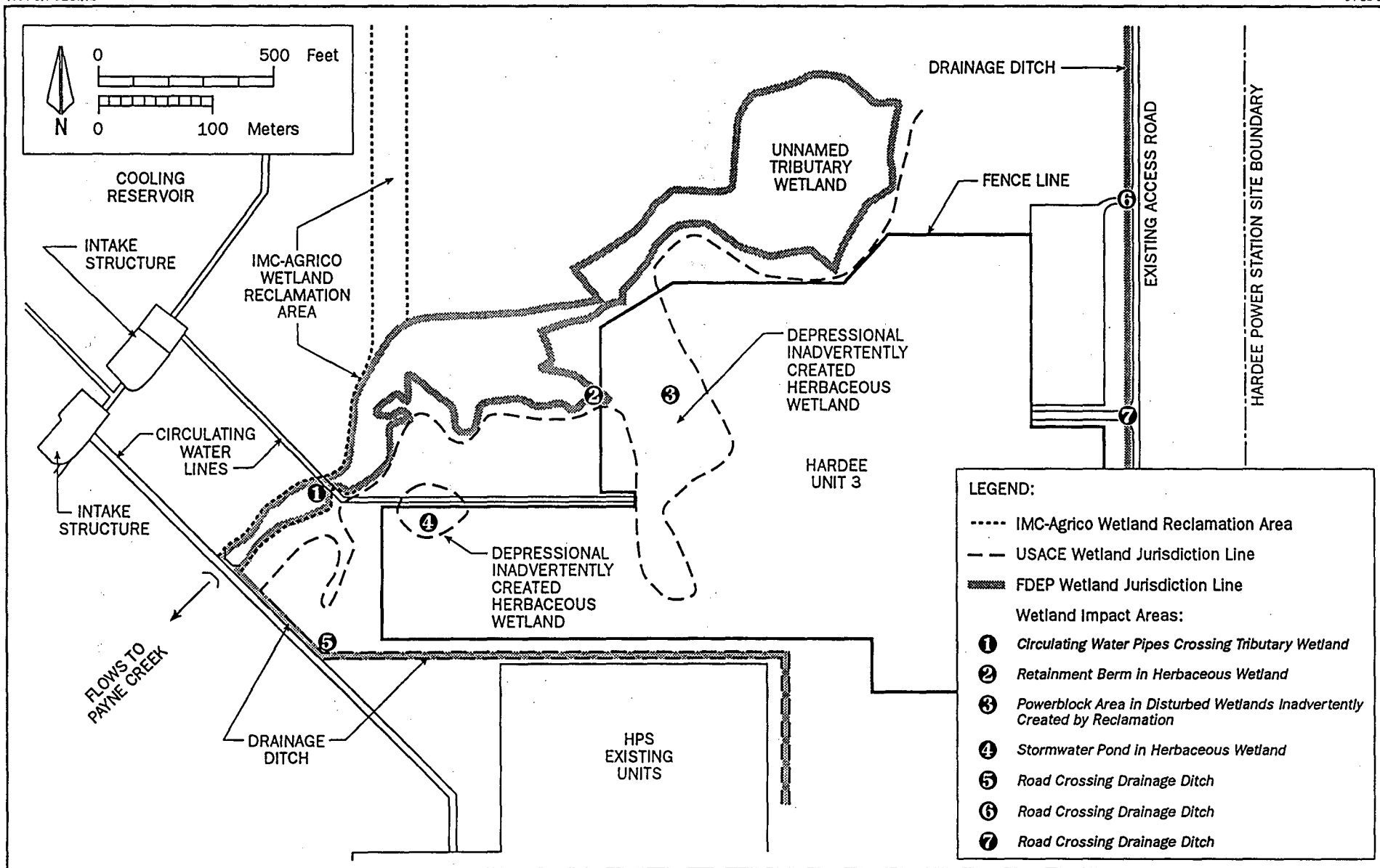
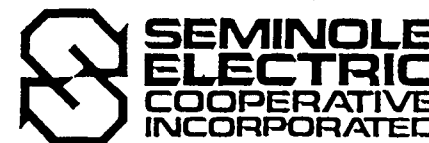


Figure 4
Location of Jurisdictional Wetlands in Relation to Hardee Unit 3 Site Plan

Source: KBN, 1994.



10.1.4-25

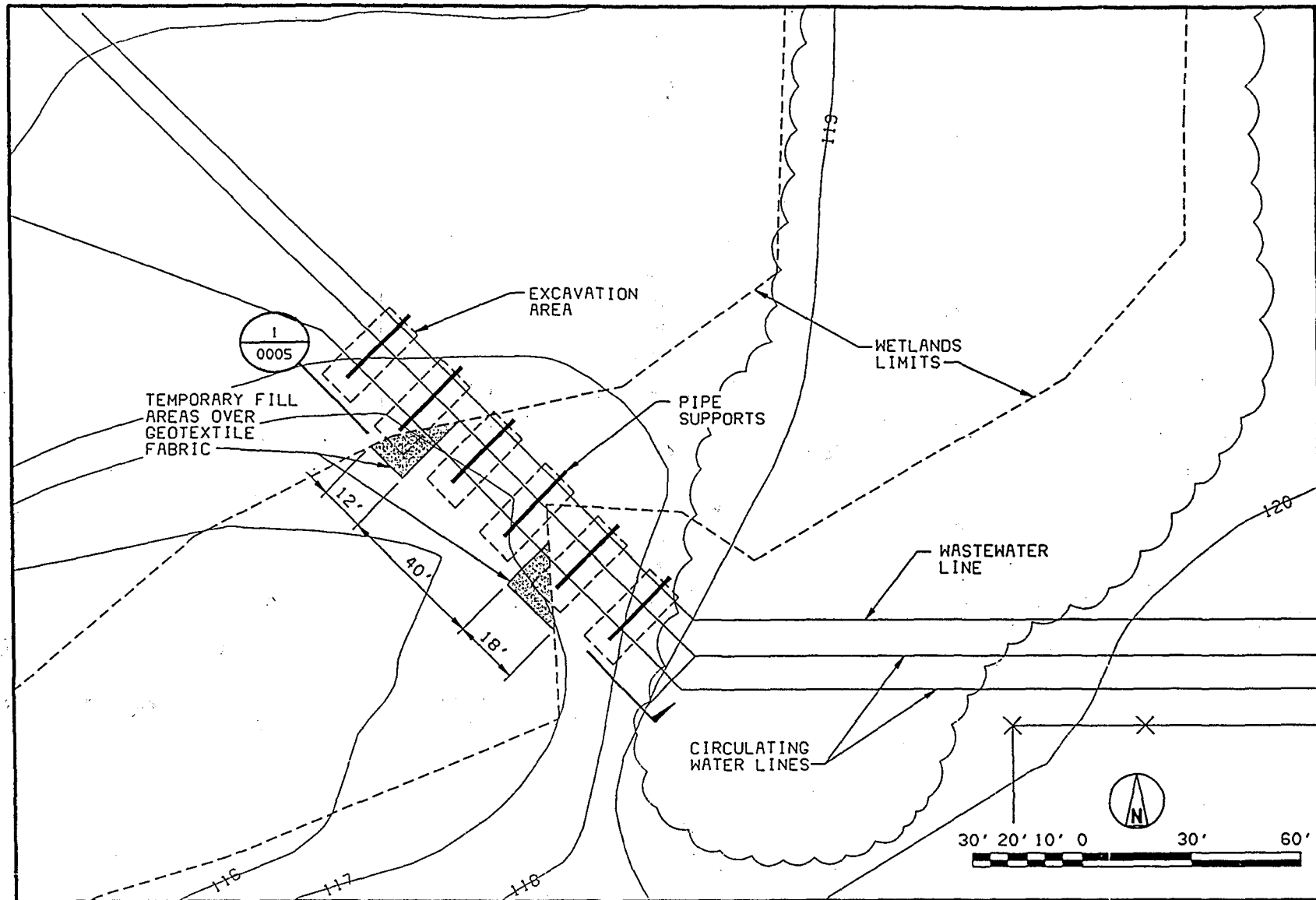


Figure 5
Plan View of the Circulating Water Pipes Crossing the Wetland

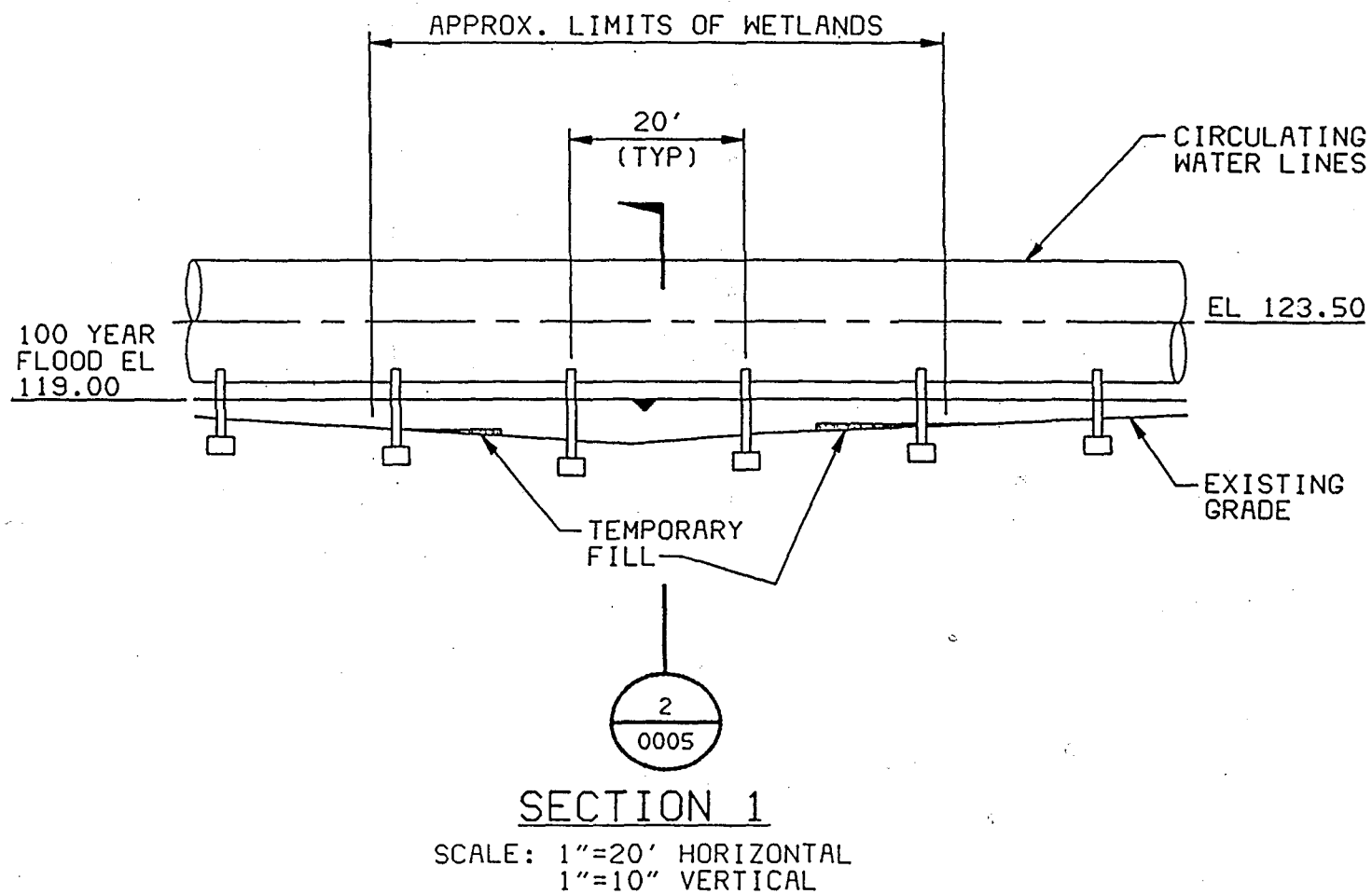


Figure 6
Cross-Section of the Circulating Water Pipes Crossing the Wetland

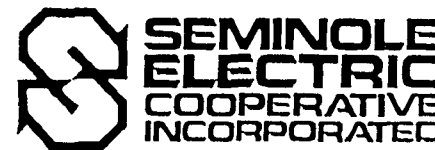
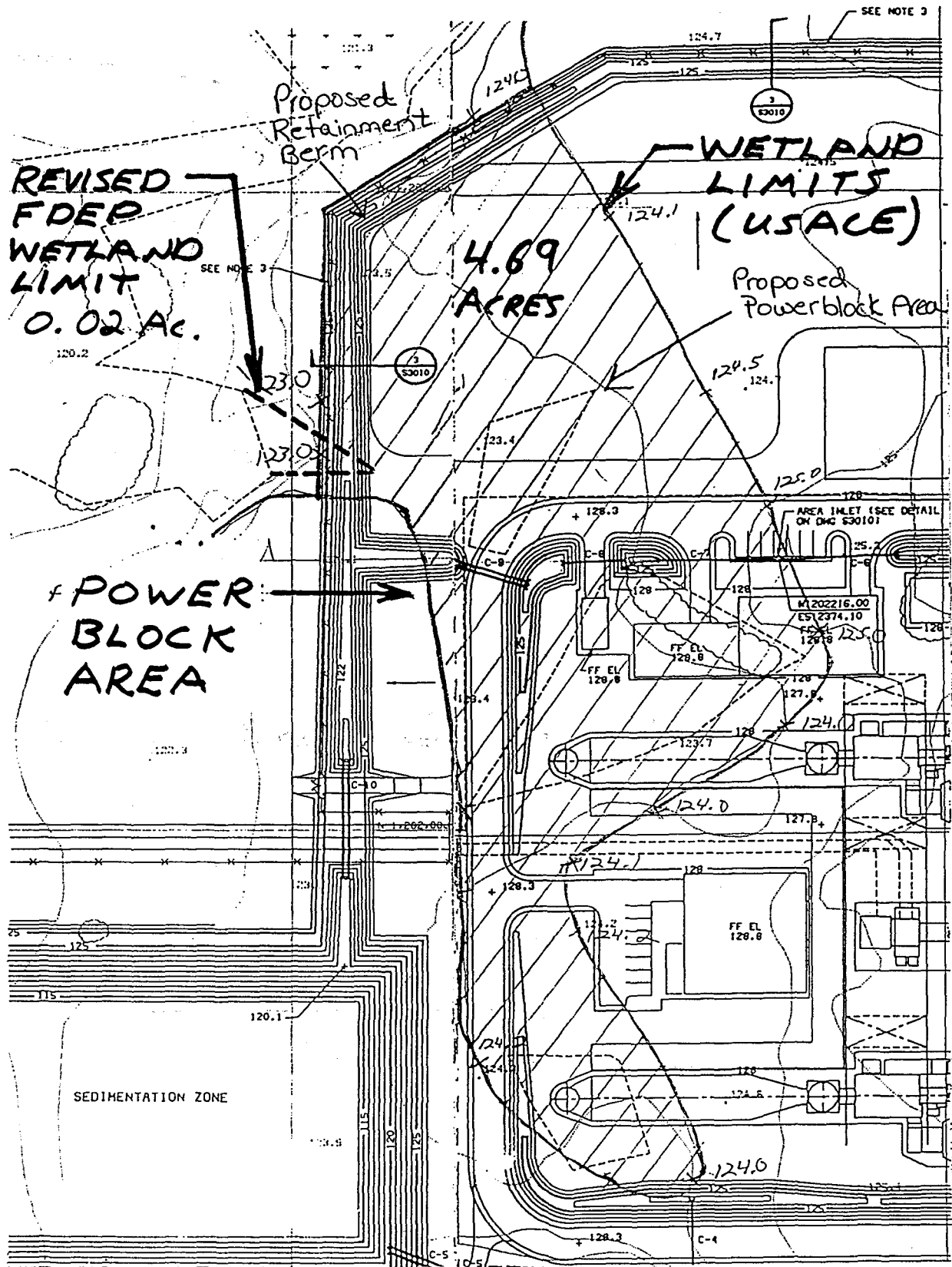
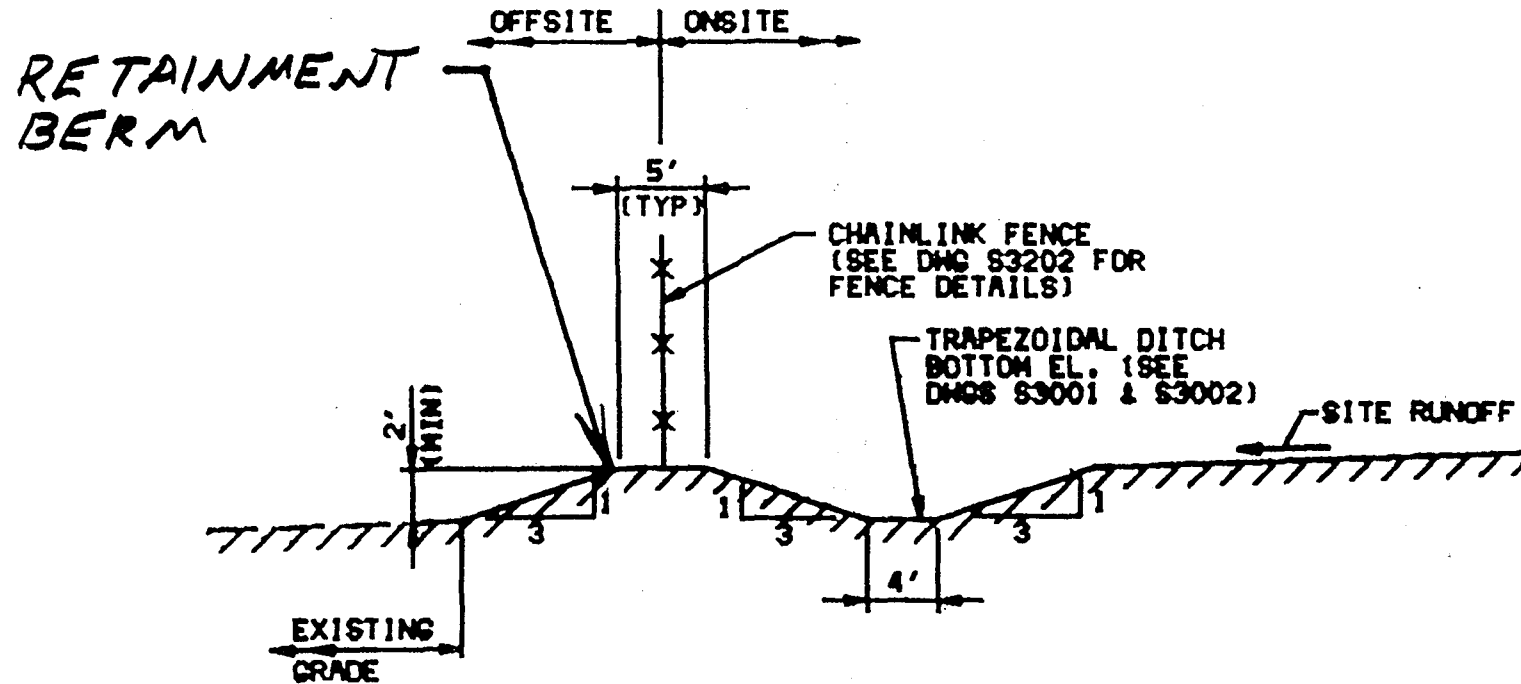


Image Quality

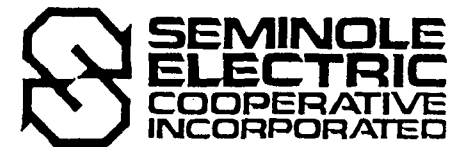
As you review the next group of images, Please note that the original documents were of poor quality.





SECTION 3
PERIMETER DITCH AND CHAINLINK FENCE
 NO SCALE

Figure 8
 Cross-Section of the Retainment Berm



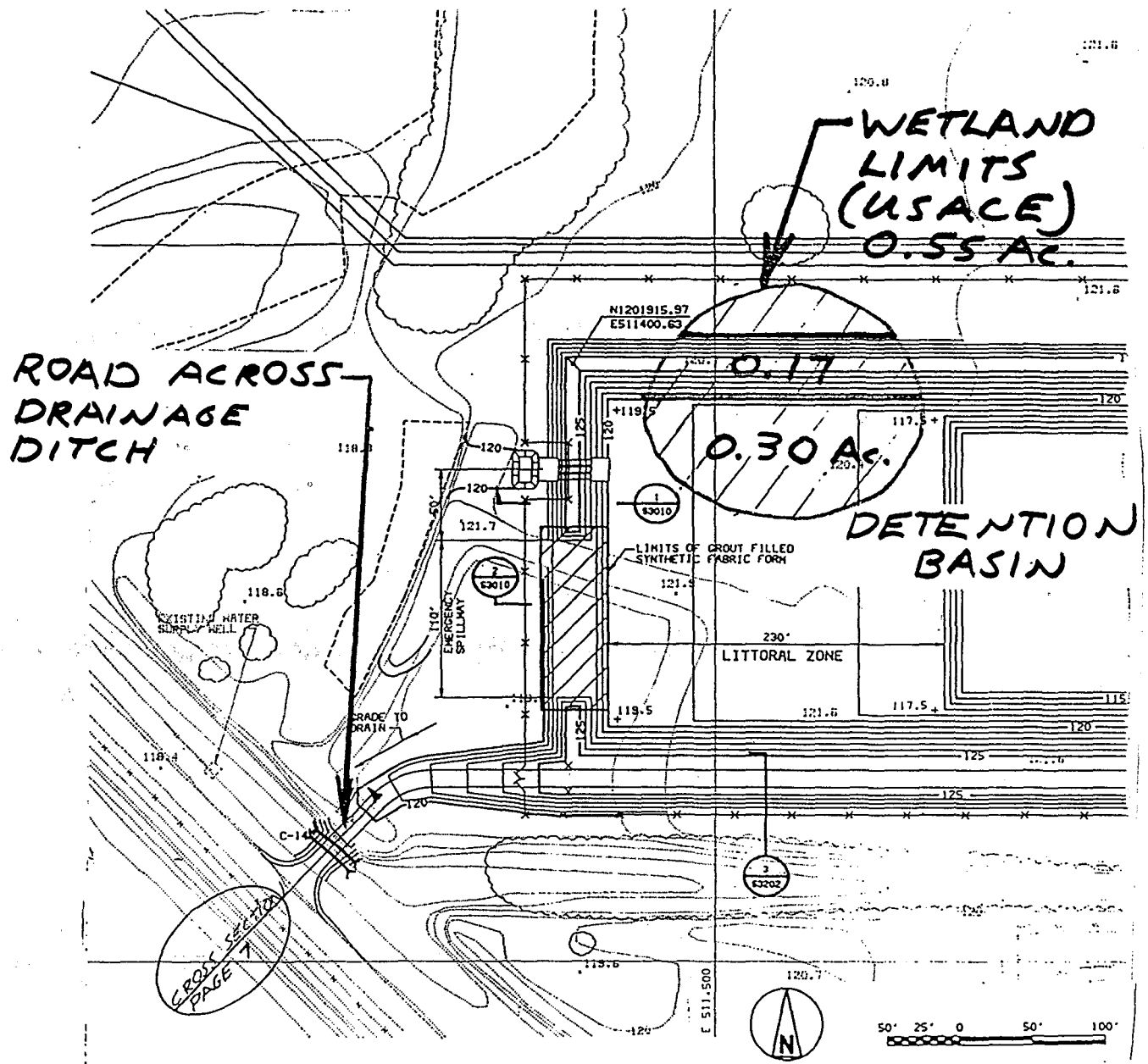
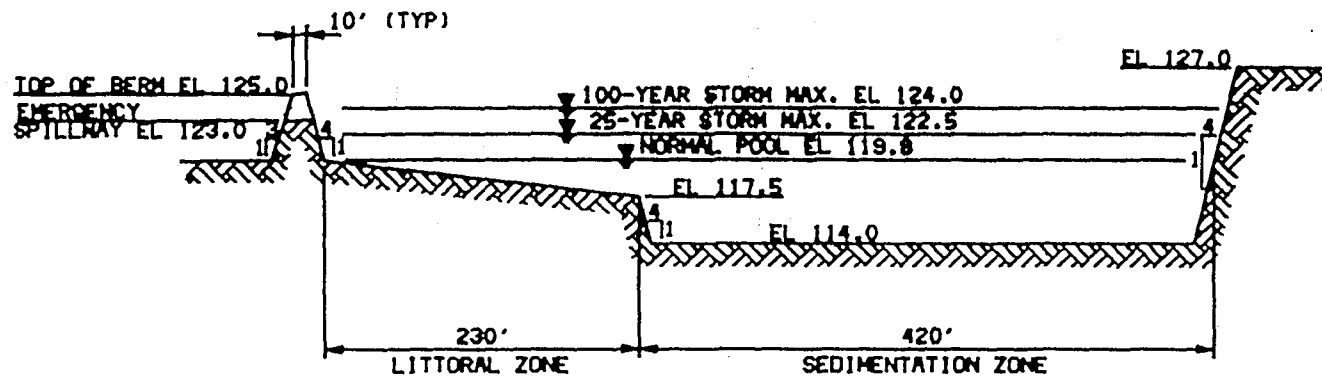


Figure 9
Plan View of the Stormwater Detention Basin (For the Portion Where
Wetland Impact Will Occur) and Drainage Ditch Crossing

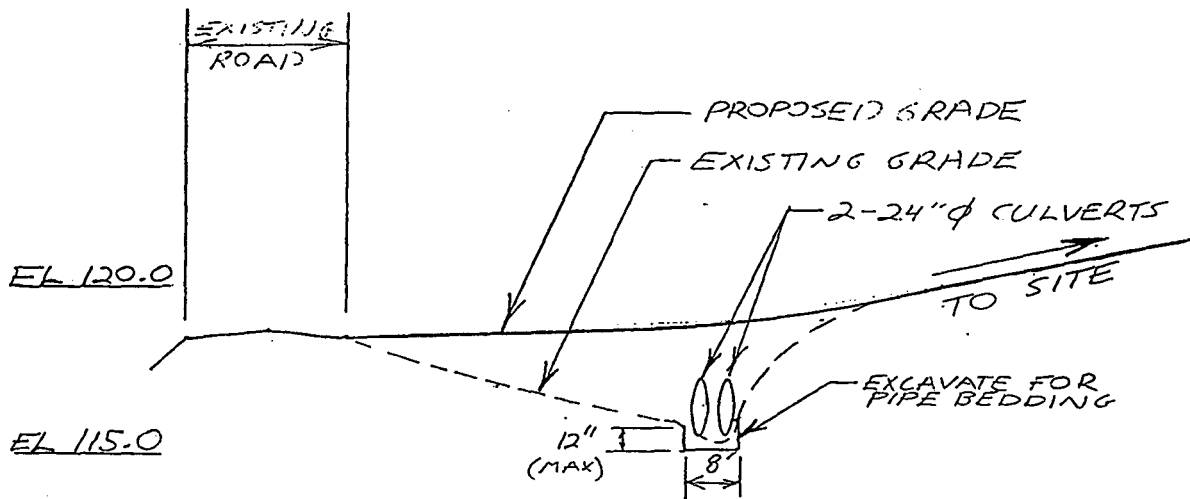




SECTION 2
DETENTION BASIN
 NO SCALE

Figure 10
 Cross-Section of the Stormwater Detention Basin

ROAD ACROSS DRAINAGE DITCH



CULVERT C-14 CROSS - SECTION

ASSUME CULVERT LENGTH = 50'

$$\text{TOTAL EXCAVATION} = (50' \times 8' \times 1') / 27 = \underline{15.0 \text{ CY}}$$

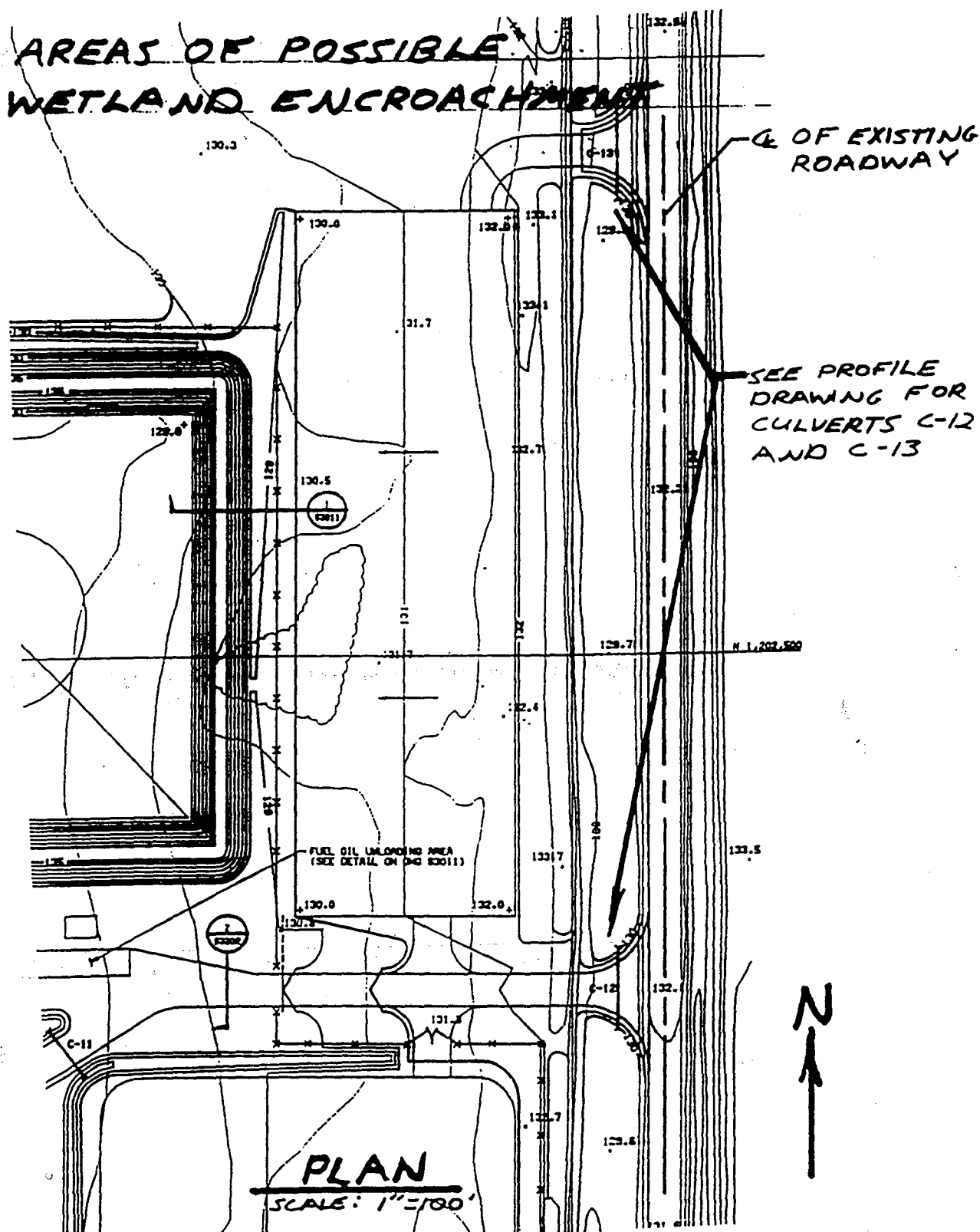
$$\text{TOTAL FILL} = (1.1 \times 5' \times 20') [18 + 3 + 3] + (2 \times \frac{1}{3} \times 3 \times 3.25) / 27 = \underline{125.0 \text{ CY}}$$

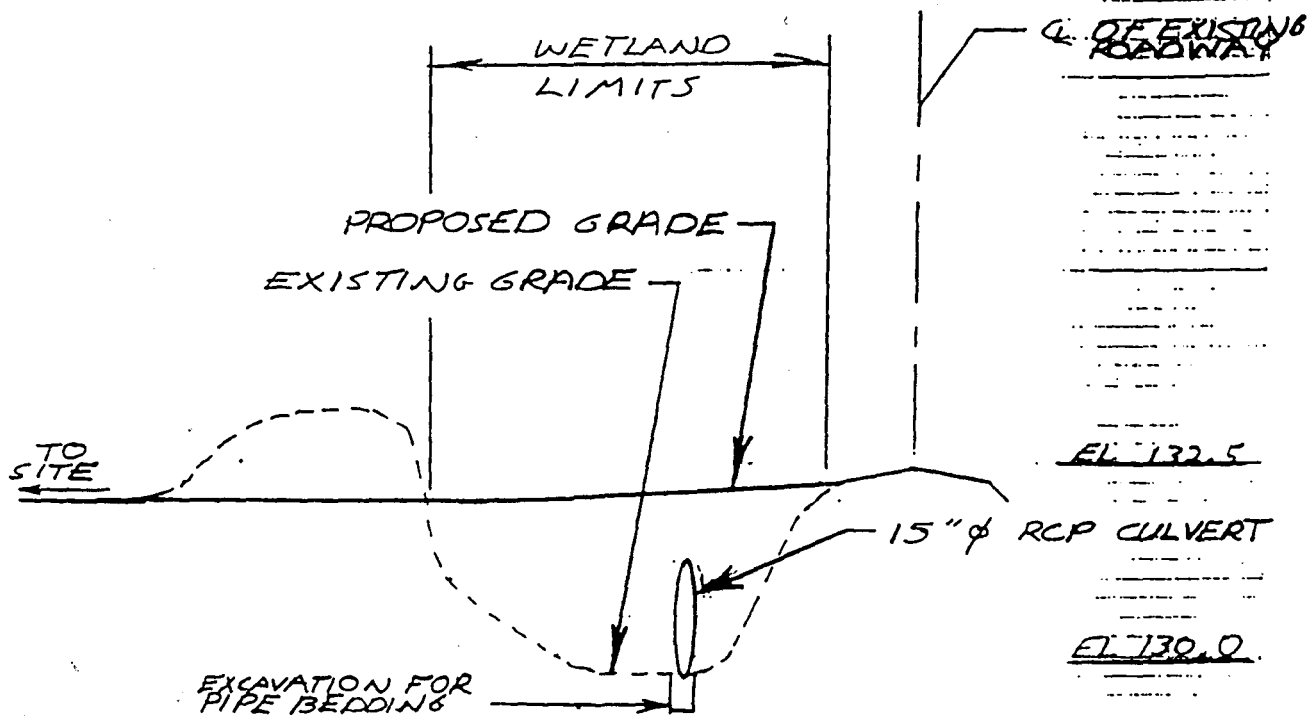
$$\text{TOTAL AREA} = 50' \times 60' = 3000 \text{ sf} \\ = \underline{0.07 \text{ ACRES}}$$

Figure 11
Cross-Section of the Drainage Ditch Crossing



AREAS OF POSSIBLE WETLAND ENCROACHMENT





CULVERT LENGTH = 75 LF

PROFILE

CULVERTS C-12 & C-13

HORIZONTAL SCALE: 1" = 30'

Figure 13
Cross-Section of the Drainage Ditch Crossing at
Culverts C-12 and C-13

T.P. Brumett
4/7/94
43668



**SEMINOLE
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WETLAND MITIGATION PLAN

1.0 INTRODUCTION

Seminole Electric Cooperative Incorporated (SECI) plans to build a 440-MW (net capacity) combined cycle unit on a 1,300-acre site in Hardee and Polk counties (Figure 1). The plant will be built adjacent to the existing Hardee Power Plant (Figure 2). The project site is located in an area that was recently mined and disturbed. The mined areas have been reclaimed predominately to upland pasture by Agrico Chemical Company under the provisions of their phosphate mine reclamation plan.

Wetland impacts are limited to five construction activities. Wetland impact acreages for both the Florida Department of Environmental Protection (FDEP) and U.S. Army Corps of Engineers (USACE) are summarized on Table 1. SECI has designed the Hardee Unit 3 facility to avoid and minimize wetland impacts to the greatest extent possible.

2.0 WETLAND IMPACTS

The circulating water pipes will be constructed across IMC-Agrico's wetland reclamation area (Area No. 1 in Figure 3), and will clear a total of 0.06 acre of FDEP-jurisdictional wetlands and 0.22 acre of USACE-jurisdictional wetlands. Within the cleared area, excavation will occur to install concrete pipe support structures. The only remaining fill in the wetland will be the actual structures, which will be embedded approximately 2 feet (ft) below ground surface. The circulating water pipes will be supported above the 100-year flood elevation and, therefore, will not obstruct or hinder the hydrologic flow of the wetland.

In its current state, the proposed wetland impact area is primarily herbaceous, but has been recently planted with wetland trees as part of Agrico's wetland reclamation program for the Payne Creek Mine. To construct the circulating water pipes across the reclaimed wetland will require permanently removing fewer than 32 planted trees. After construction of the circulation pipes, the cleared wetland area will be returned to original grade (except for the remaining concrete pipe support structures), planted with native herbaceous wetland species, and maintained as a herbaceous wetland (see section 3.2 for restoration plan).

As compensation for the wetland impact associated with constructing the circulating water pipes, SECI proposes to create 0.22 acre of forested wetland on the north side of the tributary wetland (Figure 4). This compensation will provide a 3.7:1 ratio for impacting 0.06 acre of FDEP-jurisdictional wetland, and a 1:1 ratio for impacting 0.22 acre of USACE-jurisdictional wetland.

Construction of a retainment berm will fill 0.01 acre and excavate 0.003 acre of FDEP- and USACE-jurisdictional wetlands (Area No. 2 in Figure 3). The wetland impact site is a herbaceous portion of the unnamed tributary wetland that has been extensively disturbed by feral hog activity. Vegetation at the impact site is sparse due to considerable ground disturbance. SECI proposes to compensate for this wetland impact by creating an additional 0.013 acre of forested wetland on the north side of the tributary wetland, for a total of 0.233 acre of created forested wetland (Figure 4). A mitigation ratio of 1:1 for this impact is warranted due to the extensive disturbance at the impact site, and because forested wetland will be created to compensate for disturbance of a herbaceous wetland.

Two culverts and associated fill will be placed in a FDEP and USACE-jurisdictional drainage ditch wetland to facilitate road access to the cooling reservoir (Area No. 5 in Figure 3). This road and associated wetland crossing is necessary to assure access to the cooling reservoir. A total of 0.07 acre of drainage ditch wetland will be filled. The drainage ditch receives drainage from the proposed Hardee Unit 3 Project area and adjacent existing power facilities, and conveys water to Payne Creek via the unnamed tributary wetland. In its current state, the drainage ditch is regularly mowed and maintained. Mitigation is not proposed for this wetland impact because the wetland impact is minor and will not disrupt the conveyance capacity of the drainage ditch, and because the ecological value of the drainage ditch is low.

Two additional culverts will be placed in a drainage ditch which forms the eastern boundary of the property (Areas No. 6 and 7 in Figure 3). This ditch crossing is necessary to provide access to the power plant from the existing access road. A total of 0.22 acre of wetland will be filled to install the two culverts. Like the above described drainage ditch, this ditch is regularly mowed and maintained. Mitigation is not proposed for this wetland impact.

Other construction activities that will impact wetlands include filling a 4.69-acre USACE-jurisdictional wetland to construct the power block facilities, and excavating and filling 0.47 acre

of a 0.55-acre USACE-jurisdictional wetland for constructing a stormwater detention basin (Areas No. 3 and 4 in Figure 3). The wetlands proposed to be impacted by the power block facilities (4.69 acres) and stormwater detention basin (0.47 acre) were to have been reclaimed as upland pasture, but were inadvertently created as low pockets during post-mine reclamation. These areas are slight depressions within the reclaimed upland pasture that support weedy, early colonizing wetland species such as cattail, Carolina willow, and primrose willow. The overburden material used for reclamation contains a high clay content, and has contributed to the high water retention of these depressional areas. Because these two wetlands were historical uplands and inadvertently created during reclamation, and because they provide low ecological value, mitigation is not warranted for these two USACE-jurisdictional wetlands.

3.0 MITIGATION DESIGN

3.1 WETLAND CREATION

A total of 0.23 acre of forested wetland is proposed to be created on the north side of the unnamed tributary wetland (Figure 4). The mitigation site will be approximately 35 ft wide and extend approximately 275 ft along the tributary wetland. It will be situated between the tributary wetland and an upland reclamation area created by IMC-Agrico.

Initial land grading is not proposed at the mitigation site because the area is located adjacent to the tributary wetland and it is low enough in elevation to already exhibit a hydroperiod long enough to support wetland-dependent herbaceous species. Figure 5 depicts a cross-section of the wetland creation site. The soil at the proposed mitigation site contains a high clay content as a result of overburden material from the mining process. Thus, the increased water-holding capacity of the soil is expected to adequately hydrate the planted trees.

A list of plants recommended for planting at the mitigation site was developed by identifying tree species growing in the adjacent floodplain forest and by determining which tree species are likely to be found in floodplain forests in central Florida. The purpose of this planting plan is to augment natural recruitment by increasing the density and diversity of listed tree species. The following species will be planted at the mitigation site.

- | | |
|--------------------------------|--------------|
| 1. <i>Acer rubrum</i> | Red maple |
| 2. <i>Taxodium ascendens</i> | Pond cypress |
| 3. <i>Fraxinus caroliniana</i> | Pop ash |

- | | |
|---|-----------|
| 4. <i>Nyssa sylvatica</i> var. <i>biflora</i> | Black gum |
| 5. <i>Liquidambar styraciflua</i> | Sweetgum |

Planted trees will be obtained from nursery-grown stock. Trees will be planted at a maximum of 10-ft centers to provide a density of 600 trees per acre.

Wetland monitoring will occur semiannually (in March and September to correspond with the dry and wet season) until a determination of success has been made (Figure 4). The mitigation project will be considered successful when the density of trees growing above the herbaceous stratum is equivalent to at least 400 trees per acre. Tree survival, health and vigor assessment, percent cover of desirable species, and percent cover of undesirable species will be determined during each monitoring event. Photographs will also be taken and the water level measured at the mitigation site.

3.2 WETLAND RESTORATION

Wetland restoration will be conducted to mitigate for crossing the IMC-Agrico wetland reclamation area by the water circulating pipes. Construction of the circulation pipes will result in clearing 0.06 acre of FDEP-jurisdictional wetlands and 0.22 acre of USACE-jurisdictional wetlands (see Page 1). The only permanent fill remaining in this wetland will be concrete support structures. After construction is complete, the 0.22-acre site will be graded to the original elevation and planted with native herbaceous species. Figure 6 depicts a cross-section of the wetland restoration site. The wetland will be maintained as a herbaceous wetland. The following species will be planted at the restoration site on 3-ft centers.

<i>Juncus effusus</i>	Soft rush
<i>Spartina bakeri</i>	Baker's cordgrass
<i>Scirpus validus</i>	Bulrush
<i>Panicum hemitomon</i>	Maidencane
<i>Thalia geniculata</i>	Fireflag
<i>Pontederia cordata</i>	Pickerelweed
<i>Sagittaria lancifolia</i>	Arrowhead

Wetland monitoring for the restoration area will occur semiannually (in March and September to correspond with the dry and wet season) until a determination of success has been made. The restoration project will be considered successful when percent cover of desirable species can be maintained at 80 percent or higher for three consecutive monitoring events. Plant survival, health and vigor assessment, percent cover of desirable species, and percent cover of undesirable species will be determined during each monitoring event. Photographs will also be taken and the water level measured at the restoration site.

Table 1. Wetland Impacts and Proposed Mitigation			
Wetland Impact	Type of Impact	Mitigation Ratio	Mitigation Plan
Circulating Water Line	FDEP - Clear 0.06 acre of reclamation wetland. Within the cleared area, excavate 0.015 acre and fill 0.015 acre in the form of concrete pipe support structures. USACE - Clear 0.22 acre of reclamation wetland. Within the cleared area, excavate 0.085 acre and fill 0.085 acre in the form of concrete pipe support structures.	3.7:1 1:1	Create 0.22 acre of forested wetland on the north side of the tributary wetland. Restore the 0.22 acre cleared area as a herbaceous marsh.
Retainment Berm	FDEP and USACE - Fill 0.01 acre and excavate 0.003 acre of disturbed herbaceous wetland.	1:1	Create 0.013 acre of forested wetland on the north side of the tributary wetland.
Culverts	West and South Ditch: FDEP and USACE - 0.07 acre of drainage ditch wetland will be filled to install two culverts. East Ditch: FDEP - 0.22 acre of drainage ditch wetland will be filled to install two culverts.	N/A	No mitigation is proposed for these wetland impacts due to the poor ecological quality and because the impact areas will continue to function as ditches and convey water after the culverts are installed.
Power Block Area	USACE - Fill 4.69 acre of disturbed herbaceous/shrub wetland.	N/A	No mitigation is proposed for this wetland impact due to its poor ecological quality and because this wetland was historically an upland that was inadvertently created during mine reclamation.
Detention Basin	USACE - 0.47 acre of disturbed herbaceous wetland will be excavated and filled.	N/A	No mitigation is proposed for this wetland impact due to its poor ecological quality and because this wetland was historically an upland that was inadvertently created during mine reclamation.

Note: N/A = Not Applicable.

Sources: FDOT, 1990; 1992; KBN, 1994.



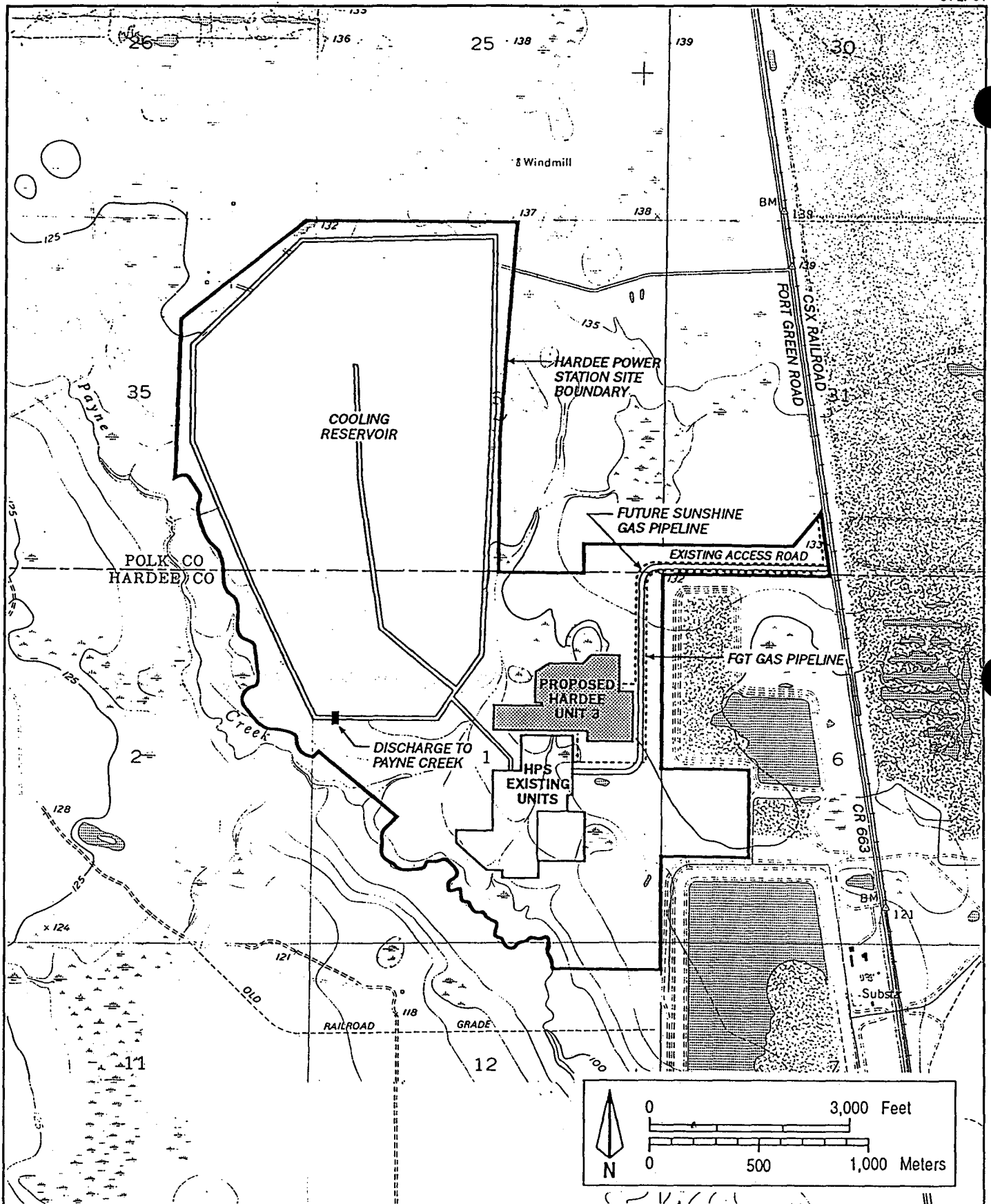


Figure 2
Hardee Unit 3 Site in Relation to Existing Facilities

Sources: USGS, 1987; KBN, 1994.



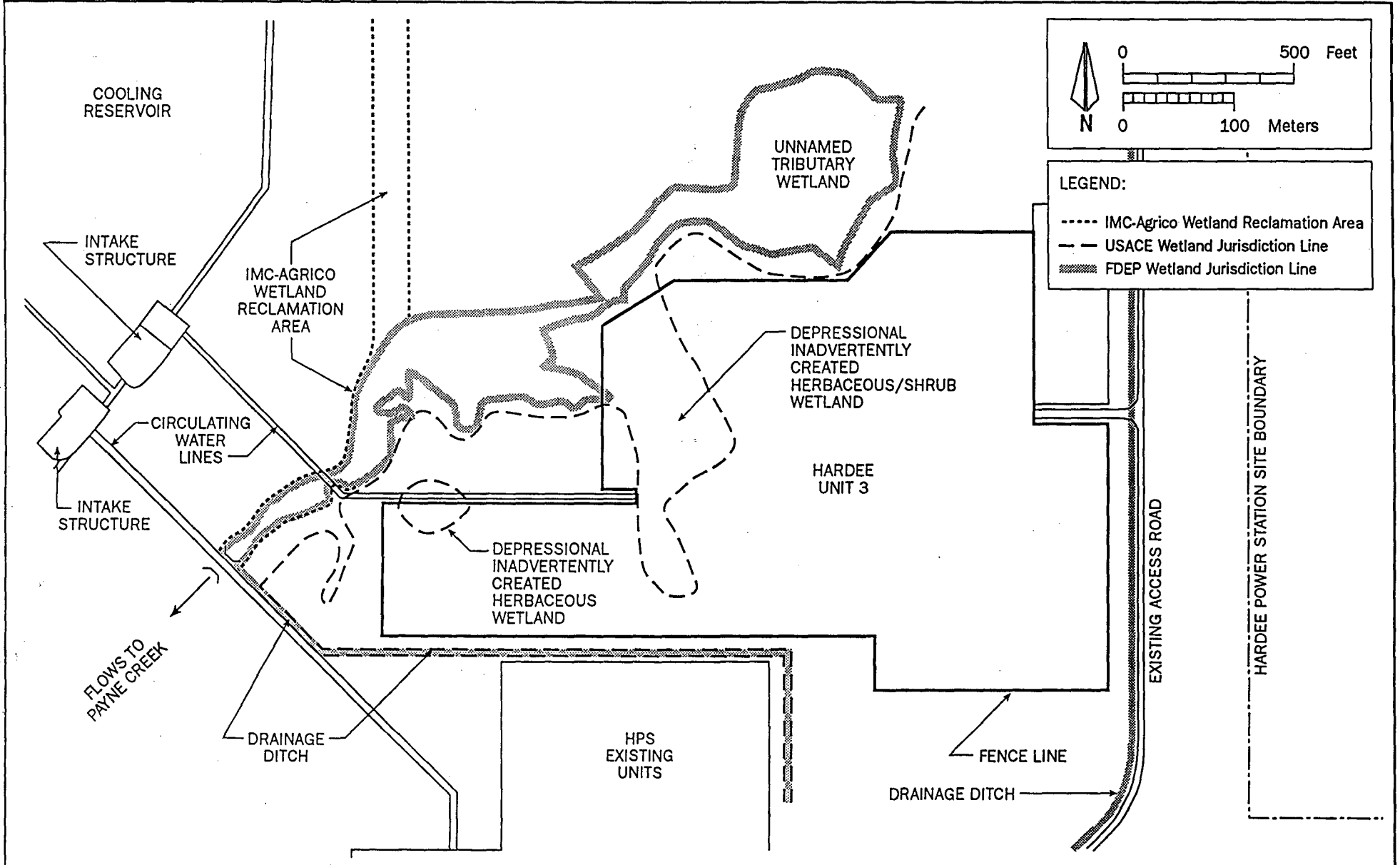


Figure 3
Location of Jurisdictional Wetlands

Source: KBN, 1994.



10.1.4-43

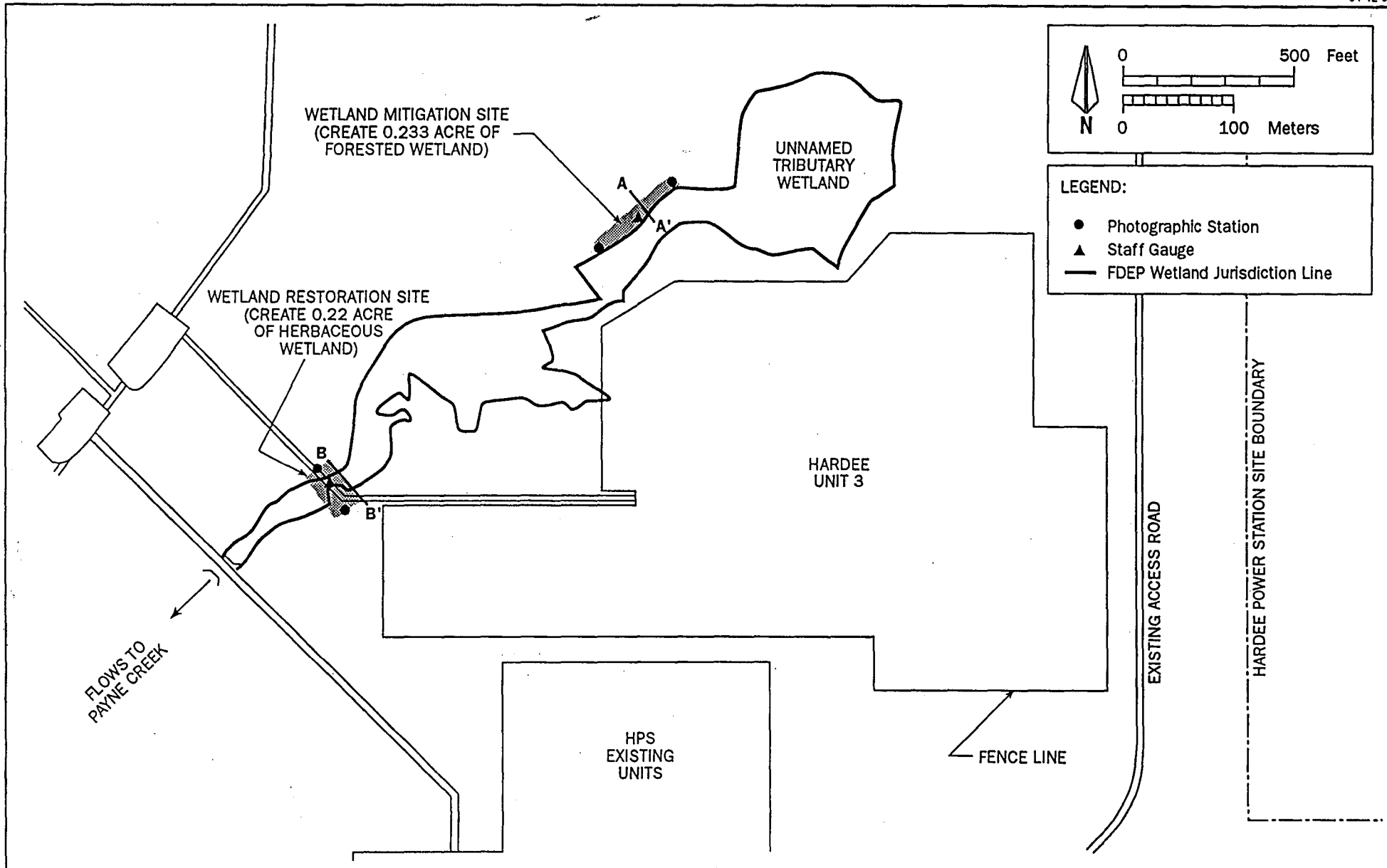
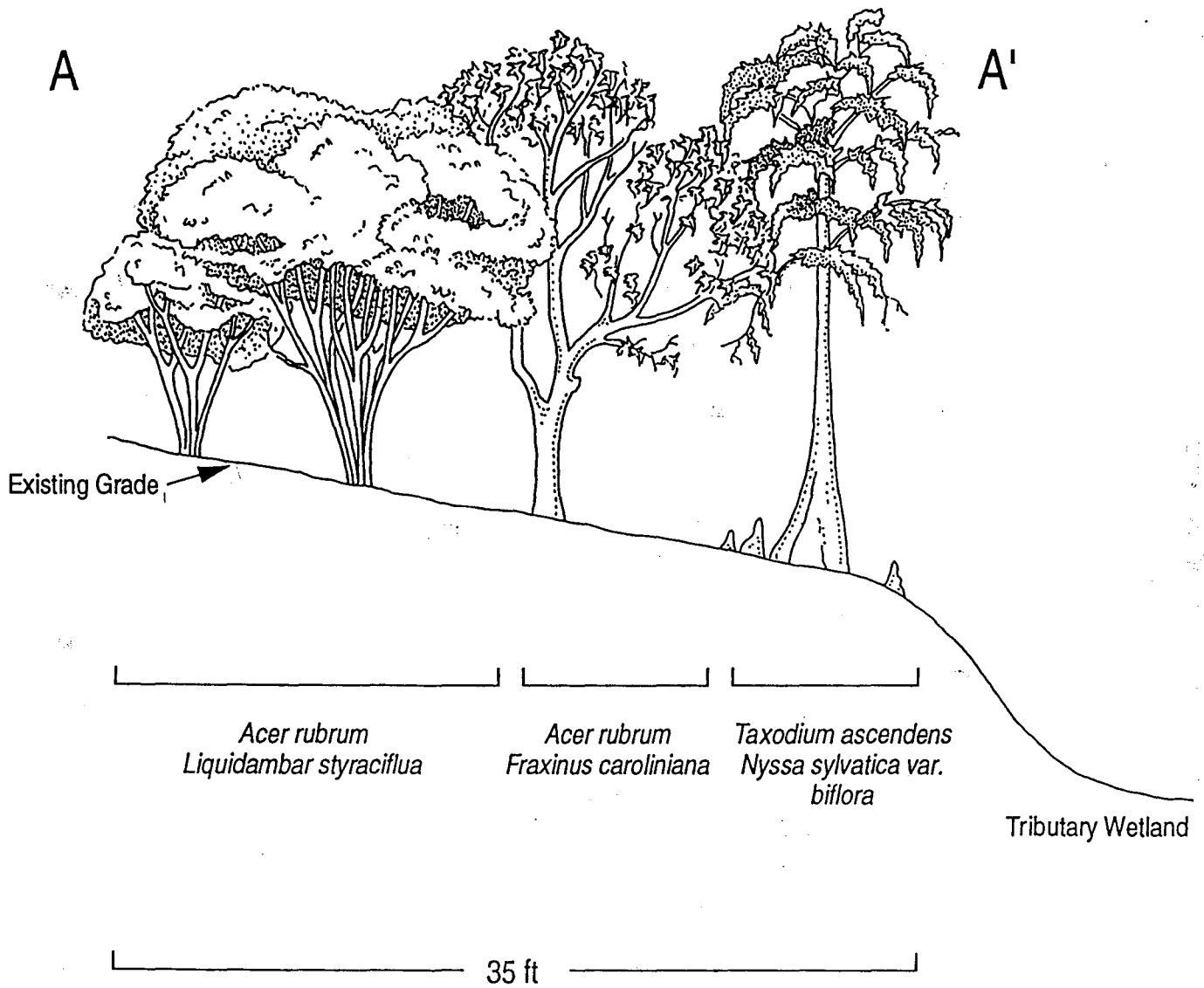


Figure 4
Plan View of Mitigation Sites

Source: KBN, 1994.

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Note: Plants planted on 10-ft centers.

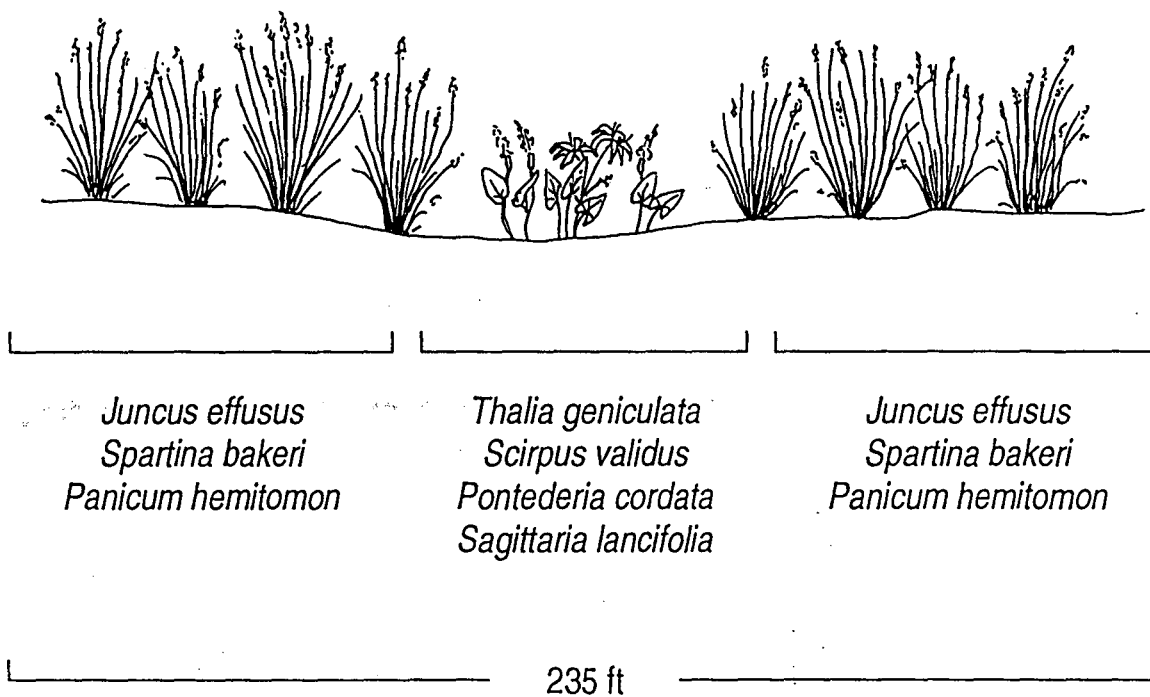
Area of wetland mitigation site is 35-ft wide by 290-ft long (0.233 acre).

Figure 5
Cross-Section of the Wetland Creation Site



B

B'



Note: Plants planted on 3-ft centers .

Area of wetland restoration site is 40-ft wide by 235-ft long (0.22 acre).

Figure 6
Cross-Section of the Wetland Restoration Site



APPENDIX 10.1.5

AIR PERMIT APPLICATION

**PREVENTION OF SIGNIFICANT
DETERIORATION APPLICATION**

HARDEE UNIT 3

Prepared For:

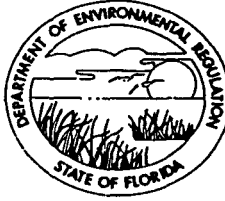
**Seminole Electric Cooperative Incorporated
16313 North Dale Mabry Highway
Tampa, Florida 33618**

Prepared By:

**KBN Engineering and Applied Sciences, Inc.
1034 NW 57th Street
Gainesville, Florida 32605**

**April 1994
13225D8**

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION



APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: Combustion Turbine [X] New¹ [] Existing¹

APPLICATION TYPE: [X] Construction [] Operation [] Modification

COMPANY NAME: Seminole Electric Cooperative Incorporated (SECI)

COUNTY: Hardee

Identify the specific emission point source(s) addressed in this application (i.e., Lime Kiln No. 4 with Venturi Scrubber; Peaking Unit No. 2, Gas Fired) Two combustion turbines, gas- and-oil fired, and two heat recovery steam generators

SOURCE LOCATION: Street _____ City _____

UTM: East 405.0 km North 3057.7 km

Latitude 27° 38' 30" N Longitude 81° 57' 45" W

APPLICANT NAME AND TITLE: _____

APPLICANT ADDRESS: _____

SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

A. APPLICANT

I am the undersigned owner or authorized representative* of SECI

I certify that the statements made in this application for a construction permit are true, correct and complete to the best of my knowledge and belief. Further, I agree to maintain and operate the pollution control source and pollution control facilities in such a manner as to comply with the provision of Chapter 403, Florida Statutes, and all the rules and regulations of the department and revisions thereof. I also understand that a permit, if granted by the department, will be non-transferable and I will promptly notify the department upon sale or legal transfer of the permitted establishment.

*Attach letter of authorization

Signed: Mike Opalinski

Mike Opalinski, Manager of Environmental Affairs
Name and Title (Please Type)

Date: 9/29/94 Telephone No. 813-963-0994

B. PROFESSIONAL ENGINEER REGISTERED IN FLORIDA (where required by Chapter 471, F.S.)

This is to certify that the engineering features of this pollution control project have been ~~designed~~/examined by me and found to be in conformity with modern engineering principles applicable to the treatment and disposal of pollutants characterized in the permit application. There is reasonable assurance, in my professional judgement, that

the pollution control facilities, when properly maintained and operated, will discharge an effluent that complies with all applicable statutes of the State of Florida and the rules and regulations of the department. It is also agreed that the undersigned will furnish, if authorized by the owner, the applicant a set of instructions for the proper maintenance and operation of the pollution control facilities and, if applicable, pollution sources.

Signed

Kennard F. Kosky

Name (Please Type)

KBN Engineering and Applied Sciences, Inc.

Company Name (Please Type)

1034 NW 57th Street, Gainesville, FL 32605

Mailing Address (Please Type)

Florida Registration No. 14996 Date: 05/02/94 Telephone No. (904) 331-9000

SECTION II: GENERAL PROJECT INFORMATION

- A. Describe the nature and extent of the project. Refer to pollution control equipment, and expected improvements in source performance as a result of installation. State whether the project will result in full compliance. Attach additional sheet if necessary.

The project consists of two combustion turbines that are natural gas- and distilled fuel oil-fired; two heat recovery steam generators; and one steam turbine. The turbines will use dry low-NO_x combustors and water injection to control NO_x emissions during natural gas and fuel oil firing, respectively. Refer to Sections 2.0 and 4.0 of the Application.

- B. Schedule of project covered in this application (Construction Permit Application Only)

Start of Construction January 1997 Completion of Construction December 1998

- C. Costs of pollution control system(s): (Note: Show breakdown of estimated costs only for individual components/units of the project serving pollution control purposes. Information on actual costs shall be furnished with the application for operation permit.)

The cost of control is integral to the overall design of the project. Dry low-NO_x combustion technology and water injection will be used to reduce air pollutant emissions.

- D. Indicate any previous DER permits, orders and notices associated with the emission point, including permit issuance and expiration dates.

No previous FDEP permits have been issued.

E. Requested permitted equipment operating time: hrs/day 24; days/wk 7; wks/yr 52;
If power plant, hrs/yr 8760; if seasonal, describe: _____

F. If this is a new source or major modification, answer the following questions.
(Yes or No)

1. Is this source in a non-attainment area for a particular pollutant? No
a. If yes, has "offset" been applied? NA
b. If yes, has "Lowest Achievable Emission Rate" been applied? NA
c. If yes, list non-attainment pollutants. NA

2. Does best available control technology (BACT) apply to this source?
If yes, see Section VI. Yes

3. Does the State "Prevention of Significant Deterioration" (PSD)
requirement apply to this source? If yes, see Sections VI and VII. Yes

4. Do "Standards of Performance for New Stationary Sources" (NSPS)
apply to this source? Yes

5. Do "National Emission Standards for Hazardous Air Pollutants"
(NESHAP) apply to this source? No

H. Do "Reasonably Available Control Technology" (RACT) requirements apply
to this source? No

- a. If yes, for what pollutants? NA
b. If yes, in addition to the information required in this form, any information
requested in Rule 17-2.650 must be submitted. NA

Attach all supportive information related to any answer of "Yes". Attach any
justification for any answer of "No" that might be considered questionable.

Refer to the following sections of the PSD Application:

1. *Non-Attainment Applicability - Subsection 3.5.3*
2. *BACT Applicability - Section 4.0*
3. *PSD Applicability - Subsection 3.5.2*
4. *NSPS Applicability - Section 3.5.2.2*

SECTION III: AIR POLLUTION SOURCES & CONTROL DEVICES (Other than Incinerators)

A. Raw Materials and Chemicals Used in your Process, if applicable: *Not Applicable*

Description	Contaminants		Utilization Rate - lbs/hr	Relate to Flow Diagram
	Type	% Wt		

B. Process Rate, if applicable: (See Section V, Item 1)

1. Total Process Input Rate (lbs/hr): _____

2. Product Weight (lbs/hr): _____

C. Airborne Contaminants Emitted: (Information in this table must be submitted for each emission point, use additional sheets as necessary)

Refer to Tables 2-1 through 2-7 and Attachment A of the PSD Application

Name of Contaminant	Emission ¹		Allowed ² Emission Rate per Rule 17-2	Allowable ³ Emission lbs/hr	Potential ⁴ Emission		Relate to Flow Diagram
	Maximum lbs/hr	Actual T/yr			lbs/hr	T/yr	
NO _x	699.2	1,205	98.8 ppmvd (oil) 105.8 ppmvd (gas) @ 15 % O ₂	1,462 (oil) 1,308 (gas)	699.2	1,205	Refer to Figure 2-1 in PSD Application
SO ₂	200.4	175	0.8% S (WGT)	2,988 (oil)	200.4	175	
CO	313.4	794	-	-	313.4	794	
VOC	41.5	98.7	-	-	41.5	98.7	
PM(TSP)/PM10	134.1	145	-	-	134.1	145	

¹See Section V, Item 2. Maximum emissions are based on 100-percent operating load; maximum lbs/hr based on firing fuel oil at 32°F ambient temperature; maximum annual emissions based on 59°F ambient temperature and firing natural gas for 7,260 hours and fuel oil for 1,500 hours. CO emissions (lb/hr) are based on firing natural gas during power augmentation at 80°F. A 5 percent margin has been added to the mass flow to maximize emissions since operating history has been limited.

²Reference applicable emission standards and units (e.g. Rule 17-2.600(5)(b)2: Table II, E. (1) - 0.1 pounds per million BTU heat input)

³Calculated from operating rate and applicable standard.

⁴Emission, if source operated without control (See Section V, Item 3).

D. Control Devices: (See Section V, Item 4)

Name and Type (Model & Serial No.)	Contaminant	Efficiency	Range of Particles Size Collected (in microns) (If applicable)	Basis for Efficiency (Section V Item 5)

E. Fuels Refer to Tables 3.3-1 and 3.3-2 in SCA and Attachment A in PSD Application

Type (Be Specific)	Consumption* (Per Turbine)		Maximum Heat Input (MMBTU/hr)
	avg/hr	max./hr	
Natural Gas	1.677 mmcf/hr	1.799 mmcf/hr	1,799
Distilled Fuel Oil	93,390 lb/hr	100,200 lb/hr	1,972
	12,971 gal/hr	13,917 gal/hr	

*Units: Natural Gas--MMCF/hr; Fuel Oils--gallons/hr; Coal, wood, refuse, others--lbs/hr.

Fuel Analysis:

Percent Sulfur: 0.05% S (oil) / 1 gr/100 cubic ft (gas) Percent Ash: <0.01% WGT

Density: 7.2 (oil) lbs/gal Typical Percent Nitrogen: ≤0.03% WGT

Heat Capacity: 23,170 (gas) / 19,680 (oil) HHV BTU/lb 141,696 (oil) BTU/gal

Other Fuel Contaminants (which may cause air pollution): See Attachment A in PSD application

F. If applicable, indicate the percent of fuel used for space heating. *Not Applicable*

Annual Average _____ Maximum _____

G. Indicate liquid or solid wastes generated and method of disposal.

Liquid and solid wastes will be disposed of in an approved manner.

H.Emission Stack Geometry and Flow Characteristics (Provide data for each stack):

Stack Height: 90 ft(HRSG)/75 ft(Bypass) ft. Stack Diameter: 19 ft(HRSG)/23 ft(Bypass) ft.

Gas Flow Rate: 974,700 (Gas) 1,170,500 (Oil) ACFM 731,400 (Gas) 745,400 (Oil) DSCFM

Gas Exit Temperature: 190 (Gas) / 285 (Oil) °F.

Water Vapor Content: 7.6 (Gas) / 10.2 (Oil) % Velocity: 57.3 (Gas) / 68.8 (Oil) FPS

Note: Operating data presented for the units operating in combined cycle mode firing natural gas and fuel oil at 59°F (no adjustment for mass flow was used in presenting flow rate and velocity). Operating data for simple and combined cycle operations are presented in the PSD Application.

SECTION IV: INCINERATOR INFORMATION

Not Applicable

Type of Waste	Type O (Plastics)	Type I (Rubbish)	Type II (Refuse)	Type III (Garbage)	Type IV (Pathological)	Type V (Liq. & Gas By-prod.)	Type VI (Solid By-prod.)
Actual lb/hr Incinerated							
Uncontrolled (lbs/hr)							

Description of Waste _____

Total Weight Incinerated (lbs/hr) _____ Design Capacity (lbs/hr) _____

Approximate Number of Hours of Operation per day _____ day/wk _____ wks/yr. _____

Manufacturer _____

Date Constructed _____ Model No. _____

	Volume (ft) ³	Heat Release (BTU/hr)	Fuel		Temperature (°F)
			Type	BTU/hr	
Primary Chamber					
Secondary Chamber					

Stack Height: _____ ft. Stack Diameter: _____ Stack Temp. _____

Gas Flow Rate: _____ ACFM _____ DSCFM* Velocity: _____ FPS

*If 50 or more tons per day design capacity, submit the emissions rate in grains per standard cubic foot dry gas corrected to 50% excess air.

Type of pollution control devices: ☐ Cyclone ☐ Wet Scrubber ☐ Afterburner
☐ Other (specify) _____

Brief description of operating characteristics of control devices: _____

Ultimate disposal of any effluent other than that emitted from the stack (scrubber water, ash, etc.):

NOTE: Items 2, 3, 4, 6, 7, 8, and 10 in Section V must be included where applicable.

SECTION V: SUPPLEMENTAL REQUIREMENTS

Please provide the following supplements where required for this application.

1. Total process input rate and product weight -- show derivation [Rule 17-2.100(127)]
See Attachment A in PSD Application
2. To a construction application, attach basis of emission estimate (e.g., design calculations, design drawings, pertinent manufacturer's test data, etc.) and attach proposed methods (e.g., FR Part 60 Methods, 1, 2, 3, 4, 5) to show proof of compliance with applicable standards. To an operation application, attach test results or methods used to show proof of compliance. Information provided when applying for an operation permit from a construction permit shall be indicative of the time at which the test was made. *See Tables 2-1 through 2-7 and Attachment A in PSD Application*
3. Attach basis of potential discharge (e.g., emission factor, that is, AP42 test).
See Attachment A in PSD Application
4. With construction permit application, include design details for all air pollution control systems (e.g., for baghouse include cloth to air ratio; for scrubber include cross-section sketch, design pressure drop, etc.) *See Attachment A in PSD Application*
5. With construction permit application, attach derivation of control device(s) efficiency. Include test or design data. Items 2, 3 and 5 should be consistent: actual emissions = potential (1-efficiency). *See Attachment A in PSD Application*
6. An 8 1/2" x 11" flow diagram which will, without revealing trade secrets, identify the individual operations and/or processes. Indicate where raw materials enter, where solid and liquid waste exit, where gaseous emissions and/or airborne particles are evolved and where finished products are obtained. *See Figure 2-1 in PSD Application*
7. An 8 1/2" x 11" plot plan showing the location of the establishment, and points of airborne emissions, in relation to the surrounding area, residences and other permanent structures and roadways (Examples: Copy of relevant portion of USGS topographic map). *See Figure 1-1 in PSD Application*
8. An 8 1/2" x 11" plot plan of facility showing the location of manufacturing processes and outlets for airborne emissions. Relate all flows to the flow diagram. *See Figure 2-2 in PSD Application*

9. The appropriate application fee in accordance with Rule 17-4.05. The check should be made payable to the Department of Environmental Regulation.
10. With an application for operation permit, attach a Certificate of Completion of Construction indicating that the source was constructed as shown in the construction permit.

SECTION VI: BEST AVAILABLE CONTROL TECHNOLOGY

- A. Are standards of performance for new stationary sources pursuant to 40 C.F.R. Part 60 applicable to the source?

☒ Yes ☐ No

Contaminant

Rate or Concentration

See Sections 3.5 and 4 in PSD

Application

- B. Has EPA declared the best available control technology for this class of sources (If yes, attach copy)

☒ Yes ☐ No

Contaminant

Rate or Concentration

See Section 4 in PSD Application

- C. What emission levels do you propose as best available control technology?

Contaminant

Rate or Concentration

See Tables 2-1 through 2-7 in PSD

Application

- D. Describe the existing control and treatment technology (if any). *Not Applicable*

1. Control Device/System:

2. Operating Principles:

3. Efficiency:*

4. Capital Costs:

*Explain method of determining

5. Useful Life:

6. Operating Costs:

7. Energy:

8. Maintenance Cost:

9. Emissions:

Contaminant	Rate or Concentration

10. Stack Parameters

a. Height: ft.

b. Diameter ft.

c. Flow Rate: ACFM

d. Temperature: °F.

e. Velocity: FPS

E. Describe the control and treatment technology available (As many types as applicable, use additional pages if necessary). See Section 4 in PSD Application

1.

a. Control Devices:

b. Operating Principles:

c. Efficiency:¹

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:²

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

2.

a. Control Device:

b. Operating Principles:

c. Efficiency:¹

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:²

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

¹Explain method of determining efficiency.

²Energy to be reported in units of electrical power - KWH design rate.

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

3.

a. Control Device:

b. Operating Principles:

c. Efficiency:¹

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:²

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

4.

a. Control Device:

b. Operating Principles:

c. Efficiency:¹

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:²

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

F. Describe the control technology selected: *See Section 4 in PSD Application*

1. Control Device:

2. Efficiency:¹

3. Capital Cost:

4. Useful Life:

5. Operating Cost:

6. Energy:²

7. Maintenance Cost:

8. Manufacturer:

9. Other locations where employed on similar processes:

a. (1) Company:

(2) Mailing Address:

(3) City:

(4) State:

¹Explain method of determining efficiency.

²Energy to be reported in units of electrical power - KWH design rate.

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:¹

Contaminant

Rate or Concentration

_____	_____
_____	_____
_____	_____

(8) Process Rate:¹

b. (1) Company:

(2) Mailing Address:

(3) City:

(4) State:

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:¹

Contaminant

Rate or Concentration

_____	_____
_____	_____
_____	_____

(8) Process Rate:¹

10. Reason for selection and description of systems:

¹Applicant must provide this information when available. Should this information not be available, applicant must state the reason(s) why.

SECTION VII - PREVENTION OF SIGNIFICANT DETERIORATION

A. Company Monitored Data See Section 5 in PSD Application

1. _____ no. sites _____ TSP _____ () SO^{2*} _____ Wind spd/dir

Period of Monitoring _____ / _____ / _____ to _____ / _____ / _____
month day year month day year

Other data recorded _____

Attach all data or statistical summaries to this application.

*Specify bubbler (B) or continuous (C).

2. Instrumentation, Field and Laboratory

- a. Was instrumentation EPA referenced or its equivalent? ☐ Yes ☐ No
- b. Was instrumentation calibrated in accordance with Department procedures?
☐ Yes ☐ No ☐ Unknown

B. Meteorological Data Used for Air Quality Modeling *See Section 6 in PSD Application*

1. _____ Year(s) of data from _____ / _____ / _____ to _____ / _____ / _____
month day year month day year
2. Surface data obtained from (location) _____
3. Upper air (mixing height) data obtained from (location) _____
4. Stability wind rose (STAR) data obtained from (location) _____

C. Computer Models Used *See Section 6 in PSD Application*

1. _____ Modified? If yes, attach description.
2. _____ Modified? If yes, attach description.
3. _____ Modified? If yes, attach description.
4. _____ Modified? If yes, attach description.

Attach copies of all final model runs showing input data, receptor locations, and principle output tables.

D. Applicants Maximum Allowable Emission Data *See Section 2 in PSD Application*

Pollutant	Emission Rate
TSP	_____ grams/sec
SO ²	_____ grams/sec

E. Emission Data Used in Modeling *See Sections 2 and 6 in PSD Application*

Attach list of emission sources. Emission data required is source name, description of point source (on NEDS point number), UTM coordinates, stack data, allowable emissions, and normal operating time.

F. Attach all other information supportive to the PSD review. *See PSD Application*

G. Discuss the social and economic impact of the selected technology versus other applicable technologies (i.e, jobs, payroll, production, taxes, energy, etc.). Include assessment of the environmental impact of the sources. *See Section 4 of PSD Application*

H. Attach scientific, engineering, and technical material, reports, publications, journals, and other competent relevant information describing the theory and application of the requested best available control technology. *See Section 4 of PSD Application*



April 28, 1994

Florida Department of Environmental Protection
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, FL 32301

Dear Sir:

This letter is to advise that Mike Opalinski, Manager of Environmental Affairs for Seminole Electric Cooperative, Inc., a Florida corporation, is authorized to act as Agent for all permitting functions with the Florida Department of Environmental Protection. These functions shall include, but not limited to, submitting permit applications, negotiating modifications and revisions and accepting or assenting to any stipulations on behalf of Seminole Electric Cooperative, Inc.

Sincerely,

A handwritten signature in cursive script, reading 'Wm. C. Walbridge'.

Wm C. Walbridge
Executive Vice President
and General Manager

dc

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1.0 INTRODUCTION

Seminole Electric Cooperative Incorporated (SECI) proposes to license, construct, and operate a 440-megawatt (MW) (net) combined cycle power plant. The site for the project is located in Hardee and Polk Counties about 14 kilometers (km) (9 miles) northwest of Wauchula, 26 km (16 miles) south-southwest of Bartow, and 64 km (40 miles) east of Tampa Bay (see Figure 1-1). The plant, referred to as Hardee Unit 3, will consist of two 150-MW advanced combustion turbines with dry low-nitrogen oxide (NO_x) burners. Each combustion turbine will be connected to a heat recovery steam generator (HRSG), which will use the waste heat to produce steam to be utilized in a single 140-MW (net) steam turbine. The total facility will have a total nominal generating capacity of 440 MW (net). The primary fuel for the combustion turbines will be natural gas with distillate fuel oil containing a maximum sulfur content of 0.05 percent as backup fuel.

The licensing of the Hardee Unit 3 Project in Florida requires compliance with federal, state, and local laws, regulations, and ordinances. As part of this process, SECI is conducting air quality licensing activities to support the Florida Site Certification Application (SCA) for the proposed power plant project. In the site certification process, the Florida Public Service Commission (PSC) is the exclusive forum for the determination of need, and the Florida Department of Environmental Protection (FDEP) acts as the central coordinator. Certification proceeds with the submittal of an SCA to FDEP by SECI and culminates with approval by the Governor and Cabinet. Implementation procedures of the Florida Power Plant Siting Act (FPPSA) are presented in FDEP's Chapter 17-17, Florida Administrative Code (F.A.C.), Electrical Power Plant Siting.

To assist in performing the necessary licensing activities, SECI has contracted KBN Engineering and Applied Sciences, Inc. (KBN), to perform the necessary air quality assessments for determining the project's compliance with state and federal new source review (NSR) regulations, including prevention of significant deterioration (PSD) and nonattainment review requirements. The critical aspects of these assessments include the air quality impact analyses performed using air dispersion models and the best available control technology (BACT) performed to evaluate the selected emission control technology.

The proposed Hardee Unit 3 facility will be a new air pollution source that will result in increases in air emissions in Hardee County. The U.S. Environmental Protection Agency (EPA) has implemented regulations requiring a PSD review for new or modified sources that increase air emissions above certain threshold amounts. Because the threshold amounts will be exceeded by the proposed project, the project is subject to PSD review. PSD regulations are promulgated under 40 Code of Federal Regulations (CFR) Part 52.21 and implemented through delegation to the FDEP. Florida's PSD regulations are codified in Chapter 17-212.400, F.A.C. These regulations incorporate the EPA PSD regulations by reference.

The technical information and analysis required by the federal and state PSD regulations are contained in this PSD application document. Although this document is an appendix to the SCA for the facility, it has been prepared as a stand-alone PSD application to allow FDEP, EPA, and other involved agencies to readily review the project.

Based on the emissions from the proposed project, a PSD review is required for each of the following regulated pollutants:

- particulate matter (PM) as total suspended particulate matter (TSP),
- particulate matter with aerodynamic diameter of 10 microns or less (PM10),
- sulfur dioxide (SO₂),
- nitrogen dioxide (NO₂),
- carbon monoxide (CO),
- volatile organic compounds (VOC), and
- other trace elements.

Hardee County has been designated as an attainment area for all criteria pollutants [i.e., ozone (O₃), PM10, SO₂, CO, and NO₂] and is classified as a PSD Class II area for PM(TSP), SO₂, and NO₂; therefore, the PSD review will follow regulations pertaining to such designations.

The proposed methods and assumptions used in the air quality modeling and emission control technology analyses to support the air permit application were submitted in a separate protocol document to FDEP (KBN, 1993). The objective of developing and submitting a technical protocol document was to obtain concurrence with the proposed methodologies from FDEP and

appropriate regulatory agencies prior to performing the detailed analyses. Based on the comments received from FDEP, the proposed protocol incorporated the recommended changes.

The air permit application is divided into eight major sections.

- Section 2.0 presents a description of the facility, including air emissions and stack parameters.
- Section 3.0 provides a review of the PSD and nonattainment requirements applicable to the proposed project.
- Section 4.0 includes the control technology review with discussions on BACT.
- Section 5.0 discusses the ambient air monitoring analysis (preconstruction monitoring) required by PSD regulations.
- Section 6.0 presents the proposed screening and detailed modeling approaches used in assessing compliance of the proposed project with ambient air quality standards (AAQS), PSD increments, and good engineering (GEP) stack height regulations.
- Section 7.0 summarizes the results of the air quality impact analyses performed for the project.
- Section 8.0 provides the additional impact analyses for soils, vegetation, and visibility.

2.0 PROJECT DESCRIPTION

2.1 BACKGROUND

In 1990, the Hardee Power Station (HPS) was certified for 660 MW of generation as follows:

1. TECO Power Services (TPS)--295 MW (1993).
2. TPS--145 MW (on or before 2003).
3. SECI--220 MW (date uncertain).

This new certification does not change the TECO Power Services certified generation above but will increase the SECI certified generation from 220 MW to 440 MW, with an inservice date of January 1999. Location of the Hardee Unit 3 facility at the HPS site and selection of the combined cycle technology will maximize the beneficial use of the HPS site while minimizing environmental, land use, and cost impacts associated with development of a 440-MW power plant at a previously undeveloped site. The proposed project will utilize a number of the HPS existing facilities, including the cooling reservoir and transmission lines, and will increase the ultimate generating capacity without increasing the overall size of the HPS site. The Hardee Unit 3 Project represents an expansion of the Phase 2 development of the HPS site from 220 MW to 440 MW. The Hardee Unit 3 site boundary is shown in Figure 2-1.

2.2 GENERAL DESCRIPTION

The proposed Hardee Unit 3 project consists of a 440-MW combined cycle power plant and directly associated facilities. The proposed project will consist of two 150-MW Westinghouse Model 501F advanced combustion turbines, with dry low-NO_x burners, with a generating capacity of 300 MW (net). Each combustion turbine will be connected to a HRSG which will use the waste heat to produce steam to be used in a single 140-MW (net) steam turbine. The proposed facility will have a nominal generating capacity of 440 MW (net). No duct burners are proposed for the Hardee Unit 3 project.

The dry low-NO_x combustor designed for the 501F combustion turbine consists of two premixed fuel zones plus a standard diffusion flame pilot burner. Low NO_x levels are achieved by introducing fuel primarily to the pre-mix zones and reducing the amount of fuel being combusted from the pilot nozzle. An option is available to use steam injection to increase the power output from the unit when firing natural gas. This is commonly referred to as "steam for

power augmentation." This is different than use of steam injection in the combustion zone for standard combustors, which results in lower NO_x levels.

By using the otherwise wasted heat from the combustion turbines, the combined cycle facility will be more efficient than either simple cycle combustion turbines or traditional steam cycle power plants. When natural gas is combusted at ambient temperatures of 80 degrees Fahrenheit (°F) or more, the turbines are not capable of generating sufficient electrical power to meet the required nominal generating capacity of 440 MW. As a result, power output will be increased through use of steam for power augmentation when firing natural gas to achieve near full load requirements when ambient temperatures are 80°F or more. Steam for power augmentation is expected to be required for a maximum of 2,000 hours per year.

The combustion turbines are capable of both combined cycle and simple cycle operation; the latter is possible by exhausting the turbine exhaust gases through bypass stacks instead of the HRSG stacks. The combustion turbines will use natural gas as the primary fuel and distillate fuel oil with a maximum sulfur content of 0.05 percent as a backup fuel. Fuel oil will be limited to a maximum of 1,500 hours for each turbine operating at maximum capacity. Natural gas will be transported to the site via pipeline and fuel oil will be trucked to the site. The facility will connect with a natural gas supply from either the Florida Gas Transmission (FGT) system or the proposed SunShine Natural Gas Pipeline. Fuel oil will be stored onsite in a 4.4-million-gallon storage tank located aboveground.

Air emissions control will consist of using state-of-the-art dry low-NO_x burners in the combustion turbines when firing natural gas. Water injection will be used for NO_x control when firing distillate fuel oil. The SO₂ emissions will be controlled by the use of low-sulfur fuels. Good combustion practices and clean fuels will also minimize potential emissions of PM, CO, VOC, and other pollutants (e.g., trace metals). These engineering and environmental designs maximize control of air emissions while minimizing economic, environmental, and energy impacts (see Section 4.0 for the BACT evaluation).

2.3 PROPOSED SOURCE EMISSIONS AND STACK PARAMETERS

The estimated maximum hourly emissions and exhaust parameters that are representative of the advanced combustion turbine (CT) design operating at baseload conditions (100-percent load) are

presented in Tables 2-1 through 2-6. The information is presented in these tables for simple and combined cycle operations based on natural gas combustion (Tables 2-1 and 2-2), natural gas combustion to produce steam for power augmentation (Tables 2-3 and 2-4), and fuel oil combustion (Tables 2-5 and 2-6). Except during power augmentation, the data are presented for ambient temperatures of 32, 59, 72, and 95°F. These temperatures represent the range of ambient temperatures that the CT is most likely to experience. Since power augmentation will only be needed during natural gas combustion when ambient temperatures exceed 80°F, the data in Tables 2-3 and 2-4 are presented for ambient temperatures of 80°F and 95°F. Power augmentation with dry low-NO_x combustors can increase dynamic pressure activity in the overall combustion process. To minimize this activity, the pilot flame percentage is increased from its normal "low NO_x" level to a slightly higher percentage. As pilot flame increases, there is a resulting increase in NO_x and CO levels. Supportive information about the bases of the emission calculations and operating data are presented in Attachment A for operating loads of 100, 75, and 50 percent.

A process flow diagram of the facility operating in combined cycle mode is presented in Figure 2-2. It should be noted that the mass flow data presented in Attachment A were adjusted from the data prepared by Westinghouse. Because of the limited operating history of the proposed turbine, Westinghouse included a 5 percent margin (increase) in estimating emissions to account for potential analytical inaccuracies. To account for this emission increase, the mass flow rate presented by Westinghouse was increased by 5 percent and resulted in the same emission rates that Westinghouse had provided. However, for modeling purposes, the exit velocities used in the analyses were based on the velocities determined from the mass flow rates provided by Westinghouse. As indicated in Tables 2-2, 2-4, and 2-6, the exit velocities used in the modeling were obtained by reducing the calculated velocities by the ratio of 1/1.05.

Based on a review of the emission rates for natural gas and fuel oil combustion, the highest emission rates for the regulated pollutants generally occur when firing fuel oil (CO emissions are higher when firing natural gas during power augmentation). Combustion of natural gas and fuel oil result in slightly different exhaust flow gas rates and stack exit temperatures. Although the exhaust conditions from natural gas combustion will result in slightly lower plume height (due to lower exit gas velocity and temperature) than fuel oil, the emissions for fuel oil combustion is generally 50 percent or more greater than the emissions for natural gas combustion for the same

ambient temperature and operating load. As a result, the air modeling analyses were primarily based on determining maximum ground-level impacts when firing fuel oil. In addition, potential CO impacts were predicted when firing natural gas during power augmentation.

As discussed in Section 6.0, the air modeling analyses that addressed compliance with ambient standards were based on modeling the CTs for the operating load and ambient temperature which produced the maximum impacts from the load impact analysis that was performed. Although the highest emission rates occur with low ambient temperatures (i.e., 32°F) and baseload conditions, the lowest exhaust gas flow rates occur with an ambient temperature of 95°F and 50 percent operating load. Since this low exhaust flow condition can result in potentially higher impacts due to lower plume rise (i.e., due to lower exit velocity and temperature), the load analysis included modeling the CTs at base, 75, and 50 percent operating loads for the two ambient temperatures of 32°F and 95°F. The load analysis also included modeling the CTs to estimate CO impacts when firing natural gas during power augmentation at baseload for ambient temperatures of 80°F and 95°F.

The maximum potential annual emissions for the proposed facility for regulated air pollutants, based on an ambient temperature of 59°F, are presented in Table 2-7. To produce the maximum annual emissions, each CT is assumed to operate for the entire year firing natural gas for 7,260 hours and fuel oil for 1,500 hours. In addition, the maximum potential annual emissions for the proposed facility are also presented for natural gas combustion when steam for power augmentation is needed to achieve near full load power requirements when ambient temperatures exceed 80°F. When firing natural gas, the CTs are assumed to need additional steam for power augmentation for 2,000 hours.

2.4 SITE LAYOUT AND STRUCTURES

A plot plan of the proposed facility is presented in Figure 2-3. The profiles of the buildings and structures are presented in Figure 2-4. The dimensions of the buildings and structures are presented in Section 6.0.

Table 2-1. Stack, Operating, and Emission Data for the Proposed Combustion Turbines With Dry Low-NO_x Combustors Firing Natural Gas--Base Load for Simple Cycle Operation

Parameter	Operating and Emission Data ^a for Ambient Temperature/Relative Humidity			
	32°F/30%	59°F/60%	72°F/80%	95°F/80%
<u>Bypass Stack Data (ft)</u>				
Height	75	75	75	75
Diameter	23	23	23	23
<u>Operating Data</u>				
Temperature (°F)	1,070	1,087	1,098	1,121
Velocity (ft/sec) ^b	102.1	97.7	95.7	92.0
<u>Maximum Hourly Emission Data (lb/hr) per Unit^c</u>				
SO ₂	5.14	4.79	4.64	4.37
PM/PM10	7.4	6.9	6.8	6.4
NO _x	104.1	92.7	82.0	60.9
CO	71.2	67.0	64.4	59.5
VOC	10.2	9.6	9.2	8.5
Sulfuric Acid Mist	0.70	0.65	0.63	0.59

^a Refer to Appendix A for detailed information. Tables A1B-1 through A1B-4 provide information on the simple and combined cycle operations.

^b For air modeling purposes, the exit velocity was reduced by the ratio of 1/1.05 to produce a conservative estimate of maximum impacts.

^c Other regulated pollutants are assumed to have negligible emissions. These pollutants include lead, reduced sulfur compounds, hydrogen sulfide, fluorides, beryllium, mercury, arsenic, asbestos, vinyl chloride, and radionuclides.

Table 2-2. Stack, Operating, and Emission Data for the Proposed Combustion Turbines With Dry Low-NO_x Combustors Firing Natural Gas--Base Load for Combined Cycle Operation

Parameter	Operating and Emission Data ^a for Ambient Temperature/Relative Humidity			
	32°F/30%	59°F/60%	72°F/80%	95°F/80%
<u>HRSO Stack Data (ft)</u>				
Height	90	90	90	90
Diameter	19	19	19	19
<u>Operating Data</u>				
Temperature (°F)	190	190	190	190
Velocity (ft/sec) ^b	63.5	60.2	58.5	55.4
<u>Maximum Hourly Emission Data (lb/hr) per Unit^c</u>				
SO ₂	5.14	4.79	4.64	4.37
PM/PM10	7.4	6.9	6.8	6.4
NO _x	104.1	92.7	82.0	60.9
CO	71.2	67.0	64.4	59.5
VOC	10.2	9.6	9.2	8.5
Sulfuric Acid Mist	1.01	0.94	0.91	0.86

^a Refer to Attachment A for detailed information. Tables A1B-1 through A1B-4 provide information on the simple and combined cycle operations.

^b For air modeling purposes, the exit velocity was reduced by the ratio of 1/1.05 to produce a conservative estimate of maximum impacts.

^c Other regulated pollutants are assumed to have negligible emissions. These pollutants include lead, reduced sulfur compounds, hydrogen sulfide, fluorides, beryllium, mercury, arsenic, asbestos, vinyl chloride, and radionuclides.

Table 2-3. Stack, Operating, and Emission Data for the Proposed Combustion Turbines With Dry Low-NO_x Combustors Firing Natural Gas--Steam for Power Augmentation for Simple Cycle Operation

Parameter	Operating and Emission Data ^a for Ambient Temperature/Relative Humidity	
	80°F/80%	95°F/80%
<u>Bypass Stack Data (ft)</u>		
Height	75	75
Diameter	23	23
<u>Operating Data</u>		
Temperature (°F)	1,124	1,106
Velocity (ft/sec) ^b	97.1	94.7
<u>Maximum Hourly Emission Data (lb/hr)/Per Unit^c</u>		
SO ₂	4.66	4.64
PM/PM10	7.22	7.11
NO _x	125.8	106.0
CO	156.7	149.8
VOC	9.0	9.0
Sulfuric Acid Mist	0.63	0.63

^a Refer to Appendix A for detailed information. Tables A1B-1A through A1B-4A provide information on simple and combined cycle operations.

^b For air modeling purposes, the exit velocity was reduced by the ratio of 1/1.05 to produce a conservative estimate of maximum impacts.

^c Other regulated pollutants are assumed to have negligible emissions. These pollutants include lead, reduced sulfur compounds, hydrogen sulfide, fluorides, beryllium, mercury, arsenic, asbestos, vinyl chloride, and radionuclides.

Table 2-4. Stack, Operating, and Emission Data for the Proposed Combustion Turbines With Dry Low-NO_x Combustors Firing Natural Gas--Steam for Power Augmentation for Combined Cycle Operation

Parameter	Operating and Emission Data ^a for Ambient Temperature/Relative Humidity	
	80°F/80%	95°F/80%
<u>HRSG Stack Data (ft)</u>		
Height	90	90
Diameter	19	19
<u>Operating Data</u>		
Temperature (°F)	190	190
Velocity (ft/sec) ^b	58.4	57.6
<u>Maximum Hourly Emission Data (lb/hr)/Per Unit^c</u>		
SO ₂	4.66	4.64
PM/PM10	7.22	7.11
NO _x	125.8	106.0
CO	156.7	149.8
VOC	9.0	9.0
Sulfuric Acid Mist	0.92	0.91

^a Refer to Appendix A for detailed information. Tables A1B-1A through A1B-4A provide information on simple and combined cycle operations.

^b For air modeling purposes, the exit velocity was reduced by the ratio of 1/1.05 to produce a conservative estimate of maximum impacts.

^c Other regulated pollutants are assumed to have negligible emissions. These pollutants include lead, reduced sulfur compounds, hydrogen sulfide, fluorides, beryllium, mercury, arsenic, asbestos, vinyl chloride, and radionuclides.

Table 2-5. Stack, Operating, and Emission Data for the Proposed Combustion Turbines With Water Injection Firing Fuel Oil--Base Load for Simple Cycle Operation

Parameter	Operating and Emission Data ^a for Ambient Temperature/Relative Humidity			
	32°F/30%	59°F/60%	72°F/80%	95°F/80%
<u>Bypass Stack Data (ft)</u>				
Height	75	75	75	75
Diameter	23	23	23	23
<u>Operating Data</u>				
Temperature (°F)	1,073	1,088	1,099	1,121
Velocity (ft/sec) ^b	107.2	102.4	100.3	96.3
<u>Maximum Hourly Emission Data (lb/hr) per Unit^c</u>				
SO ₂	100.2	93.4	90.4	85.1
PM/PM10	67.0	62.7	60.6	56.5
NO _x	349.6	310.8	269.3	199.6
CO	90.8	85.3	82.0	75.8
VOC	20.7	19.5	18.7	17.3
Lead	0.114	0.107	0.103	0.097
Arsenic	0.0097	0.0090	0.0087	0.0082
Beryllium	0.0049	0.0046	0.0045	0.0042
Fluoride	0.064	0.060	0.058	0.055
Mercury	0.017	0.016	0.016	0.015
Sulfuric Acid Mist	15.3	14.3	13.8	13.0

^a Refer to Appendix A for detailed information. Tables A4-1 through A4-4 provide information on the simple and combined cycle operations.

^b For air modeling purposes, the exit velocity was reduced by the ratio of 1/1.05 to produce a conservative estimate of maximum impacts.

^c Other regulated pollutants are assumed to have negligible emissions. These pollutants include reduced sulfur compounds, hydrogen sulfide, asbestos, vinyl chloride, and radionuclides.

Table 2-6. Stack, Operating, and Emission Data for the Proposed Combustion Turbines With Water Injection Firing Fuel Oil--Base Load for Combined Cycle Operation

Parameter	Operating and Emission Data ^a for Ambient Temperature/Relative Humidity			
	32°F/30%	59°F/60%	72°F/80%	95°F/80%
<u>HRSG Stack Data (ft)</u>				
Height	90	90	90	90
Diameter	19	19	19	19
<u>Operating Data</u>				
Temperature (°F)	285	285	285	285
Velocity (ft/sec) ^b	76.4	72.2	70.2	66.5
<u>Maximum Hourly Emission Data (lb/hr) per Unit^c</u>				
SO ₂	100.2	93.4	90.4	85.1
PM/PM10	67.0	62.7	60.6	56.5
NO _x	349.6	310.8	269.3	199.6
CO	90.8	85.3	82.0	75.8
VOC	20.7	19.5	18.7	17.3
Lead	0.114	0.107	0.103	0.097
Arsenic	0.0097	0.0090	0.0087	0.0082
Beryllium	0.0049	0.0046	0.0045	0.0042
Fluoride	0.064	0.060	0.058	0.055
Mercury	0.017	0.016	0.016	0.015
Sulfuric Acid Mist	22.3	20.7	20.1	18.9

^a Refer to Appendix A for detailed information. Tables A4-1 through A4-4 provide information on the simple and combined cycle operations.

^b For air modeling purposes, the exit velocity was reduced by the ratio of 1/1.05 to produce a conservative estimate of maximum impacts.

^c Other regulated pollutants are assumed to have negligible emissions. These pollutants include reduced sulfur compounds, hydrogen sulfide, asbestos, vinyl chloride, and radionuclides.

Table 2-7. Summary of the Maximum Potential Annual Emissions for the Proposed Combustion Turbines for Combined Cycle Operation at the Hardee Unit 3 Facility

Emissions (TPY)				
Pollutant	Fuel Oil	Natural Gas	Natural Gas- Steam for Power Augmentation	Total
<u>Potential Emissions (Without Power Augmentation)^a</u>				
SO ₂	140.1	34.8	NA	174.9
PM/PM10	94.1	50.4	NA	144.5
NO _x	466.2	673.2	NA	1,139.4
CO	127.9	486.1	NA	614.0
VOC	29.2	69.5	NA	98.7
Lead	0.16	NA	NA	0.16
Arsenic	0.014	NA	NA	0.014
Beryllium	0.0069	NA	NA	0.0069
Fluoride	0.090	NA	NA	0.090
Mercury	0.024	0.0003	NA	0.025
Sulfuric Acid Mist	31.1	6.86	NA	38.0
<u>Potential Emissions (With Power Augmentation)^b</u>				
SO ₂	140.1	25.2	9.32	174.6
PM/PM10	94.1	36.5	14.4	145.1
NO _x	466.2	487.7	251.5	1,205.4
CO	127.9	352.2	313.4	793.5
VOC	29.2	50.3	17.9	97.5
Lead	0.16	NA	NA	0.16
Arsenic	0.014	NA	NA	0.014
Beryllium	0.0069	NA	NA	0.0069
Fluoride	0.090	NA	NA	0.090
Mercury	0.024	0.0002	0.00009	0.025
Sulfuric Acid Mist	31.1	4.97	1.84	37.9

Note: NA = not applicable.

^a Emission rates are based on two combustion turbines firing fuel oil for 1,500 hours and natural gas for 7,260 hours at ambient temperature of 59°F (without power augmentation) and relative humidity of 60%.

^b Emission rates are based on two combustion turbines firing fuel oil for 1,500 hours and natural gas for 7,260 hours at ambient temperature of 59°F and relative humidity of 60%. Natural gas combustion includes 2,000 hours of steam for power augmentation at ambient temperature of 80°F and relative humidity of 80%.

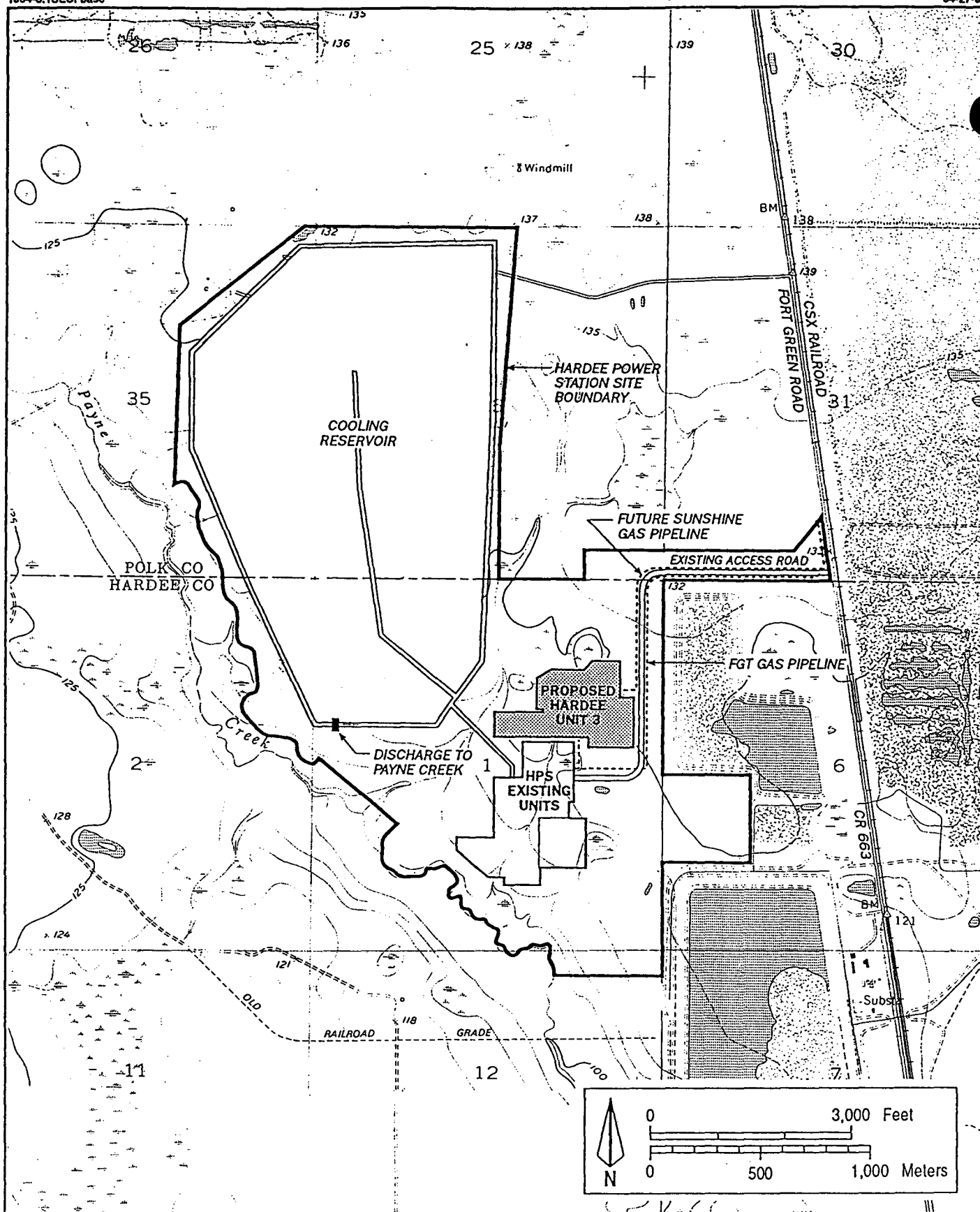
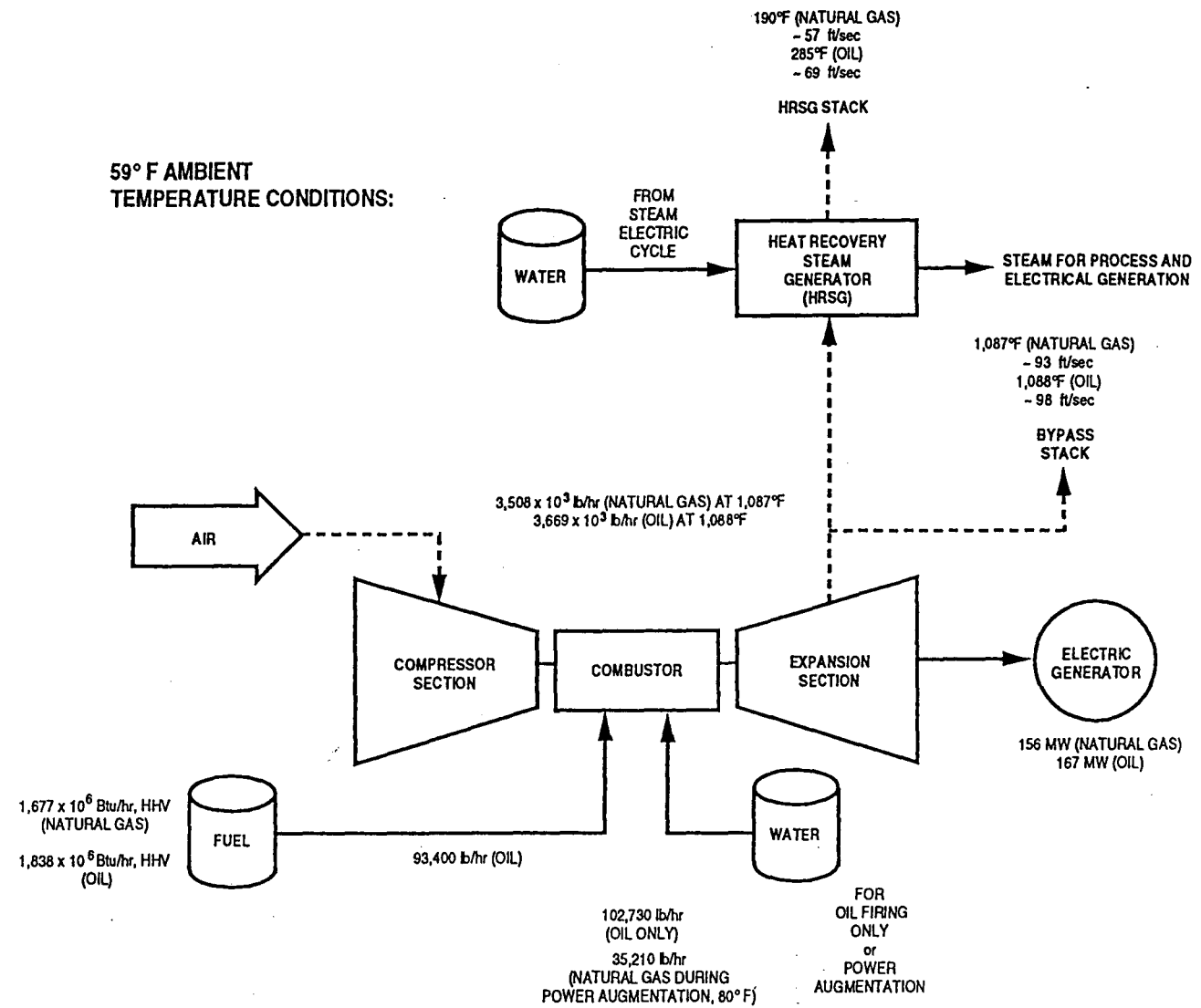


Figure 2-1
Hardee Unit 3 Boundary and Adjacent Properties

Source: USGS, 1987; KBN, 1994.





NOTE: SEE ATTACHMENT A FOR DESIGN INFORMATION AND STACK PARAMETERS FOR EACH FUEL. BASED ON FLOW RATES PROVIDED BY WESTINGHOUSE.

Figure 2-2
Simplified Flow Diagram of Hardee Unit 3

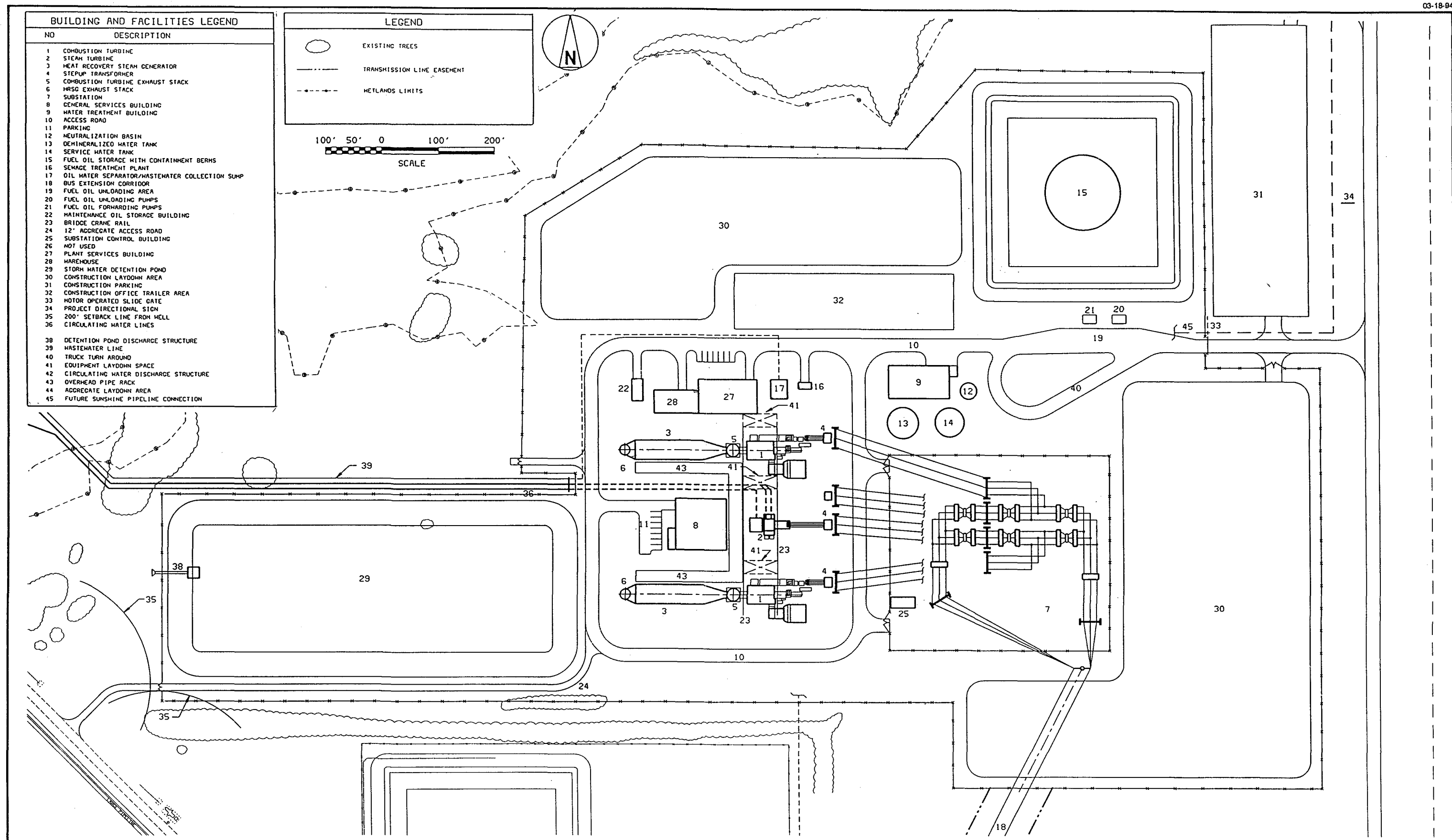


Figure 2-3
Hardee Unit 3 Plot Plan

Source: Black & Veatch, 1994.

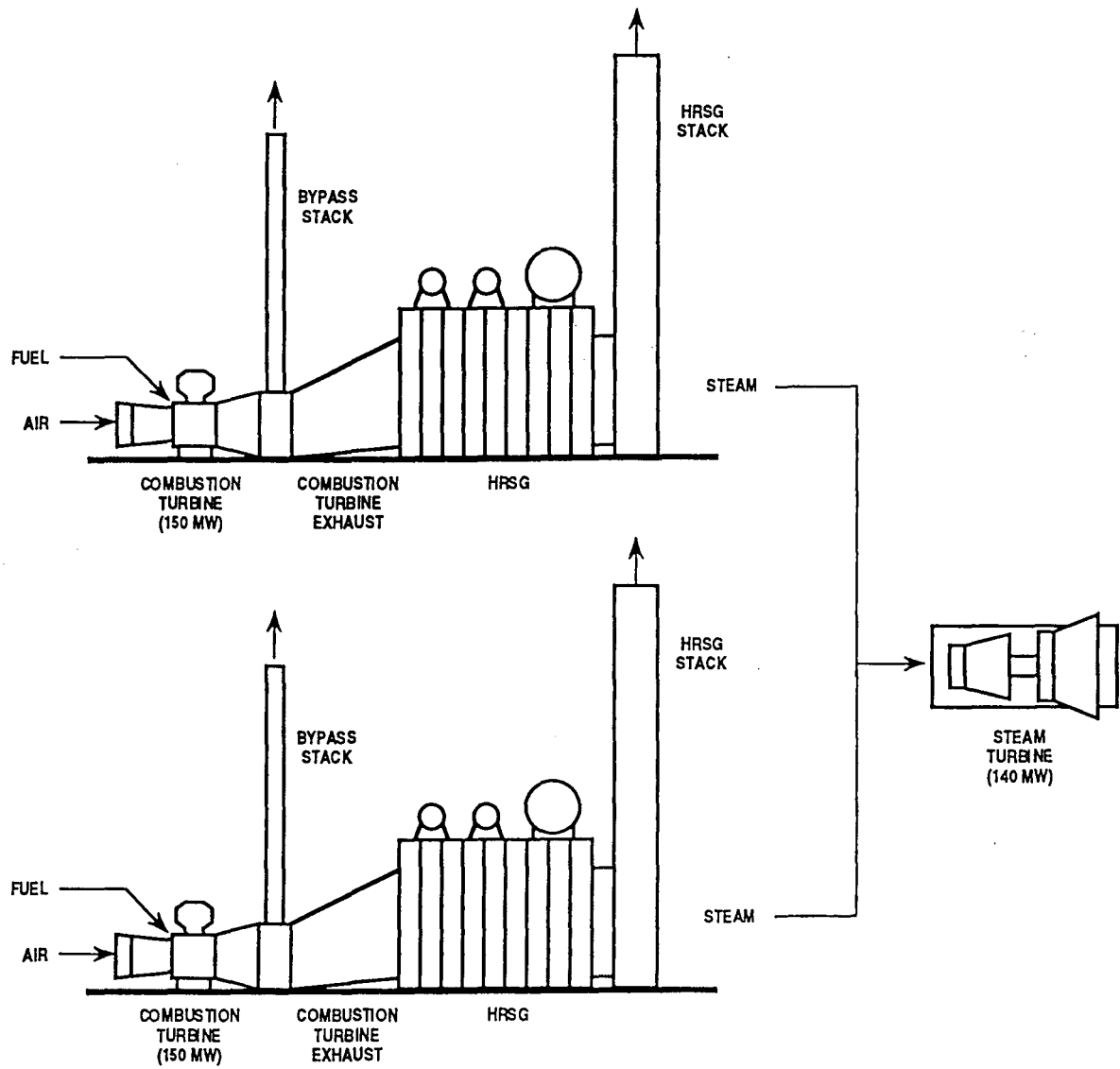


Figure 2-4
Schematic Flow Diagram of Hardee Unit 3 Facility

3.0 AIR QUALITY REVIEW REQUIREMENTS AND APPLICABILITY

The following discussion pertains to the federal and state air regulatory requirements and their applicability to the proposed Hardee Unit 3 facility. These regulations must be satisfied before the proposed CTs can begin operation.

3.1 NATIONAL AND STATE AAQS

The existing applicable national and Florida AAQS are presented in Table 3-1. 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.

3.2 PSD REQUIREMENTS

3.2.1 GENERAL REQUIREMENTS

Under federal and State of Florida PSD review requirements, all major new or modified sources of air pollutants regulated under the Clean Air Act (CAA) must be reviewed and a preconstruction permit issued. Florida's State Implementation Plan (SIP), which contains PSD regulations, has been approved by EPA; therefore, PSD approval authority has been granted to FDEP.

A "major facility" is defined as any one of 28 named source categories that have the potential to emit 100 tons per year (TPY) or more or any other stationary facility that has the potential to emit 250 TPY or more of any pollutant regulated under CAA. "Potential to emit" means the capability, at maximum design capacity, to emit a pollutant after the application of control equipment.

A "major modification" is defined under PSD regulations as a change at an existing major facility that increases emissions by greater than significant amounts. PSD significant emission rates are shown in Table 3-2.

EPA has promulgated as regulations certain increases above an air quality baseline concentration level of SO₂, PM(TSP), and NO₂ concentrations that would constitute significant deterioration.

The EPA class designations and allowable PSD increments are presented in Table 3-1. The State of Florida has adopted the EPA class designations and allowable PSD increments for SO₂, PM(TSP), and NO₂ increments. EPA has promulgated PSD increments for PM₁₀ that will become effective in June 1994. The State of Florida has not yet adopted these increments. However, because the PM₁₀ increments are more stringent than and will replace the PM(TSP) increments, the maximum PM impacts for PSD-affected sources are compared to the PM₁₀ increments.

PSD review is used to determine whether significant air quality deterioration will result from the new or modified facility. Federal PSD requirements are contained in 40 CFR 52.21, Prevention of Significant Deterioration of Air Quality. The State of Florida has adopted PSD regulations that are identical to federal regulations (Chapter 17-212.400, F.A.C.). Major facilities and major modifications are required to undergo the following analysis related to PSD for each pollutant emitted in significant amounts:

1. Control technology review,
2. Source impact analysis,
3. Air quality analysis (monitoring),
4. Source information, and
5. Additional impact analyses.

In addition to these analyses, a new facility also must be reviewed with respect to GEP stack height regulations. Discussions concerning each of these requirements are presented in the following sections.

3.2.2 CONTROL TECHNOLOGY REVIEW

The control technology review requirements of the federal and state PSD regulations require that all applicable federal and state emission-limiting standards be met, and that BACT be applied to control emissions from the source (Chapter 17-212.410, F.A.C.). The BACT requirements are applicable to all regulated pollutants for which the increase in emissions from the facility or modification exceeds the significant emission rate (see Table 3-2).

BACT is defined in Chapter 17-212.200(16), F.A.C., as:

An emissions limitation, including a visible emission 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 such pollutant. If the Department determines that technological or economic limitations on the application of measurement methodology to a particular part of a source 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.

BACT was promulgated within the framework of the PSD requirements in the 1977 amendments of the CAA [Public Law 95-95; Part C, Section 165(a)(4)]. The primary purpose of BACT is to optimize consumption of PSD air quality increments and thereby enlarge the potential for future economic growth without significantly degrading air quality (EPA, 1978; 1980). Guidelines for the evaluation of BACT can be found in EPA's *Guidelines for Determining Best Available Control Technology (BACT)* (EPA, 1978) and in the *PSD Workshop Manual* (EPA, 1980). These guidelines were promulgated 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. In addition, through implementation of these guidelines, BACT in one area may not be identical to BACT in another area. According to EPA (1980), "BACT analyses for the same types of emissions unit 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. Therefore, BACT analyses must be conducted on a case-by-case basis."

The BACT requirements are intended to ensure that the control systems incorporated in the design of a proposed facility reflect the latest in control technologies used in a particular industry and take into consideration existing and future air quality in the vicinity of the proposed facility. BACT must, as a minimum, demonstrate compliance with new source performance standards (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 decision on BACT is to be based on sound judgment, balancing environmental benefits with energy, economic, and other impacts (EPA, 1978).

Historically, a "bottom-up" approach consistent with the BACT Guidelines and PSD Workshop Manual has been used. With this approach, an initial control level, which is usually NSPS, is evaluated against successively more stringent controls until a BACT level is selected. However, EPA developed a concern that the bottom-up approach was not providing the level of BACT decisions originally intended. As a result, in December 1987, the EPA Assistant Administrator for Air and Radiation mandated changes in the implementation of the PSD program, including the adoption of a new "top-down" approach to BACT decisionmaking.

The top-down BACT approach essentially starts with the most stringent (or top) technology and emissions limit that have been applied elsewhere to the same or a similar source category. The applicant must next provide a basis for rejecting this technology in favor of the next most stringent technology or propose to use it. Rejection of control alternatives may be based on technical or economic infeasibility. Such decisions are made on the basis of physical differences (e.g., fuel type), locational differences (e.g., availability of water), or significant differences that may exist in the environmental, economic, or energy impacts. The differences between the proposed facility and the facility on which the control technique was applied previously must be justified. EPA has issued a draft guidance document on the top-down approach entitled *Top-Down Best Available Control Technology Guidance Document* (EPA, 1990).

3.2.3 SOURCE IMPACT ANALYSIS

A source impact analysis must be performed for a proposed major source subject to PSD review for each pollutant for which the increase in emissions exceeds the significant emission rate (Table 3-2). The PSD regulations specifically provide for the use of atmospheric dispersion models in performing impact analyses, estimating baseline and future air quality levels, and determining compliance with AAQS and allowable PSD increments. Designated EPA models normally must be used in performing the impact analysis. Specific applications for other than EPA-approved models require EPA's consultation and prior approval. Guidance for the use and application of dispersion models is presented in the EPA publication *Guideline on Air Quality Models (Revised)*. The source impact analysis for criteria pollutants to address compliance with

AAQS and PSD Class II increments may be limited to the new or modified source if the net increase in impacts as a result of the new or modified source is above significance levels, as presented in Table 3-1.

The National Park Service (NPS) has recommended significant impact levels for PSD Class I areas. The levels are as follows:

Pollutant	Averaging Time	Maximum Significance Level ($\mu\text{g}/\text{m}^3$) ^a
SO ₂	3-hour	0.48
	24-hour	0.07
	Annual	0.025
PM(TSP)	24-hour	0.33
	Annual	0.08
NO ₂	Annual	0.025

^a $\mu\text{g}/\text{m}^3$ = micrograms per cubic meter.

Although these levels have not undergone regulatory or public review and may not be binding in other states, the proposed levels serve as a guideline in assessing a source's impact in a Class I area. Independently, EPA's Office of Air Quality Planning and Standards has initiated a motion that will lead to rulemaking to address the general need for Class I significant impact levels. The action is part of EPA's efforts to incorporate NSR provisions of the 1990 CAA Amendments. Because the process of developing the regulations will be lengthy, EPA believes that immediate guidance concerning the significant impact levels is appropriate in order to assist states in implementing the PSD permit process.

Various lengths of record for meteorological data can be used for impact analysis. A 5-year period can be used with corresponding evaluation of highest, second-highest short-term concentrations for comparison to AAQS or PSD increments. The term "highest, second-highest" (HSH) refers to the highest of the second-highest concentrations at all receptors (i.e., the highest concentration at each receptor is discarded). The second-highest concentration is significant because short-term AAQS specify that the standard should not be exceeded at any location more

than once a year. If fewer than 5 years of meteorological data are used in the modeling analysis, the highest concentration at each receptor normally must be used for comparison to air quality standards.

The term "baseline concentration" evolves from federal and state PSD regulations and refers to a concentration level corresponding to a specified baseline date and certain additional baseline sources. By definition, in the PSD regulations as amended August 7, 1980, baseline concentration means the ambient concentration level that exists in the baseline area at the time of the applicable baseline date. A baseline concentration is determined for each pollutant for which a baseline date is established and includes:

1. The actual emissions representative of facilities in existence on the applicable baseline date; and
2. The allowable emissions of major stationary facilities that commenced construction before January 6, 1975, for SO₂ and PM(TSP) concentrations, or February 8, 1988, for NO₂ concentrations, but that were not in operation by the applicable baseline date.

The following emissions are not included in the baseline concentration and therefore affect PSD increment consumption:

1. Actual emissions from any major stationary facility on which construction commenced after January 6, 1975, for SO₂ and PM(TSP) concentrations, and after February 8, 1988, for NO₂ concentrations; and
2. Actual emission increases and decreases at any stationary facility occurring after the baseline date.

In reference to the baseline concentration, the term "baseline date" actually includes three different dates:

1. The major facility baseline date, which is January 6, 1975, in the cases of SO₂ and PM(TSP), and February 8, 1988, in the case of NO₂.
2. The minor facility baseline date, which is the earliest date after the trigger date on which a major stationary facility or major modification subject to PSD regulations submits a complete PSD application.

3. The trigger date, which is August 7, 1977, for SO₂ and PM(TSP), and February 8, 1988, for NO₂.

The minor source baseline date for SO₂ and PM(TSP) has been set as December 27, 1977, for the entire State of Florida (Chapter 17-275.700, F.A.C.). The minor source baseline for NO₂ has been set as March 28, 1988 (Chapter 17-275.700, F.A.C.). It should be noted that references to PM(TSP) are also applicable to PM10.

3.2.4 AIR QUALITY MONITORING REQUIREMENTS

In accordance with requirements of 40 CFR 52.21(m) and Chapter 17-212.400(5)(f), F.A.C, any application for a PSD permit must contain an analysis of continuous ambient air quality data in the area affected by the proposed major stationary facility or major modification. For a new major facility, the affected pollutants are those that the facility potentially would emit in significant amounts. For a major modification, the pollutants are those for which the net emissions increase exceeds the significant emission rate (see Table 3-2).

Ambient air monitoring for a period of up to 1 year generally is appropriate to satisfy the PSD monitoring requirements. A minimum of 4 months of data is required. Existing data from the vicinity of the proposed source may be used if the data meet certain quality assurance requirements; otherwise, additional data may need to be gathered. Guidance in designing a PSD monitoring network is provided in EPA's *Ambient Monitoring Guidelines for Prevention of Significant Deterioration* (EPA, 1987a).

The regulations include an exemption that excludes or limits the pollutants for which an air quality analysis must be conducted. This exemption states that FDEP may exempt a proposed major stationary facility or major modification from the monitoring requirements with respect to a particular pollutant if the emissions increase of the pollutant from the facility or modification would cause, in any area, air quality impacts less than the *de minimis* levels presented in Table 3-2 (Table 17-212.400-3, F.A.C.).

3.2.5 SOURCE INFORMATION/GOOD ENGINEERING PRACTICE STACK HEIGHT

Source information must be provided to adequately describe the proposed project. The general type of information that will be presented for this project will be similar to that presented in Section 2.0. Additional information required as part of the SCA is also submitted.

The 1977 CAA Amendments require that the degree of emission limitation required for control of any 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). Identical regulations have been adopted by FDEP (Chapter 17-210.550, F.A.C.). GEP stack height is defined as the highest of:

1. 65 meters (m); or
2. A height established by applying the formula:

$$H_g = H + 1.5L$$

where: H_g = GEP stack height,

H = Height of the structure or nearby structure, and

L = Lesser dimension (height or projected width) of nearby structure(s); or

3. A height demonstrated by a fluid model or field study.

"Nearby" is defined 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 used in modeling for determining compliance with AAQS and PSD increments not exceed the GEP stack height, the actual stack height may be greater.

The stack height regulations also allow increased GEP stack height beyond that resulting from the above formula in cases where plume impaction occurs. Plume impaction is defined as concentrations measured or predicted to occur when the plume interacts with elevated terrain. Elevated terrain is defined as terrain that exceeds the height calculated by the GEP stack height formula.

3.2.6 ADDITIONAL IMPACT ANALYSIS

In addition to air quality impact analyses, federal and State of Florida 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 [40 CFR 52.21; Chapter 17-212.400(5)(c), F.A.C.]. These analyses are to be conducted primarily for PSD Class I areas. Impacts as a result of general commercial, residential, industrial, and other growth associated with the source also must be addressed. These analyses are required for each pollutant emitted in significant amounts (Table 3-2).

3.3 NONATTAINMENT RULES

Based on the current nonattainment provisions (Chapter 17-212.500, F.A.C.), all major new facilities and modifications to existing major facilities located in a nonattainment area must undergo nonattainment review. A new major facility is required to undergo this review if the proposed pieces of equipment have the potential to emit 100 TPY or more of the nonattainment pollutant. A major modification at a major facility is required to undergo review if it results in a significant net emission increase of 40 TPY or more of the nonattainment pollutant or if the modification is major (i.e., 100 TPY or more).

For major facilities or major modifications that locate in an attainment or unclassifiable area, the nonattainment review procedures apply if the source or modification is located within the area of influence of a nonattainment area. The area of influence is defined as an area that is outside the boundary of a nonattainment area but within the locus of all points that are 50 km outside the boundary of the nonattainment area. Based on Chapter 17-2.500(2)(a)2, F.A.C., all VOC sources that are located within an area of influence are exempt from the provisions of NSR for nonattainment areas. Sources that emit other nonattainment pollutants and are located within the area of influence are subject to nonattainment review unless the maximum allowable emissions from the proposed source do not have a significant impact within the nonattainment area.

3.4 EMISSION STANDARDS

3.4.1 NEW SOURCE PERFORMANCE STANDARDS

The NSPS are a set of national emission standards that apply to specific categories of new sources. As stated in the CAA Amendments of 1977, these standards "shall reflect the degree of emission limitation and the percentage reduction achievable through application of the best technological system of continuous emission reduction the Administrator determines has been adequately demonstrated."

The proposed project will be subject to one or more NSPS. The CTs will be subject to 40 CFR Part 60, Subpart GG, and the fuel oil storage tank (4.4-million-gallon capacity) will be subject to 40 CFR Part 60, Subpart Kb.

3.4.1.1 Combustion Turbine

The CTs will be subject to emission limitations covered under Subpart GG, which limits NO_x and SO₂ emissions from all stationary gas turbines with a heat input at peak load equal to 10.7 gigajoules per hour (10 MMBtu/hr), based on the lower heating value of the fuel fired.

3.4.1.2 Fuel Oil Storage Tank

The applicable NSPS is 40 CFR Part 60, Subpart Kb--Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels for which Construction, Reconstruction, or Modification Commenced after July 23, 1984). The storage tank will contain distillate fuel oil, a volatile organic liquid as defined in Subpart Kb.

3.4.2 FLORIDA RULES

FDEP regulations for new stationary sources are covered in the F.A.C. These rules are incorporated by reference (Chapter 17-296.800, F.A.C.) the federal NSPS, 40 CFR 60. Therefore, they will require the project to meet the same requirements as those described in Section 3.4.1.

3.4.3 FLORIDA AIR PERMITTING REQUIREMENTS

FDEP regulations require any new source to obtain an air permit prior to construction. Major new sources must meet the appropriate PSD and nonattainment requirements as discussed previously. The requirements for permits, approvals, and registrations are presented in Chapter 17-4, F.A.C. Required permits and approvals include NSR for nonattainment areas, PSD, NSPS, National Emission Standards for Hazardous Air Pollutants (NESHAP), Permit to Construct, and Permit to Operate. Specific emission standards are set forth in Chapter 17-296, F.A.C.

3.4.4 HAZARDOUS POLLUTANT REVIEW

FDEP has promulgated guidelines (FDEP, 1992) to determine whether any emission of a hazardous or toxic pollutant can pose a possible health risk to the public. Maximum concentrations for all regulated pollutants for which an ambient standard does not exist and all nonregulated hazardous pollutants are to be compared to no-threat levels (NTLs) for each applicable pollutant. If the maximum predicted concentration for any hazardous pollutant is less than the corresponding NTL for each applicable averaging time, that emission is considered not to pose a significant health risk. However, the NTLs are not environmental standards but, rather, evaluation tools to determine if an apparent threat to the public health may exist.

3.5 SOURCE APPLICABILITY

3.5.1 AREA CLASSIFICATION

The project site is located in Hardee County, which has been designated by EPA and FDEP as an attainment area for all criteria pollutants. Hardee County and surrounding counties are designated as PSD Class II areas for SO₂, PM(TSP), and NO₂. The site is located approximately 130 km (80 miles) from the closest part of the Chassahowitzka National Wilderness Area (NWA), a PSD Class I area.

3.5.2 PSD REVIEW

3.5.2.1 Pollutant Applicability

The proposed plant is considered to be a major facility because the emissions of several regulated pollutants will exceed 100 TPY (see Table 3-3); therefore, PSD review is required for any pollutant for which the net increase in emissions exceeds the PSD significant emission rates. As shown in Table 3-3, potential emissions from the proposed project will be major for PM(TSP), PM10, NO_x, CO, and VOC and will exceed the PSD significant emission rates for arsenic (As), beryllium (Be), and sulfuric acid mist (H₂SO₄). Because the proposed plant's impacts for SO₂ and PM10 concentrations are predicted to be greater than the significant impact levels (see Section 7.1), this review requires determining compliance with the SO₂ and PM10 AAQS and PSD Class II increments.

As part of the PSD review, a PSD Class I increment analysis is required if the proposed power plant's impacts are greater than the NPS-recommended Class I significant impact levels. The nearest Class I area to the plant site is the Chassahowitzka NWA located approximately 130 km

(80 miles) from the site. Based on the proposed project's predicted SO₂, NO₂, and PM₁₀ impacts in the Class I area (see Section 7.1), a PSD Class I increment-consumption analysis was performed for only SO₂ concentrations (the proposed project's NO₂ and PM₁₀ impacts were predicted to be less than the NPS-recommended Class I screening levels) (see Section 3.2.3). Based on discussions with FDEP, PSD increment-consuming sources located within approximately 150 km (93 miles) of the Class I area were also considered in the analysis. Since other Class I areas are located more than 200 km (124 miles) from the plant site, no additional analyses were required for other PSD Class I areas since the proposed plant's impacts are expected to be insignificant and will not adversely affect other Class I areas.

3.5.2.2 Emission Standards

The applicable NSPS for the CTs is 40 CFR Part 60, Subpart GG. The proposed emissions for the turbines will be well below the specified limits (see Section 4.0). The fuel oil storage tank will have a maximum storage capacity of 4.4 million gallons of No. 2 fuel oil. Since the storage tank has a capacity greater than 40 cubic meters (m³) [approximately 10,568 gallons], the applicable NSPS is 40 CFR Part 60, Subpart Kb. The storage tank will contain distillate fuel oil, a volatile organic liquid as defined in Subpart Kb, with a true vapor pressure of 0.022 pound per square inch (psi) at 100°F. Because the fuel oil is expected to have a maximum true vapor pressure of less than 3.5 kilopascals (kPa) or 0.51 psi, only the minor monitoring of operating requirements specified in 40 CFR 60.116b(a) and (b) will apply.

3.5.2.3 Ambient Monitoring

Based on the increase in emissions from the proposed plant (see Table 3-4), a preconstruction ambient monitoring analysis is required for SO₂, PM(TSP), PM₁₀, NO₂, CO, O₃ (based on VOC emissions), H₂SO₄ mist, Be, and As. If the net increase in impact of other pollutants is less than the applicable *de minimis* monitoring concentration (100 TPY in the case of VOC), then an exemption from the preconstruction ambient monitoring requirement is provided for in the PSD regulations. In addition, if an acceptable ambient monitoring method for the pollutant has not been established by EPA, monitoring is not required.

If preconstruction monitoring data are required to be submitted, data collected at or near the project site can be submitted, based on existing air quality data or the collection of onsite data.

As shown in Table 3-4, the proposed plant's impacts are predicted to be greater than the applicable *de minimis* monitoring concentration levels for SO₂, PM(TSP), PM₁₀, and Be. For O₃, the potential VOC emissions are less than the *de minimis* monitoring emission level. For H₂SO₄ mist and As, although the proposed plant's potential emissions are estimated to be greater than the applicable significant emission rate, no acceptable ambient monitoring methods for these pollutants have been established by EPA. Therefore, except for SO₂, PM(TSP), PM₁₀, and Be, exemption from the preconstruction ambient monitoring requirement is appropriate and complies with the PSD regulations.

For this project, ambient SO₂ and PM₁₀ monitoring data collected in the vicinity of the project site have been determined by FDEP to be adequate in order to satisfy the preconstruction monitoring requirements [PM₁₀ data would satisfy the PM(TSP) data requirements]. These data, which were collected by FDEP and private companies, were submitted to and approved by FDEP as meeting the PSD monitoring guidelines for data collection and PSD preconstruction monitoring guidelines. These data, summarized in Section 5.2, are considered representative of current air quality because there has been minimal industrial or commercial growth in the area of the proposed plant since the monitoring data were collected. As a result of minimal growth, no significant air emission increases occurred which would significantly change the air quality measured by the monitoring program.

The maximum Be concentrations are predicted to be greater than the *de minimis* monitoring concentration for 50-percent operating load. For baseload operation, the maximum predicted concentrations are less than the *de minimis* concentration. However, the maximum concentrations are less than the NTLs (see Table 7-21). Although the maximum concentrations at 50-percent load are predicted to be slightly greater than the *de minimis* concentration but less than the NTLs, preconstruction monitoring is not warranted for this project.

3.5.2.4 GEP Stack Height Impact Analysis

The GEP stack height regulations allow any stack to be at least 65 m [213 feet (ft)] high. The HRSG stacks (combined-cycle operation) and bypass stacks (simple-cycle operation) will be 90 ft (27.4 m) and 75 ft (22.9 m), respectively. These stack heights do not exceed the GEP stack

height. The potential for downwash of the units' emissions caused by nearby structures is discussed in Section 6.0, Air Quality Modeling Approach.

3.5.3 NONATTAINMENT REVIEW

The project site is located in Hardee County, which is classified as an attainment area for all criteria pollutants. The plant is also located more than 50 km (31 miles) from any nonattainment area. Therefore, nonattainment requirements are not applicable.

3.5.4 HAZARDOUS POLLUTANT REVIEW

The maximum concentrations of the applicable hazardous air pollutants predicted for Hardee Unit 3 are presented in Section 7.5. These maximum concentrations are compared to the FDEP NTLs. The bases and emissions for these pollutants are presented in Attachment A. The NTLs are not environmental standards but, rather, evaluation tools to determine if an apparent threat to the public health may exist.

3.5.5 OTHER CLEAN AIR ACT REQUIREMENTS

The 1990 CAA Amendments established a program to reduce potential precursors of acidic deposition. The Acid Rain Program was delineated in Title IV of the CAA Amendments and required EPA to develop the program. EPA's final regulations were promulgated on January 11, 1993, and included permit provisions (40 CFR Part 72), allowance system (Part 73), continuous emission monitoring (Part 75), excess emission procedures (Part 77), and appeal procedures (Part 78).

EPA's Acid Rain Program applies to all existing and new utility units except those serving a generator less than 25 MW, existing simple cycle CTs, and non-utility units which fall under the program are referred to as affected units. The EPA regulations would be applicable to the proposed project for the purposes for obtaining a permit and allowances, as well as emission monitoring. New units are required to obtain permits under the program by submitting a complete application 24 months before the later of January 1, 2000, or the date on which the unit begins serving an electric generator (greater than 25 MW).

The permit would provide SO₂ and NO_x emission limitations and the requirement to hold emission allowances. Emission limitations established in the Acid Rain Program are presumed to be less

stringent than BACT or lowest achievable emission rate (LAER) for new units. An allowance is a market-based financial instrument that is equivalent to 1 ton of SO₂ emissions. Allowances can be sold, purchased, or traded. For the proposed project, SO₂ allowances will be obtained either from excess allowances from the SECI system or through the market.

Continuous emission monitoring (CEM) for SO₂ and NO_x is required for gas-fired and oil-fired affected units. When an SO₂ CEM is selected to monitor SO₂ mass emissions, a flow monitor is also required. Alternately, SO₂ emissions may be determined using procedures established in Appendix D, 40 CFR Part 75 (flow proportional oil sampling or manual daily oil sampling). CO₂ emissions must also be determined either through a CEM (e.g., as a diluent for NO_x monitoring) or calculation. Alternate procedures, test methods, and quality assurance/quality control (QA/QC) procedures for CEM are specified (Part 75 Appendices A through I). The CEM requirements including QA/QC procedures are, in general, more stringent than those specified in the NSPS for Subpart GG. New units are required to meet the requirements by the later of January 1, 1995, or not later than 90 days after the unit commences commercial operation.

Table 3-1. National and State AAQS, Allowable PSD Increments, and Significant Impact Levels ($\mu\text{g}/\text{m}^3$)

Pollutant	Averaging Time	AAQS ^a			PSD Increments ^a		Significant Impact Levels ^b
		National		State of Florida	Class I	Class II	
		Primary Standard	Secondary Standard				
Particulate Matter (TSP)	Annual Geometric Mean	NA	NA	NA	5	19	1
	24-Hour Maximum	NA	NA	NA	10	37	5
Particulate Matter (PM10)	Annual Arithmetic Mean	50	50	50	4 ^c	17 ^c	1
	24-Hour Maximum	150	150	150	8 ^c	30 ^c	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 ^d	235	235	235	NA	NA	NA
Lead	Calendar Quarter Arithmetic Mean	1.5	1.5	15	NA	NA	NA

Note: Particulate matter (TSP) = total suspended particulate matter.

Particulate matter (PM10) = 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.

^b Maximum concentrations are not to be exceeded.

^c Final regulations were promulgated in the Federal Register, 58 FR 31622, June 3, 1993, and become effective the earlier of 1 year after the promulgation date or the date adopted by state regulation.

^d 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 CFR 50.

40 CFR 52.21.

Chapter 17-272, F.A.C.

Table 3-2. PSD Significant Emission Rates and *De Minimis* Monitoring Concentrations

Pollutant	Regulated Under	Significant Emission Rate (TPY)	<i>De Minimis</i> Monitoring Concentration ^a ($\mu\text{g}/\text{m}^3$)
Sulfur Dioxide	NAAQS, NSPS	40	13, 24-hour
Particulate Matter [PM(TSP)]	NAAQS, 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
Asbestos	NESHAP	0.007	NM
Beryllium	NESHAP	0.0004	0.001, 24-hour
Mercury	NESHAP	0.1	0.25, 24-hour
Vinyl Chloride	NESHAP	1	15, 24-hour
Benzene	NESHAP	^c	NM
Radionuclides	NESHAP	^c	NM
Inorganic Arsenic	NESHAP	^c	NM

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.

$\mu\text{g}/\text{m}^3$ = 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.

^c Any emission rate of these pollutants.

Sources: 40 CFR 52.21.

Chapter 17-212, F.A.C.

Table 3-3. Net Increase in Emissions Due To the Proposed Hardee Unit 3 Power Plant Compared to the PSD Significant Emission Rates

Pollutant	Emissions (TPY)		
	Potential Emissions From Proposed Facility ^a	Significant Emission Rate	PSD Review
Sulfur Dioxide	175	40	Yes
Particulate Matter [PM(TSP)]	145	25	Yes
Particulate Matter (PM10)	145	15	Yes
Nitrogen Dioxide	1,205	40	Yes
Carbon Monoxide	794	100	Yes
Volatile Organic Compounds	98.7	40	Yes
Lead	0.16	0.6	No
Sulfuric Acid Mist	38.0	7	Yes
Total Fluorides	0.090	3	No
Total Reduced Sulfur	NEG	10	No
Reduced Sulfur Compounds	NEG	10	No
Hydrogen Sulfide	NEG	10	No
Asbestos	NEG	0.007	No
Beryllium	0.0069	0.0004	Yes
Mercury	0.025	0.1	No
Vinyl Chloride	NEG	1	No
Benzene	NEG	0	No
Radionuclides	NEG	0	No
Inorganic Arsenic	0.014	0	Yes

Note: NEG = Negligible.

^a Based on emissions from two combustion turbine units operating at baseload conditions at 59°F and firing natural gas and distillate fuel oil for 7,260 and 1,500 hours, respectively. For most pollutants, slightly higher annual emissions are calculated when natural gas combustion includes 2,000 hours of power augmentation at 80°F.

Table 3-4. Predicted Net Increase in Impacts Due To the Proposed Hardee Unit 3 Facility
Compared to PSD *De Minimis* Monitoring Concentrations

Pollutant	Concentration ($\mu\text{g}/\text{m}^3$)	
	Predicted Net Increase in Impacts ^a	<i>De Minimis</i> Monitoring Concentration
Sulfur Dioxide	27.8	13, 24-hour
Particulate Matter (TSP)	21.5	10, 24-hour
Particulate Matter (PM10)	21.5	10, 24-hour
Nitrogen Dioxide	0.59	14, annual
Carbon Monoxide	115 ^b	575, 8-hour
Volatile Organic Compounds	98.7 TPY	100 TPY
Sulfuric Acid Mist	NA	NM
Beryllium	0.0014	0.001, 24-hour
Arsenic	NA	NE

Note: NA = not applicable.
NE = no monitoring method established.
NM = no ambient measurement method.
TPY = tons per year.

^a See Section 7.1 for air dispersion modeling results.

^b During power augmentation, the maximum predicted 8-hour concentration is $168 \mu\text{g}/\text{m}^3$.

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, SO₂, CO, VOC, PM/PM10, Be, inorganic As, and sulfuric acid mist (see Section 3.0). The maximum potential annual emissions of these pollutants from the proposed Hardee Unit 3 plant are (see Table 2-7):

<u>Pollutant</u>	Emissions (TPY)
	<u>440 MW</u>
NO _x	1,205
SO ₂	175
CO	794
VOC	98.7
PM/PM10	145
Beryllium	0.0069
Inorganic As	0.014
Sulfuric acid mist	38.0

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 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); and Chapter 17-212.200(16), and Chapter 17-214.410, F.A.C.]. The analysis must, by definition, be specific to the project (i.e., case-by-case).

4.2 NEW SOURCE PERFORMANCE STANDARDS

The applicable NSPS for CTs are codified in 40 CFR 60, Subpart GG and summarized in Attachment 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 oxygen. For the CTs being considered for the project, the NSPS emission limit NO_x with the NSPS heat rate correction is 98.8 parts per million

(ppm) on oil and 105.8 ppm on gas (corrected to 15 percent oxygen at a fuel-bound nitrogen content of 0.015 percent). More information on the NSPS is presented in Attachment B. The proposed NO_x emission limits for the project will be much lower than the NSPS.

4.3 BEST AVAILABLE CONTROL TECHNOLOGY

In recent permitting actions, FDEP has established BACT for heavy-duty industrial gas turbines. These decisions have included the use of advanced dry low-NO_x combustors for limiting NO_x and CO emissions and clean fuels (natural gas and distillate oil) for control of other emissions, including SO₂. The BACT proposed for the Hardee Unit 3 project is consistent with these FDEP permits. The proposed project will have three modes of operation (see Section 2.3) for which a BACT analysis has been performed. The results of the analysis have concluded the following controls as BACT for the project.

1. Natural Gas Fired. Hardee Unit 3 will utilize state-of-the-art dry low-NO_x combustion technology which will achieve gas turbine exhaust NO_x levels of no greater than 15 ppmvd corrected to 15 percent O₂ and ISO conditions. CO emissions will be limited to 20 ppmvd at base load.
2. Fuel Oil Fired. Hardee Unit 3 will utilize water injection to achieve gas turbine exhaust NO_x levels of no greater than 42 ppmvd corrected to 15 percent O₂ and ISO conditions. CO emissions will be limited to 25 ppmvd at base load.
3. Natural Gas Fired - Power Augmentation. Hardee Unit 3 will utilize state-of-the-art dry low-NO_x combustion technology during power augmentation mode to reduce NO_x emissions to no greater than 25 ppmvd corrected to 15 percent O₂ and ISO conditions. CO emissions will be limited to 50 ppmvd.

4.3.1 NITROGEN OXIDES

The BACT analysis was performed for the following alternatives:

1. Advanced dry low-NO_x combustors at an emission rate of 15 ppmvd corrected to 15 percent O₂ when firing gas (25 ppmvd during power augmentation) and 42 ppmvd (corrected) when firing oil.
2. Selective catalytic reduction (SCR) and advanced dry low-NO_x combustors at an emission rate of approximately 9 ppmvd corrected to 15 percent O₂ when firing natural gas and 15 ppmvd when firing oil.

Attachment B presents a discussion of NO_x control technologies and their feasibility for the project.

Dry low-NO_x combustor technology has recently 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 as low as 15 ppmvd (corrected to 15-percent O₂) has been offered by manufacturers for advanced combustion turbines. Advanced in this context is the larger (over 150 MW) and more efficient (higher initial firing temperatures and lower heat rate) combustion turbines. This technology is truly pollution prevention since NO_x emissions are inhibited from forming.

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. The reaction occurs typically between 600°F and 750°F, which limits SCR application to combined cycle units where such temperatures occur in the HRSG. Exhausts from simple cycle operation are in the range of 1,000°F, thus limiting SCR application for this mode of operation. SCR has been installed and operated on combined cycle facilities generally achieving 9 ppmvd (corrected to 15-percent O₂) while burning natural gas.

Applications of SCR with oil firing are limited. Where oil firing has been attempted, catalyst poisoning and ammonium salt formation has occurred. 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 that does not react with NO_x is emitted directly and referred to as ammonia slip. In general, SCR manufacturers guarantee ammonia slip to be no more than 10 ppmvd; however, permitted limits in some applications have exceeded 25 ppmvd. While SCR is technically feasible for the project, SCR has not been applied to an advanced combustion turbine of the size proposed for this project or to the amount of oil firing that may occur.

The recent permitting trend for advanced combustion turbines is the use of dry low-NO_x combustors. Indeed, all of the recent projects have been permitted with this technology, including 3 projects in Florida (Florida Power & Light Martin Units 3 and 4; Florida Power Corporation

Polk Power Park; and Central Florida Cogeneration Project) and one in Maryland (Baltimore Gas & Electric Perryman Project).

As discussed in Section 2.1, the CT will be fired primarily with natural gas. Distillate oil will be used as backup fuel not to exceed 1,500 hours per year. Table 4-1 presents a summary of emissions with dry low-NO_x combustors and with dry low-NO_x combustors and SCR assuming 100 percent operating capacity at an ambient temperature of 59°F (except 80°F when firing natural gas for power augmentation). The NO_x removed using SCR would be 300 TPY when firing oil and 356 TPY when firing natural gas. The NO_x removed when firing oil is based on 1,500 hours per year and the difference between 466 TPY at 42 ppmvd and 166 TPY at 15 ppmvd. The NO_x removed when firing natural gas is based on 7,260 hours of operation: 2,000 hours of operation for power augmentation and the difference between 251 TPY at 25 ppmvd and 90 TPY at 9 ppmvd; and 5,260 hours of normal operation and the difference between 488 TPY at 15 ppmvd and 293 TPY at 9 ppmvd.

4.3.1.1 Proposed BACT and Rationale

The proposed BACT for the project is advanced dry low-NO_x combustion technology. The proposed NO_x emissions level using this technology is 15 ppmvd (corrected to 15 percent oxygen and ISO conditions) when firing natural gas under base load conditions and 25 ppmvd during power augmentation. NO_x from oil firing will be controlled using water injection. This combination of control technologies is proposed for the following reasons:

1. SCR was rejected based on technical, economic, environmental, and energy grounds. Table 4-2 summarizes these considerations which overwhelmingly favor the dry low-NO_x pollution prevention technology.
2. The estimated incremental cost of SCR is about \$6,802 per ton of NO_x removed. These costs are in the range for other projects that have rejected SCR as unreasonable. This is even more apparent if additional pollutant emissions due to SCR are considered. The cost effectiveness is more than \$15,000 per ton of pollutant removed when the net emissions of all pollutants (exclusive of CO₂) are considered.
3. Additional environmental impacts would result from SCR operation, including emissions of ammonia; from secondary emissions (to replace the lost generation); and from the generation of hazardous waste (i.e., spent catalyst replacement). While NO_x

emissions would be reduced by about 656 TPY with SCR, the net emissions reduction would not be as great. There are three additional factors that must be considered:

- a. Ammonia slip would occur, and it may be as high as 193 TPY.
 - b. Additional particulate matter may be formed through the reaction of ammonia and sulfur oxides forming ammonium salts. As much as 51 TPY additional particulate matter may be formed.
 - c. SCR will require energy for system operation and reduce the efficiency of the combustion turbine. This lost energy would have to be replaced since the proposed project would be an efficient baseload plant while operating. Any power plants replacing this lost energy would be lower on the dispatch list and inevitably more polluting. Conservatively, this lost energy would result in the emissions of an additional 135 TPY of criteria pollutants. Additional emissions of carbon dioxide would also result.
4. The energy impacts of SCR will reduce potential electrical power generation by more than 15 million kilowatt hours (kWh) per year. This amount of energy is sufficient to provide the annual electrical needs of 1,250 residential customers.
 5. The proposed BACT (i.e., dry low-NO_x combustion) provides the most cost effective control alternative, is pollution preventing and results in low environmental impacts (less than the significant impact levels). Dry low-NO_x combustion at the proposed emissions levels has been adopted previously in BACT determinations. Indeed, compared to conventional CTs, the proposed BACT will result in 10 percent less NO_x emission from the same amount of generation.

The analyses of economic, environmental, and energy impacts follow.

4.3.1.2 Impacts Analysis

Economic—The total capital costs of SCR for the proposed Hardee Unit 3 plant are \$8,647,400.

The total annualized cost of applying SCR with dry low-NO_x combustion is \$4,462,200.

Attachment B contains the detailed cost estimates for the capital and annualized costs. The incremental cost effectiveness of adding SCR to the dry low-NO_x combustors and water injection (for oil firing) is estimated to be \$6,802/ton of NO_x removed assuming maximum operation on oil (i.e., 1,500 hours) and on natural gas (i.e., 7,260 hours), which includes power augmentation (i.e., 2,000 hours).

This cost effectiveness accounts only for the reduction of NO_x with SCR use and not the potential emissions on ammonia or other criteria pollutants that may result. The net cost effectiveness will be much higher. Indeed, it could be more than \$15,000/ton of ammonia and criteria pollutants removed (see Table 4-3; \$4,462,200 divided by the net reduction of 276 TPY).

The cost effectiveness of \$6,802 per ton of NO_x removed is conservatively estimated by assuming that the proposed project would run at full load all year at the maximum emission rates. Such a condition is generally unrealistic but provides a conservative basis for calculating cost effectiveness. In reality, the actual capacity factor will be lower than 100 percent, and fuel oil will only be used as a backup supply. The actual cost effectiveness would likely be in the range of \$9,000 to \$13,000 per ton of NO_x removed. Presented below is the calculated cost effectiveness for a range of operating scenarios (i.e., capacity factor and fuel oil usage).

Cost Effectiveness (per ton NO _x removed)	Total Capacity Factor (%)	Fuel Operation ^a (hours per year)
\$9,108	100	500 oil; 2,000 P.A.; 6,260 gas
\$9,732	70	1,000 oil; 1,600 P.A.; 3,532 gas
\$12,906	70	350 oil; 1,400 P.A.; 4,382 gas

^a P.A. refers to firing natural gas during power augmentation.

As noted from this analysis, the application of SCR is economically unreasonable and should be rejected as BACT.

Environmental—The maximum predicted NO_x impacts using the dry low-NO_x technology are all considerably below the PSD Class II increment for NO_x of 25 µg/m³, annual average, and the AAQS for NO_x, 100 µg/m³. Indeed, the maximum annual impact is 0.59 µg/m³, which is 60 percent of the significant impact level. While additional controls beyond dry low-NO_x combustors (i.e., SCR and SCR with water injection) would reduce predicted impacts, the effect will not be significant and much less than 1 percent of the PSD increment and the AAQS for the project.

The use of dry low-NO_x combustor technology is truly "pollution prevention". In contrast, use of SCR on the proposed Hardee Unit 3 project will cause emissions of ammonia and ammonium salts, such as ammonium sulfate and bisulfate. Ammonia emissions associated with SCR are

expected to be up to 10 ppm based on reported experience; previous permit conditions have specified this level. Indeed, ammonia emissions could be as high as 193 TPY for the Hardee Unit 3 project. Potential emissions of ammonium sulfate and bisulfate will increase emissions of PM10; up to 51.2 TPY could be emitted.

The electrical energy required to run the SCR system and the back pressure from the turbine will reduce the available power from the project. This 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 air pollutant emissions that would not have occurred without SCR. These "secondary" emissions, coupled with potential emissions of ammonia and ammonium salts, are presented in Table 4-3. This table shows the emissions balance for the project with and without SCR. As shown, the net reduction in emissions with SCR when all criteria pollutants are considered will be 276 TPY. In addition to criteria pollutants, additional secondary emissions of carbon dioxide would be emitted and were included in Table 4-1. As noted from this table, the emissions including CO₂ would be greater with SCR than that proposed using dry low-NO_x combustion technology.

The replacement of the SCR catalyst will create additional economic and environmental impacts since certain catalysts contain materials that are listed as hazardous chemical wastes under Resource Conservation and Recovery Act (RCRA) regulations (40 CFR 261). In addition, SCR will require the construction and maintenance of storage vessels of anhydrous or aqueous ammonia for use in the reaction. Ammonia has a number of 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.

At elevated temperatures, ammonia may contribute to instability and cause containers to burst (ammonia will auto-ignite at a temperature of approximately 100°F). It is incompatible with strong oxidizers, calcium, hypochlorite bleaches, gold, mercury, halogens, and silver. Liquid ammonia will corrode some forms of plastic, rubber, and coatings. Ammonia is a severe irritant of the eyes, especially the cornea, the respiratory tract, and the skin. It is detectable at about 5 ppm and causes respiratory irritation in humans above 25 ppm. The irritating effects of ammonia are less noticeable with chronic exposure.

As a strong alkali, ammonia can cause severe burns of the cornea and the effects are often delayed. Even burns that at the time of injury appear to be mild can go on to opacification, vascularization, and ulceration or perforation. Of all the alkali compounds that cause eye damage, ammonia penetrates the cornea the most rapidly, resulting in potentially severe damage to the cornea. Because ammonia is very soluble in water, it is irritating to the upper respiratory tract. Inhalation of the gas will cause throat and nose irritation and dyspnea as aqueous ammonia is formed. Liquid anhydrous ammonia will cause first and second degree burns on contact with the skin.

Energy--Significant energy penalties occur with SCR. With SCR, the output of the CT may be reduced by about 0.50 percent over that of advanced low-NO_x combustors. This penalty is the result of the SCR pressure drop, which would be about 4 inches of water and would amount to about 13,691,880 kWh/yr in potential lost generation. The energy required by the SCR equipment would be about 1,401,600 kWh/yr. Taken together, the total lost generation and energy requirements of SCR of 15,093,480 kWh/yr could supply the annual electrical needs of about 1,250 residential customers. To replace this lost energy, an additional 15×10^{10} British thermal units per year (Btu/yr) or about 150 million cubic feet per year (ft³/yr) of natural gas would be required.

Technology Comparison--The Hardee Unit 3 project will use an advanced heavy-duty industrial gas turbine with advanced dry low-NO_x 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 is dry low-NO_x combustors that prevent the formation of air pollutants within the combustion process, thereby eliminating the need for add-on controls that can have detrimental effects 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 of 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 selected Westinghouse advanced machine is about 150 MW, compared to conventional machines, which range from about 70 MW to 120 MW. The higher initial firing temperature (i.e., 2,350°F) results in about 10 percent more electrical

energy produced for the same amount of fossil fuel used in conventional machines, which have firing temperatures of about 2,000°F. This has the added advantage of producing lower 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 dry low-NO_x combustors that will reduce NO_x emissions to 15 ppmvd when firing natural gas. Thermal NO_x formation is inhibited by using staged combustion techniques where the natural gas and combustion air are premixed prior to ignition. This level of control has not been achieved previously in an advanced CT and will result in NO_x emissions of less than 0.1 lb/10⁶ Btu, which is more than two times lower than emissions from conventional fossil fuel-fired steam generators.

Since the purpose of the project is to produce electrical energy, and CT technology is rapidly advancing, it is appropriate to compare the proposed emissions on an equivalent generation basis to that of a conventional CT. The heat rate of the advanced CT will be about 9,900 Btu/kWh or better. In contrast, the heat rate for the conventional CT is about 11,000 Btu/kWh. Therefore, the amount of total NO_x from the advanced CT will be 10-percent lower than that of a conventional turbine for the same amount of generation.

Also, the amount of NO_x control achieved by the dry low-NO_x combustor on an advanced CT is considerably higher than that achieved by a conventional CT. Because of the higher firing initial temperatures, the advanced CT results in greater NO_x emission formation. This is illustrated in Table 4-4. Since the advanced machine has higher firing temperatures, the NO_x emissions without the use of dry low-NO_x combustion technology are much higher than a conventional CT (179 ppmvd vs. 150 ppmvd). This results in an overall greater NO_x reduction on the advanced CT [e.g., 92-percent reduction for gas (179-15)/179 for the advanced CT versus 90 percent for the conventional CT (150-15)/150].

4.3.2 CARBON MONOXIDE

Emissions of CO are dependent upon the combustion 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 (i.e., for oil firing). The CTs proposed for the project have designs to optimize combustion efficiency and minimize CO as well as NO_x emissions.

For the project, the following alternatives were evaluated as BACT:

1. Combustion controls at 20 ppmvd when firing natural gas (50 ppmvd during power augmentation) and 25 ppmvd when firing oil; maximum annual CO emissions are 794 TPY; and
2. Oxidation catalyst at 10 ppmvd; maximum annual CO emissions are 290 TPY.

Combined cycle facilities with an oxidation catalyst and combustion controls generally have controlled CO levels of 10 ppm or less as LAER.

4.3.2.1 Proposed BACT and Rationale

Combustion design is proposed as BACT as a result of the technical and economic consequences of using catalytic oxidation on CTs. The proposed BACT emission rates for CO will not exceed 20 ppmvd when firing natural gas and 25 ppmvd when firing distillate oil. CO emissions during power augmentation would not exceed 50 ppmvd. Catalytic oxidation is considered unreasonable for the following reasons:

1. Catalytic oxidation will not produce measurable reduction in the air quality impacts; and
2. The economic impacts are significant (i.e., an annualized cost of about \$2 million, with a cost effectiveness of approximately \$4,000/ton of CO removed).

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 lower CO emissions substantially and will not produce a measurable reduction in the air quality impacts. Indeed, recent BACT decisions for similar advanced CTs have set limits in the 30 ppmvd range and higher. Even the Northeast States for Coordinated Air Use Management (NESCAUM) has recognized a BACT level of 50 ppmvd for CO emissions. The cost of an oxidation catalyst would be significant and not cost effective given the maximum proposed emission limits of 20 ppmvd for the CT when firing gas, 25 ppmvd when firing distillate oil, and 50 ppmvd when firing gas during power augmentation.

4.3.2.2 Impact Analysis

Economic--The estimated annualized cost of a CO oxidation catalyst is \$2,005,120, resulting in a cost effectiveness of approximately \$4,000/ton of CO removed. The cost effectiveness is based on 7,260 hours/year on natural gas (including 2,000 hours/year operation with power augmentation) and 1,500 hours/year of operation on oil, with the maximum emissions controlled to 10 ppmvd. No costs are associated with combustion techniques since they are inherent in the design. The cost effectiveness is a conservatively low estimate that assumes the proposed unit would run at full load all year. The cost effectiveness will be higher based on the proposed unit's actual capacity factor of 70 percent.

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. Indeed, additional particulate and secondary emissions as a result of an oxidation catalyst would be about 60 TPY. The particulate would result from the conversion of SO₂ to sulfates, and the secondary emissions would result from the heat rate reduction. Moreover, the air quality impacts at the proposed CT emission rate are predicted to be much less than the PSD significant impact levels.

Energy--An energy penalty would result from the pressure drop across the catalyst bed. A pressure drop of about 2 inches water gauge would be expected. At a catalyst back pressure of about 2 inches, an energy penalty of about 5,476,752 kWh/yr would result at 100 percent load. This energy penalty is sufficient to supply the electrical needs of about 460 residential customers for a year. To replace this lost energy, about 5.5×10^{10} Btu/yr or about 55 million ft³/yr of natural gas would be required.

4.3.3 SULFUR OXIDES

Emissions of sulfur oxides (SO₂ and potentially H₂SO₄ mist) are a result of the oxidation of sulfur in fossil fuel and can be minimized by reducing the sulfur content in fuel or through applying post-combustion removal techniques. For CTs, the use of low sulfur fuels is the only demonstrated control technology determined to be technically feasible. Post-combustion techniques, such as flue gas desulfurization (FGD), have not been applied to CTs.

FGD systems have been applied to oil- and coal-fired steam electric power plants. However, the relative gas volume for such facilities is significantly less than that for CTs (i.e., about 2 to 3 times), and the resultant SO₂ concentration is considerably higher. While the former factor will influence the cost of FGD, the latter poses significant technological constraints to removing SO₂. As a result, FGD is not feasible for application to CTs.

The BACT/LAER clearinghouse documents show that fuel sulfur contents from 0.8 percent to less than 0.1 percent have been specified as BACT for CTs. The lowest sulfur-containing fuels were required in California and the Northeastern United States, where LAER decisions dictated more stringent standards. Furthermore, such requirements generally limited fuel oil use for backup or emergency purposes only.

In Florida, BACT determinations for CTs have restricted sulfur content in oil from a maximum of 0.5 percent to 0.05 percent. Recent cogeneration facilities and power plants have been permitted using 0.1 percent sulfur fuel oil or less.

For the proposed CT, the only technically feasible control technology for SO₂ and H₂SO₄ is natural gas and low sulfur fuel oil use. The use of natural gas will minimize sulfur oxides emissions. Sulfur oxides emissions from distillate fuel oil can be minimized by specification of a lower sulfur content fuel. The use of natural gas and distillate oil with a maximum sulfur content of 0.05 percent was selected as the top-down BACT level since it is the lowest sulfur content being permitted by FDEP or being recognized in other states as BACT.

4.3.4 VOLATILE ORGANIC COMPOUNDS

VOCs will be emitted by the CT and are a result of incomplete combustion. The proposed BACT for VOC emissions will be the use of combustion technology and the use of clean fuels so that emissions will not exceed 5.0 ppmvd when firing natural gas and 10 ppmvd when firing distillate oil. These emission levels are 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.

4.3.5 PM/PM10 AND OTHER REGULATED AND NONREGULATED POLLUTANT EMISSIONS

The emission of particulates from the CT is a result of incomplete combustion and trace elements in the fuel. Beryllium and inorganic As would be included in the PM/PM10 emissions. 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- or oil-fired CTs.

The maximum particulate emissions from the CT will be lower in concentration than that normally specified for fabric filter designs {i.e., the grain loading associated with the maximum particulate emissions [about 6 pounds per hour (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 these pollutants from CTs, other than the inherent quality of the fuel. Clean fuels, natural gas and distillate oil represent BACT for these pollutants.

For the nonregulated pollutants, none of the control technologies evaluated for other pollutants (i.e., SCR) would reduce such emissions; thus, natural gas and distillate oil represent BACT because of their inherently low contaminant content.

Table 4-1. NO_x Emission Estimates (TPY) of BACT Alternative Technologies

Alternative BACT Control Technologies	Operating Mode ^a			Total
	Oil	Gas	Gas/PA	
<u>NO_x Emission (TPY)</u>				
Dry Low-NO _x (DLN) only	466	488	251	1,205
DLN with SCR ^b	166	293	90	549
Reduction	(300)	(195)	(161)	(656)
<u>Basis of Emissions (ppmvd)</u>				
DLN only	42	15	25	
DLN with SCR	15	9	9	
Hours of Operation	1,500	5,260	2,000	8,760

Note: Gas/PA = gas with power augmentation.

DLN = Dry low-NO_x.

SCR = selective catalytic reduction.

TPY = tons per year.

^a Emission rates are based on two combustion turbines operating at 100-percent capacity and firing fuel oil for 1,500 hours and natural gas for 7,260 hours, which includes 2,000 hours of power augmentation. Emission data are based on an ambient temperature of 59°F, except for power augmentation (80°F is assumed).

^b Based on primary emissions with SCR; no account is made for additional emissions (secondary) due to lost energy from heat rate penalty and electrical usage for SCR operation (see Table 4-3).

Table 4-2. Comparison of Alternative BACT Control Technologies for NO_x

	Alternative BACT Control Technologies	
	DLN Only	SCR
Technical Feasibility	Feasible	Feasible for gas Not demonstrated for oil
Economic Impact ^a		
Capital Costs	included	\$8,647,400
Annualized Costs	included	\$4,462,200
Cost Effectiveness		
Best Case	NA	\$6,802
Expected	NA	\$12,906 ^c
Environmental Impact ^b		
Total NO _x (TPY)	1,205	549
NO _x Reduction (TPY)	NA	(656)
Ammonia Emissions (TPY)	0	193
PM Emissions (TPY)	0	51
Secondary Emissions (TPY)	0	135
Net Emission Reduction (TPY)	NA	(276)
Energy Impacts ^d		
Energy Use (kWh/yr)	0	15,093,480
Energy Use (mmBtu/yr) at 10,000 Btu/kWh	0	150,000
Energy Use (mmcf/yr) at 1,000 Btu/cf for natural gas	0	150

^a See Attachment B for detailed development of capital costs (including recurring costs) and annualized costs.

^b See emission data presented in Tables 4-1 and 4-3.

^c Based on annual capacity factor of 70 percent and assuming firing fuel oil for 350 hours and natural gas for 5,782 hours, which includes 1,400 hours for power augmentation.

^d 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 is based on 0.5 percent of 156.3 MW per CT or 13,691,880 kWh/hr for 2 CTs. SCR electrical usage is based on 0.080 MWh per SCR system or 1,401,600 kWh/yr for 2 SCR systems.

Table 4-3. Maximum Potential Incremental Emissions (TPY) With Selective Catalytic Reduction

Pollutants	Incremental Emissions (TPY) of Project With SCR		Total
	Primary	Secondary ^a	
Particulate	51.2 ^b	7.5	58.7
Sulfur Dioxide	--	83.0	83.0
Nitrogen Oxides	(656) ^c	41.5	(614)
Carbon Monoxide	--	2.5	2.5
Volatile Organic Compounds	--	0.4	0.4
Ammonia	193 ^d	0.0	193
Total	783.1	135	(276)
Carbon Dioxide ^e	--	12,959	12,959

Note: Btu/kWh = British thermal units per kilowatt-hour.

CT = combustion turbine.

MW = megawatt.

% = percent.

SCR = selective catalytic reduction.

TPY = tons per year.

-- = no differences in the project's emissions with SCR and without SCR.

^a Lost energy from heat rate penalty and electrical usage for 8,760 hours per year operation (0.5% of 156.3 MW per CT plus 0.080 MWh per SCR system). Assumes baseloaded oil-fired unit would replace lost energy. EPA emission factors used for 1% sulfur fuel oil and an assumed heat rate of 10,000 Btu/kWh. Emission factors use were (lb/10⁶ Btu): PM = 0.1; SO₂ = 1.1; NO_x = 0.55, CO = 0.033 and VOC = 0.005. Example calculation for PM - 1.723 MW x 10,000 Btu/kwh x 1,000 kW/MW x 8,760 hr/yr x 0.1 lb pm/10⁶ Btu ÷ 2,000 lb/ton = 7.5 TPY.

^b Assume SO₃ reacts with ammonia; 38 TPY SO₃ x 132 (MW of ammonia salt) ÷ 98 (MW of H₂SO₄).

^c Based on the difference between the project's emissions with SCR (549 TPY) and without SCR (1,205 TPY) (See Table 4-1).

^d 10 ppm ammonia slip (ideal gas law): 1,023,458 acfm x 10 ppm ÷ 10⁶ x 17 x 2,116.8 ÷ 1,545 ÷ (460 + 190) x 60 x 8,760 ÷ 2,000 x 2.

^e Reflects differential emissions due to lost energy efficiency with SCR (i.e., calculated from total heat input lost; 1.723 MW times 10,000 Btu/kWh; CO₂ calculated based on 85.7% carbon in fuel oil and 18,300 Btu/lb for 1% sulfur oil).

Table 4-4. NO_x Emissions Comparison of Conventional and Advanced Combustion Turbines

	Fuel	Units	NO _x Emissions	
			Conventional	Advanced
Emissions Without Dry Low-NO _x Technology	Gas	ppmvd	150	179
	Oil	ppmvd	245	276
Emissions With Dry Low-NO _x Technology	Gas	ppmvd	15	15
	Oil	ppmvd	42	42
Reduction with Dry Low-NO _x Technology	Gas	ppmvd	135	164
		%	90	92
	Oil	ppmvd	203	234
		%	83	85

5.0 PRECONSTRUCTION AIR QUALITY MONITORING ANALYSIS

5.1 OVERVIEW OF PRECONSTRUCTION MONITORING REQUIREMENTS

The CAA requires that an air quality analysis be conducted for each criteria and noncriteria pollutant subject to regulation under the act before a major stationary source is constructed. Criteria pollutants are those pollutants for which AAQS have been established. Noncriteria pollutants are those pollutants that may be regulated by emission standards, but no AAQS have been established. This analysis may be performed by the use of modeling and/or by monitoring the air quality. The use of monitoring data refers to either (1) using representative air quality data from existing monitoring stations, or (2) establishing a monitoring network to monitor existing air quality. Monitoring must be conducted for a period of up to 1 year prior to submission of a construction permit application.

For criteria pollutants, continuous air quality monitoring data must be used to establish existing air quality concentrations in the vicinity of the proposed source. However, preconstruction monitoring data generally will not be required if the ambient air quality concentrations before construction are less than *de minimis* impact monitoring concentrations (refer to Table 3-2 for *de minimis* impact levels) or if the maximum predicted impacts of the proposed source are less than the *de minimis* impact monitoring requirements.

In general, EPA recommends that an analysis for noncriteria pollutants be based on air quality modeling instead of monitoring data. However, if the maximum concentrations from the proposed source are predicted to be above the *de minimis* monitoring levels, EPA recommends that an EPA-approved measurement method be available before a permit-granting authority requires preconstruction monitoring.

5.2 EXISTING AIR MONITORING DATA

FDEP operates a statewide ambient air monitoring network with monitoring stations nearest to the project site located in Polk County. The network in Polk County consists of several monitoring stations that measure SO₂ and O₃ concentrations. Ambient SO₂ concentrations are measured at monitoring stations located in Mulberry, approximately 28 km (17 miles) from the project site, and in Nichols, located approximately 24 km (15 miles) from the project site. Ambient O₃

concentrations are measured at two monitoring stations, both located in Lakeland, approximately 33 km (21 miles) and 43 km (27 miles) from the project site.

Over the last several years, ambient data have been collected in the vicinity of the site by Tampa Electric Company and Florida Power Corporation (FPC). A 1-year program was conducted by Tampa Electric Company at two sites located approximately 10 km (6 miles) to the north of the project site. Ambient SO₂, PM10, and O₃ concentrations were measured from April 1991 through March 1992. A 1-year program was conducted by FPC at one site located approximately 23 km (14 miles) to the northeast of the project site. Ambient SO₂, PM10, and O₃ concentrations were measured from October 1991 through October 1992.

Summaries of observed SO₂, PM10, and O₃ concentrations measured at these stations from 1990 through 1992 are given in Tables 5-1 through 5-3.

The SO₂, PM10, and O₃ concentrations observed at these stations are within national and state AAQS. Because these monitors are located in more developed areas and/or in proximity [i.e., within 10 km (6.2 miles)] of major sources, the observed concentrations are considered to be higher than those expected to occur at the proposed facility site.

Given the rural nature of the site, existing concentrations of other criteria pollutants, i.e., CO, NO₂, and lead (Pb), which are usually associated with an urban environment, should be well below the AAQS.

5.3 PROJECT MONITORING APPLICABILITY

As determined by the source applicability analysis described in Section 3.4, an ambient monitoring analysis is required by PSD regulations for SO₂, PM(TSP), PM10, NO₂, CO, O₃, H₂SO₄ mist, Be, and As. Monitoring analyses for these pollutants are required because the proposed plant's maximum emissions are expected to be greater than the PSD significant emission rates (see Table 3-3). The maximum net increase in pollutant concentrations predicted for the project compared to the PSD *de minimis* monitoring concentrations are presented in Table 5-4. For VOCs, the maximum emissions are less than the *de minimis* monitoring emission rate of 100 TPY. Sulfuric acid mist and As may be exempt from monitoring requirements because no acceptable monitoring techniques have been established by the agencies for those pollutants.

Except for SO₂, PM(TSP), PM10, and Be concentrations, the maximum predicted impacts for the other pollutants (i.e., NO₂ and CO) emitted from the proposed facility are less than the applicable *de minimis* monitoring levels. Therefore, preconstruction monitoring is not required for NO₂ and CO for this project.

For SO₂, PM(TSP), and PM10 concentrations, monitoring data collected by FDEP, TECO, and FPC have been determined by FDEP to be adequate in order to satisfy the preconstruction monitoring requirements [PM10 data would satisfy the PM(TSP) data requirements]. These data, which were submitted to and approved by FDEP, meet the PSD monitoring guidelines for data collection and PSD preconstruction monitoring guidelines.

Summaries of the maximum SO₂ and PM10 concentrations measured by FDEP, TECO, and FPC are presented in Table 5-1 and Table 5-2, respectively. These monitoring data show that the ambient air quality measured near the proposed project site is well below national and state AAQS.

Based on the most recent data collected, the highest SO₂ concentrations have been measured at the FDEP monitoring stations in Mulberry and Nichols. In 1992, the highest 3-hour, 24-hour, and annual average concentrations were 256 µg/m³ (Mulberry), 50 µg/m³ (Nichols), and 11 µg/m³ (Nichols), respectively. These concentrations are less than 20 percent of the national and state AAQS.

The highest PM10 concentrations have been measured at the FPC monitoring stations in Homeland. During the monitoring program, the highest 24-hour and annual average concentrations were 70 µg/m³ and 20 µg/m³, respectively. These concentrations are less than 50 percent of the national and state AAQS.

Because there has been minimal commercial or industrial development near the project site, these measured values are considered to represent existing air quality. Therefore, submittal of these data fulfills the PSD preconstruction monitoring requirement for SO₂ and PM10 concentrations.

The maximum Be concentrations are predicted to be greater than the *de minimis* monitoring concentration for 50-percent operating load. For baseload operation, the maximum predicted

concentrations are less than the *de minimis* concentration. Although the maximum concentrations are predicted to be slightly greater than the *de minimis* levels, the maximum concentrations are less than the NTLs (see Section 7.0). Therefore, preconstruction monitoring is not warranted for this project.

Table 5-1. Ambient SO₂ Concentrations for Air Monitoring Stations Located Within 55 km of the Hardee Unit 3 Project--1990 to 1992

Location		Site Number	UTM Coordinates (km) ^a		Period		Number of Observations	Concentration (µg/m ³)				
			East	North				3-Hour		24-Hour		Annual
City	County				Year	Months		1st	2nd	1st	2nd	
Mulberry	Polk	2860-006-F02	405.5	3086.0 (1°; 28.3 km)	1992	January-December	8,655	256	151	39	38	10
					1991	February-December	7,118	203	176	42	40	12
Nichols	Polk	3680-010-F02	399.5	3081.3 (347°; 24.2 km)	1992	January-December	8,205	213	183	50	48	11
					1991	January-December	8,542	179	167	67	58	10
					1990	January-December	8,612	341	252	66	62	9
Lakeland	Polk	2160-004-F02	412.75	3108.5 (9°; 51.4 km)	1991	January-January	252	31	16	7	5	3
					1990	January-December	8,683	122	122	42	27	5
Homeland ^b	Polk	3680-037-J02	418.7	3076.35 (36°; 23.1 km)	1992	January-October	6,040	170	161	42	42	7
					1991	October-December	1,657	72	49	31	29	6
Nichols ^c	Polk	3680-036-J01	400.1	3066.2 (330°; 9.8 km)	1992	January-March	1,920	199	—	42	—	10
					1991	April-December	5,694	202	136	42	40	8

^a Relative location to proposed Hardee Unit 3 east and north UTM coordinates (km) of 405.0 and 3057.7, respectively, given in parentheses.

^b Monitoring station from Florida Power Corporation's Polk County site.

^c Monitoring station from Tampa Electric Company's Polk Power Station site.

Sources: FDEP, 1990, 1991, 1992. KBN, 1994.

Table 5-2. Ambient PM10 Concentrations for Air Monitoring Stations Located Within 55 km of the Hardee Unit 3 Project--1991 to 1992

Location		Site Number	UTM Coordinates (km) ^a		Period		Number of Observations	Concentration ($\mu\text{g}/\text{m}^3$)		
City	County		East	North	Year	Months		24-Hour		Annual
Homeland ^b	Polk	3680-037-J02	418.7	3076.35	1992	January-October	46	70	44	20
			(36°; 23.1 km)		1991	October-December	13	38	24	17
Homeland ^b	Polk	3680-037-J09	418.7	3076.35	1992	January-October	42	60	42	20
			(36°; 23.1 km)							
Nichols ^c	Polk	3680-035-J01	401.1	3067.4	1992	January-March	16	28	20	14
			(338°; 10.5 km)		1991	March-December	26	43	34	18
Nichols ^c	Polk	3680-036-J01	400.1	3066.2	1992	January-March	16	30	26	14
			(330°; 9.8 km)		1991	March-December	30	48	45	19

^a Relative location to proposed Hardee Unit 3 east and north UTM coordinates (km) of 405.0 and 3057.7, respectively, given in parentheses.

^b Monitoring station from Florida Power Corporation's Polk County site.

^c Monitoring station from Tampa Electric Company's Polk Power Station site.

Sources: FDEP, 1990, 1991, 1992. KBN, 1994.

Table 5-3. Ambient O₃ Concentrations for Air Monitoring Stations Located Within 55 km of the Hardee Unit 3 Project--1991 to 1992

Location		Site Number	UTM Coordinates (km) ^a		Period		Number of Observations	Concentration [ppm (μg/m ³)]	
City	County		East	North	Year	Months		1-Hour	
								1st	2nd
Lakeland	Polk	2160-005-G01	401.588	3090.755	1992	June-December	4,678	0.098 (192)	0.082 (161)
			(354°; 33.2 km)						
Lakeland	Polk	2160-006-G01	404.435	3100.652	1992	June-December	4,360	0.108 (212)	0.107 (210)
			(359°; 43.0 km)						
Homeland ^b	Polk	3680-037-J02	418.7	3076.35	1992	January-October	6,525	0.095 (186)	0.095 (186)
			(36°; 23.1 km)		1991	October-December	1,845	0.076 (149)	0.076 (149)
Nichols ^c	Polk	3680-036-J01	400.1	3066.2	1992	January-March	1,911	0.075 (147)	—
			(330°; 9.8 km)		1991	April-December	5,911	0.098 (192)	0.096 (188)

^a Relative location to proposed Hardee Unit 3 east and north UTM coordinates (km) of 405.0 and 3057.7, respectively, given in parentheses.

^b Monitoring station from Florida Power Corporation's Polk County site.

^c Monitoring station from Tampa Electric Company's Polk Power Station site.

Sources: FDEP, 1990, 1991, 1992. KBN, 1994.

Table 5-4. Predicted Net Increase in Impacts Due To the Proposed Hardee Unit 3 Facility
Compared to PSD *De Minimis* Monitoring Concentrations

Pollutant	Concentration ($\mu\text{g}/\text{m}^3$)	
	Predicted Net Increase in Impacts ^a	<i>De Minimis</i> Monitoring Concentration
Sulfur Dioxide	27.8	13, 24-hour
Particulate Matter (TSP)	21.5	10, 24-hour
Particulate Matter (PM10)	21.5	10, 24-hour
Nitrogen Dioxide	0.59	14, annual
Carbon Monoxide	115 ^b	575, 8-hour
Volatile Organic Compounds	98.7 TPY	100 TPY
Sulfuric Acid Mist	NA	NM
Beryllium	0.0014	0.001, 24-hour
Arsenic	NA	NE

Note: NA = not applicable.
NE = no monitoring method established.
NM = no ambient measurement method.
TPY = tons per year.

^a See Section 7.1 for air dispersion modeling results.

^b During power augmentation, the maximum predicted 8-hour concentration is 168 $\mu\text{g}/\text{m}^3$.

6.0 AIR QUALITY IMPACT ANALYSIS

6.1 ANALYSIS APPROACH AND ASSUMPTIONS

6.1.1 GENERAL MODELING APPROACH

The general modeling approach follows EPA and FDEP air modeling guidelines. The highest predicted concentrations are compared with both PSD significant impact levels and *de minimis* monitoring levels. If a proposed facility exceeds the significant impact level for a particular pollutant, current policies stipulate that the highest annual average and HSH short-term (i.e., 24 hours or less) concentrations must be compared with AAQS and PSD increments when 5 years of meteorological data are used. The HSH concentration is calculated for a receptor field by:

1. Eliminating the highest concentration predicted at each receptor
2. Identifying the second-highest concentration at each receptor
3. Selecting the highest concentration among these second-highest concentrations

This approach is consistent with the development of AAQS, which permit a short-term average concentration to be exceeded once per year at each receptor.

To develop the maximum short-term concentrations for the facility, the general modeling approach is divided into screening and refined phases to reduce the computation time required to perform the modeling analysis. The only difference between the two phases is the receptor grid used when predicting concentrations.

Concentrations for the screening phase were predicted using a coarse receptor grid and a 5-year meteorological record. After a final list of maximum annual and short-term average concentrations was developed, the refined phase of the analysis was conducted by predicting concentrations for a refined receptor grid centered on the receptor at which the HSH concentration from the screening phase was produced. Next, the air dispersion model was executed for the entire year during which HSH concentrations were predicted. This approach is used to ensure that valid HSH concentrations are obtained. More detailed descriptions of the emission inventory and receptor grids used in the screening and refined phases of the analysis are presented in the following sections.

6.1.2 MODEL SELECTION

Prior to performing air impact analyses, the methods and assumptions used in the air quality modeling analyses were submitted in a separate protocol document to FDEP. Based on the comments received from FDEP, the modeling methodology was revised to incorporate recommended changes. The methods used in the analyses (e.g., proposed plant operates at maximum capacity and emissions for every hour in the year; all interacting sources were assumed to operate continuously at maximum emission rates) were designed to produce conservative (i.e., higher than expected) impacts; actual impacts from the proposed plant and other emission sources are expected to be lower.

The selection of the appropriate air dispersion model is based on its ability to simulate impacts in areas surrounding the plant site. Within 50 km (31 miles) of the site, the terrain can be described as simple (i.e., flat to gently rolling). As defined in the EPA modeling guidelines, simple terrain is considered to be an area where the terrain features are all lower in elevation than the top of the stack(s) under evaluation. Therefore, a simple terrain model has been selected to predict maximum ground-level concentrations.

The Industrial Source Complex (ISC) dispersion model (EPA, 1992a) has been selected to evaluate the pollutant emissions from the proposed unit and other modeled sources. This model is contained in EPA's User's Network for Applied Modeling of Air Pollution (UNAMAP), Version 6 (EPA, 1988a). The ISC model is applicable to sources located in either flat or rolling terrain where terrain heights do not exceed stack heights.

The ISC model consists of two sets of computer codes that are used to calculate short- and long-term ground-level concentrations. The main differences between the two codes are the input format of the meteorological data and the method of estimating the plume's horizontal dispersion.

The first model code, the ISC short-term (ISCST2) model, is an extended version of the single-source (CRSTER) model (EPA, 1977). The ISCST2 model is designed to calculate hourly concentrations based on hourly meteorological parameters (i.e., wind direction, wind speed, atmospheric stability, ambient temperature, and mixing heights). The hourly concentrations are processed into non-overlapping, short-term, and annual averaging periods. The second model code within the ISC model is the ISC long-term (ISCLT2) model. The ISCLT2 model uses the

joint frequencies of occurrences of meteorological parameters to calculate seasonal and/or annual average ground-level concentrations. The frequencies are developed for a total of 576 combinations of meteorological events which consist of 16 wind direction classes, 6 wind speed classes, and 6 atmospheric stability classes.

In this analysis, the ISCST2 model, Version 93109, was used to calculate both short-term and annual average concentrations. This is the latest approved version of the ISCST2 model. Major features of the ISCST2 model are shown in Table 6-1.

The criteria used to determine when the rural or urban mode (which affects the dispersion parameters) is appropriate are based on land use near the proposed plant's surroundings (Auer, 1978). If the land use is classified as heavy industrial, light-moderate industrial, commercial, or compact residential for more than 50 percent of the area within a 3-km (1.9-mile) radius circle centered on the proposed source, the urban option should be selected. Otherwise, the rural option is more appropriate.

Based on reviews of aerial and U.S. Geological Survey (USGS) topographical maps (see Figure 2.2.3-1 in Chapter 2.0 of the SCA/EA) and a site visit, the land use within a 3-km (1.9-mile) radius of the project site is considered to be rural (i.e., very little heavy industrial, light-moderate industrial, commercial, or compact residential land use categories). Therefore, the rural mode was used in the air dispersion model to predict impacts from the proposed plant and other emission sources considered in the model.

For the AAQS and PSD Class II and Class I increment analyses, the sources and receptors were assumed to be located in flat terrain (no terrain elevations used).

For modeling analyses that will undergo regulatory review, such as PSD permit applications, the following model features are recommended by EPA (1993) for rural mode and are referred to as the regulatory options in the ISCST2 model:

1. Final plume rise at all receptor locations,
2. Stack-tip downwash,
3. Buoyancy-induced dispersion,
4. Default wind speed profile coefficients for rural or urban option,

5. Default vertical potential temperature gradients,
6. Calm wind processing, and
7. Reducing calculated SO₂ concentrations in urban areas by using a decay half-life of 4 hours (i.e., reduce the SO₂ concentration emitted by 50 percent for every 4 hours of plume travel time).

In this analysis, the EPA regulatory options were used to address maximum impacts.

6.2 METEOROLOGICAL DATA

Meteorological data used in the ISCST2 model were based on those data recommended and approved for use by FDEP and used in recent SCA and PSD permit applications for sources located near the project site. The meteorological data used to determine air quality impacts consisted of a concurrent 5-year period of hourly surface weather observations and twice-daily upper-air soundings from the National Weather Service (NWS) station at Tampa International Airport and Ruskin, respectively. The 5-year period of meteorological data was from 1982 through 1986. The NWS station in Tampa is located approximately 65 km (40 miles) west-northwest of the site and is the closest primary weather station to the study area considered to have meteorological data representative of the project site. This station has surrounding topographical features similar to the project site and the most readily available and complete database.

The surface observations included wind direction, wind speed, temperature, cloud cover, and cloud ceiling height. The wind speed, cloud cover, and cloud ceiling values were used in the ISCST2 meteorological preprocessor program to determine atmospheric stability using the Turner stability scheme. Based on the temperature measurements at morning and afternoon, mixing heights were calculated from the radiosonde data at Ruskin using the Holzworth approach (Holzworth, 1972). Hourly mixing heights were derived from the morning and afternoon mixing heights using the interpolation method developed by EPA (Holzworth, 1972). The hourly surface data and mixing heights were used to develop a sequential series of hourly meteorological data (i.e., wind direction, wind speed, temperature, stability, and mixing heights). Because the observed hourly wind directions at the NWS stations are classified into one of thirty-six 10-degree sectors, the wind directions were randomized within each sector to account for the expected

variability in air flow. These calculations were performed using the EPA RAMMET meteorological preprocessor program.

6.3 EMISSION INVENTORY

6.3.1 PROPOSED PROJECT ONLY

Stack and operating parameters and emission rates of criteria pollutants for the CTs were developed from design data supplied by the turbine manufacturer, Westinghouse, Inc., selected by SECI for this project. The design data were developed for the turbines firing natural gas and distillate fuel oil and operating at 50, 75, and 100 percent of maximum capacity (see Section 2.0). Because the inlet ambient air temperature directly affects turbine combustion and operation, design data were also provided for four ambient air temperatures that cover the range of temperatures for the project site location: 32, 59, 72, and 95°F. Air dispersion modeling was performed for the three operating loads and two extreme ambient temperatures of 32 and 95°F to provide a range of operating conditions that will potentially produce maximum ground-level impacts. These modeling scenarios encompass the operating conditions that will produce the maximum emissions on a short-term basis (i.e., 100 percent load at 32°F) and the minimum plume rise (i.e., 50 percent load at 95°F).

For most pollutants, the highest air impacts were based on the use of fuel oil since the maximum hourly and annual emission rates are generated with fuel oil combustion. For CO and NO_x, additional modeling was performed for the turbines firing natural gas. For CO, the short-term air impacts were also developed for the 1-hour and 8-hour averaging periods (basis of the averaging periods for the AAQS) assuming the turbines were firing natural gas for power augmentation. For NO_x, the annual impacts were also estimated for the PSD Class I increment consumption based on the turbines firing fuel oil (1,500 hours), natural gas (5,260 hours), and natural gas for power augmentation (2,000 hours).

In summary, the operating scenarios considered for the proposed turbines were as follows:

- A. All pollutants and averaging periods when firing distillate fuel oil:
 - 1. Operating loads of 100, 75, and 50 percent; and
 - 2. Ambient temperatures of 32 and 95°F.
- B. Additional analyses for CO concentrations (1-hour and 8-hour averaging period) when firing natural gas during power augmentation at 80°F and 95°F.

- C. Additional analyses for NO_x concentrations (annual averaging period) for assessing impacts in the PSD Class I area for the following combinations of annual fuel combustion (turbines operating at 100-percent load):
1. Distillate Fuel Oil (1,500 hours) at 59°F
 2. Natural Gas (5,260 hours) at 59°F
 3. Natural Gas for Power Augmentation (2,000 hours) at 80°F

The stack, operating, and emission data used in the air dispersion modeling are presented in Tables 2-1 through 2-6 and in Attachment A. This modeling provided initial evaluations to determine the proposed source's impacts relative to the significant impact levels and, where applicable, the distance at which the proposed source's impacts are below the significant impact levels. Based on this modeling, subsequent modeling analyses were performed based on the operating load that produced the maximum potential impacts for applicable pollutants and averaging times.

6.3.2 OTHER EMISSION SOURCES

AAQS and PSD Class II Analyses

For AAQS and PSD Class II analyses, preliminary modeling indicated that the proposed facility's impacts were below the significant impact levels for applicable pollutants (i.e., CO, NO₂), except for SO₂ and PM₁₀. As a result, further modeling of CO and NO₂ was not required to determine compliance with the applicable AAQS and PSD Class II increments. Because the modeling demonstrated that the facility's impacts were predicted to be above the significant impact levels for SO₂ and PM₁₀, further modeling for these pollutants was required. The maximum SO₂ and PM₁₀ concentrations from the proposed source were predicted to be greater than the significant impact levels at a distance of approximately 1 km (0.6 mile) from the facility for both pollutants. This distance was used to limit receptor locations and background sources to be modeled.

Emission inventories for SO₂ and PM were developed from available databases, such as FDEP's Air Pollution Inventory System (APIS), previous studies performed by KBN, and recent air construction permit applications submitted in Polk County (e.g., Tampa Electric Company's Polk County Station and Florida Power Corporation's Polk County site). After review and consultation with FDEP, the inventories were updated to reflect the most current data that are based on a

source's emission limits of permit conditions and reflect the physical characteristics of each source (i.e., stack height, diameter).

Emission inventories of background sources were developed for the proposed source's modeling area and screening area. The modeling area is defined as the significant impact area for the proposed source. The screening area extends 50 km (31 miles) beyond the modeling area. Within the modeling area, cumulative impact analyses were performed for the proposed source and all identified background sources located in the modeling and screening areas. Additional background sources beyond the screening area were also included in the modeling.

FDEP has approved a technique for eliminating sources in the modeling analyses if the source's emissions do not meet an emission criterion. The technique is the *Screening Threshold* method, developed by the North Carolina Department of Natural Resources and Community Development, and approved by EPA. The method is designed to objectively eliminate from the emission inventory those sources that are unlikely to have a significant interaction with the source undergoing evaluation. In general, sources that should be considered in the modeling analyses are those with emissions greater than a screening threshold value (in TPY) that is calculated by the following criteria:

$$Q = 20 \times D$$

where Q = the screening threshold value (TPY), and

D = The distance (km) from the proposed facility to the source undergoing evaluation for short-term analysis, or

The distance (km) from the edge of the proposed facility's significant impact area to the source undergoing evaluation for long-term (annual) analysis.

For this analysis, the long-term criterion was used since fewer facilities would be eliminated than with the short-term criterion. Also, the total emissions from a facility were used rather than emissions from individual sources for comparison to the screening threshold value. These methods result in a more conservative approach to produce higher-than-expected concentrations. Those facilities with maximum allowable emissions that are below the calculated *screening threshold* were eliminated from further consideration in the AAQS and PSD Class II modeling

analyses. A summary of all facilities, their locations with respect to the proposed Hardee Unit 3 Plant, their maximum SO₂ and PM₁₀ emissions, and the calculated screening threshold are provided in Tables 6-2 and 6-3. The existing HPS was the only facility located within the proposed plant's significant impact area (SIA) [i.e., 1 km (0.6 mile)]. As a result, it was not subject to the screening analysis and, therefore, was included in the SO₂ and PM₁₀ modeling analyses. Those facilities eliminated from the modeling analysis using the screening threshold technique are noted in Tables 6-2 and 6-3. For all facilities that were not eliminated, the individual source emissions, stack, and operating parameters for the PSD and AAQS modeling analyses were developed.

Where individual sources within a facility contained identical or similar parameters, the sources were combined in order to obtain a manageable source inventory for modeling purposes. For SO₂ and PM emission sources, those facilities located near the proposed project [e.g., within 20 km (12 miles)] and all utility sources were not combined in order to maintain the integrity of the facility's emissions. For PM emission sources only, non-utility sources located beyond 20 km (12 miles) from the proposed facility were combined based on EPA's method for merging sources (EPA, 1992b). Individual PM emission sources of 100 TPY or more within a facility were modeled separately (i.e., no merging was performed). Those PM emission sources of less than 100 TPY were all merged into one source based on the following approach. For each stack, the parameter M was computed:

$$M = \frac{h_s V T_s}{Q}$$

where: M = merged stack parameter which accounts for the relative influence of stack height, plume rise, and emission rate on concentrations

h_s = stack height (m)

$V = (\pi/4) d_s^2 v_s$ = stack gas volumetric flow rate (m³/s)

d_s = inside stack diameter (m)

v_s = stack gas exit velocity (m/s)

T_s = stack gas exit temperature (K)

Q = pollutant emission rate (g/s)

The stack that had the lowest value of M was used as the representative stack. Then, the sum of the emissions from all applicable sources was assumed to be emitted from the representative stack.

Summaries of all SO₂ and PM10 sources, including all the combined sources used in the modeling analysis, are presented in Attachment C.

PSD Class I Analysis

The proposed project's impacts were predicted to be less than the NPS significant impact levels at the Class I area of the Chassahowitzka NWA for NO_x and PM10 but greater than the NPS significant impact levels for SO₂. As a result, an emission inventory of all SO₂ PSD increment-consuming sources within approximately 150 km (90 miles) of the Class I area of the Chassahowitzka National Wildlife Refuge (NWR) was obtained from FDEP. The inventory was developed for recent SO₂ PSD impact assessments at the PSD Class I area and contains major and minor increment-consuming sources. Based on discussions with and review by FDEP, the inventory has been updated to reflect the most current PSD increment-consuming and -expanding sources. A summary of the facilities considered in the analysis is presented in Table 6-4. Source parameters used in the modeling are presented in Attachment D.

6.4 RECEPTOR LOCATIONS

The general modeling approach used screening and refined phases to address compliance with AAQS and PSD increments. For the screening phase, concentrations were predicted for the following receptor locations:

1. For determination of the proposed plant's significant impact area and maximum impact, the initial receptor grid consisted of 397 receptors located at the fenced plant property and at distances of 100; 200; 300; 400; 600; 1,000; 1,500; 2,000; 3,000; 4,000; and 5,000 m along 36 radials with each radial spaced at 10-degree increments. This grid was centered on the midpoint between the locations of the proposed HRSG stacks. Additional receptors were located near the plant property at the closest distances at which the model could calculate a concentration (based on the limitation imposed by the building data).

2. For the SO₂ AAQS and PSD Class II analysis, 277 receptors were located in radial grids centered at a location between the proposed HRSG stacks. These receptors are classified into two main groups:
 - a. 36 plant property receptors placed at the nearest plant boundary along 36 radials spaced at 10-degree increments (additional receptors were located near the plant property at the closest distances at which the model could calculate a concentration).
 - b. 241 general grid receptors located around the Hardee Unit 3 plant at distances of 100; 200; 300; 400; 500; 600; 800; and 1,000 m along 36 radials with each radial spaced at 10-degree increments.

A list of the property boundary screening receptors for the Hardee Unit 3 plant is presented in Table 6-5.

Concentrations were calculated at ambient air locations only (i.e., beyond areas with restricted access, such as fenced locations and areas patrolled by security guards). Therefore, general grid receptors located on restricted-access property were excluded from the analysis.

After the screening modeling was completed, refined modeling was conducted using a receptor grid centered on the receptor that had the highest annual and highest short-term concentration from the screening analysis. The receptors were located at intervals of 100 m between the distances considered in the screening phase, along 9 radials spaced at 2-degree increments, centered on the radial along which the maximum concentration was produced. For example, if the maximum concentration was produced along the 90-degree radial at a distance of 0.8 km, the refined receptor grid would consist of receptors at the following locations:

<u>Directions (degrees)</u>	<u>Distance (km)</u>
82, 84, 86, 88, 90, 92, 94	0.6, 0.7, 0.8, 0.9, and 1.0 per direction

To ensure that a valid maximum concentration is calculated, concentrations were predicted using the refined grid for the entire year that produced the highest concentration from the screening receptor grid.

The maximum PSD increment consumption at the PSD Class I area of the Chassahowitzka NWA was determined for the proposed facility alone and in conjunction with other PSD sources at 13 discrete receptors located along the boundary of the Class I area. These receptors, shown in Table 6-6, were provided by FDEP and have been used consistently in air permit applications for sources undergoing evaluations for PSD increment consumption.

6.5 BUILDING DOWNWASH EFFECTS

Based on the building dimensions associated with buildings and structures planned at the plant, the stacks for the proposed units (i.e., bypass CT stack for simple cycle operation and HRSG stack) will comply with the GEP stack height regulations. However, these stacks will be less than GEP. Therefore, the potential for building downwash to occur was considered in the modeling analysis for these stacks.

The ISC model uses two procedures to address the effects of building downwash. For both methods the direction-specific building dimensions are input for H_b and l_b for 36 radial directions, with each direction representing a 10-degree sector, which uses these parameters to modify the dispersion parameters. The H_b is the building height and l_b is the lesser of the building height or projected width. For short stacks (i.e., physical stack height is less than $H_b + 0.5 l_b$), the Schulman and Scire (1980) method is used. The features of the Schulman and Scire method are as follows:

1. Reduced plume rise as a result of initial plume dilution,
2. Enhanced plume spread as a linear function of the effective plume height, and
3. Specification of building dimensions as a function of wind direction.

For cases where the physical stack is greater than $H_b + 0.5 l_b$ but less than GEP, the Huber-Snyder (1976) method is used.

The building dimensions considered in the modeling analysis are presented in Table 6-7. The Building Profile Input Program (BPIP), Version 93320, was used to generate building data for model input. A detailed listing of direction-specific building data used in the modeling analysis is given in Attachment E.

6.6 BACKGROUND CONCENTRATIONS

Background concentrations are concentrations due to sources not associated with the proposed plant. These concentrations consist of two components: impacts due to other modeled emission sources (i.e., non-project related) and impacts due to sources not explicitly modeled. Background concentrations due to other modeled sources were predicted with the air dispersion model based on the data developed from the emission inventory in Section 6.3. Background concentrations due to sources not explicitly modeled were developed from ambient monitoring data.

For this project, background SO₂ and PM₁₀ concentrations were needed because the proposed plant's SO₂ and PM₁₀ impacts were predicted to be greater than the significant impact levels (see Section 7.1) which required further modeling analyses with other sources to determine compliance with AAQS. Because the proposed plant's impacts were predicted to be less than significant impact levels for other pollutants, no additional modeling analyses or background concentrations were required to be developed for these pollutants.

The non-modeled background SO₂ and PM₁₀ concentrations, developed from the latest year of monitoring data, were based on the highest concentrations measured from nearby monitoring stations presented in Section 5.0. Based on the data collected, the background 3-hour, 24-hour, and annual average SO₂ concentrations are assumed to be 256, 50, and 11 µg/m³, respectively. For PM₁₀ concentrations, the background 24-hour and annual average concentrations are assumed to be 70 and 20 µg/m³, respectively. These background levels were added to model-predicted concentrations to estimate total air quality levels for comparison to AAQS.

There has been minimal industrial or commercial growth in the area of the proposed plant, indicating minimal increases, if any, of potential air emissions or air quality levels since the monitoring data were collected.

6.7 AAQS COMPLIANCE ANALYSIS

Maximum total air quality SO₂ and PM₁₀ impacts were compared to the applicable national and state AAQS (see Table 3-1). Total air quality impacts are based on adding the modeled maximum impacts from the proposed power plant and background emission sources to the non-modeled background concentration. A total of 30 and 25 facilities, respectively, were modeled as background SO₂ and PM emission sources. It should be noted that this is a conservative approach

to predict total air quality impacts since impacts from existing sources are not only modeled but are included in the background concentration. As a result, impacts from existing sources considered in the modeling are potentially included twice or double-counted (by modeling and including in the monitoring data). Both screening and refined modeling analyses were performed to determine the modeled maximum concentrations. The methodology and approaches used to predict the modeled concentrations are described in the previous sections. As discussed in Section 6.1.1, where applicable, maximum total air quality concentrations are identified when Hardee Unit 3's impacts are predicted to be greater than the significant impact levels.

6.8 PSD CLASS II COMPLIANCE ANALYSIS

Maximum air quality SO₂ and PM₁₀ impacts from PSD sources were compared to the applicable PSD Class II increments (see Table 3-1). These impacts are based on adding the modeling maximum impacts from the proposed power plant to impacts from other PSD sources. A total of 26 and 11 facilities, respectively, were modeled as PSD SO₂ and PM background sources. Similar to the AAQS compliance analysis, both screening and refined modeling analyses were performed to determine the modeled maximum concentrations. The methodology and approaches used to predict the modeled concentrations are described in the previous sections. Similar to the AAQS analysis, the maximum PSD increment concentrations are identified when Hardee Unit 3's impacts are predicted to be greater than significant impact levels.

6.9 PSD CLASS I COMPLIANCE ANALYSIS

6.9.1 ISCST2 MODEL ANALYSIS

Maximum air quality impacts from the proposed power plant alone were modeled at the Class I area of the Chassahowitzka NWA. Since SO₂ impacts were greater than the recommended NPS screening levels, additional modeling was performed. Impacts from the PSD sources located within approximately 150 km of the Class I area were compared to the applicable PSD Class I increments (see Table 3-1). These impacts were based on adding the modeling maximum impacts from the proposed power plant to impacts from other PSD sources. A total of 62 facilities were modeled as PSD Class I background sources. The methodology and approaches used to predict the modeled concentrations are described in the previous sections.

6.9.2 SUPPLEMENTARY PSD CLASS I AREA IMPACTS

A long-range transport modeling analysis was used as a supplemental air quality evaluation to determine compliance with the PSD Class I increment consumption for SO₂ concentrations at the Chassahowitzka NWA. Potential violations of the 3-hour and 24-hour PSD Class I increments were predicted with the ISCST2 model (see Section 7.4.1), which required the use of a refined model that accounts for long-range transport. This modeling analysis used the long-range transport model, MESOPUFF II, to address impacts from the proposed Hardee Unit 3 as well as other PSD increment consuming and expanding sources. The analysis is based on the Mesopuff II Modeling Protocol developed by the Interagency Workgroup on Air Quality Modeling (IWAQM).

As discussed in Sections 6.7, 6.8 and 6.9.1, ambient air quality analyses have been performed to demonstrate the compliance of the proposed project with AAQS and PSD Class II and I increments. The model selection and application for those analyses were based on recommendations in the U.S. EPA *Guideline on Air Quality Models (Revised)*, 1990. The air dispersion model used in these analyses was the ISCST2 model, which is intended to predict impacts out to 50 km (31 miles) from a source. This model is referenced in Appendix A ("Appendix A" model) of the modeling guidelines, which means that the model may be used without justifying the use of technical methods and procedures provided the recommended regulatory options are selected. Because the proposed Hardee Unit 3 facility is more than 100 km (62 miles) from the Class I area, the ISCST2 model may not be appropriate for addressing impacts at the Class I area. However, the modeling guideline does not specify a preferred model or protocol for long-range transport beyond 50 km.

Based on discussions with and approval of the protocol by FDEP and NPS [the NPS performs the technical evaluation of air quality for the U.S. Fish and Wildlife Service (USFWS), which has jurisdiction for the Class I area], the reviewing agencies recommended the use of a long-range transport model, such as the MESOPUFF II model, to address impacts for this application. Although the MESOPUFF II model is not an "Appendix A" model from the EPA modeling guidelines, it is referenced in Appendix B ("Appendix B" model) of the modeling guidelines and can be used on a case-by-case basis provided it can perform critical calculations or routines that are not available from an "Appendix A" model. In this case, the ISCST2 model, an "Appendix A" model, does not have the necessary dispersion and transport routines to adequately address long-range transport of plumes from emission sources. Since the proposed facility is

more than 50 km (30 miles) from the critical receptors, the MESOPUFF II model is an appropriate method for addressing impacts at the Chassahowitzka NWA.

The modeling methods and assumptions used in the MESOPUFF II model follow those presented in the modeling guidelines by IWAQM and incorporate specific procedures approved by FDEP and NPS.

GENERAL DESCRIPTION OF MESOPUFF II MODEL

MESOPUFF II is a long-range transport model that is currently recommended by EPA for determining source impacts at distances greater than 100 km (60 miles). Based on discussions with FDEP, EPA and NPS, this model can be used for the PSD Class I increment-consumption analysis in support of air permit applications for emission sources located more than 50 km (30 miles) from a Class I area. The MESOPUFF II model has two preprocessor programs, READ56 and MESOPAC II, and one postprocessor program, MESOFILE II. The READ56 program is a preprocessor program to MESOPAC II, which is designed to read upper air (i.e., sounding) data obtained from the National Climatic Data Center (NCDC) in Asheville, North Carolina, and to reformat the data for use in the MESOPAC II program. The READ56 program also identifies missing data records. Missing data identified by READ56 must be filled in manually before input to the MESOPAC II program.

The MESOPAC II program is the meteorological preprocessor program for MESOPUFF II. The MESOPAC II program reads the upper air data file output from the READ56 program, as well as hourly surface meteorological data and hourly precipitation data collected at stations within the modeling area. Other data required for the MESOPUFF II model include land use and surface roughness lengths for each receptor grid point to be modeled.

The MESOPUFF II model provides concentration results for user-specified averaging times. The results can be processed by the MESOFILE II program to obtain additional statistical information about the concentrations produced from MESOPUFF II (e.g., annual average values).

Postprocessor programs are used to produce HSH short-term concentrations from MESOPUFF II model's output. The annual average and HSH concentrations for the 3-hour and 24-hour averaging period can be compared directly to allowable PSD Class I increments.

METEOROLOGICAL DATA

The general grid in which the meteorological data was prepared and processed consisted of a model domain that covered an area of 90,000 km² (3,475 square miles), extending 300 km (186 miles) in the east-west and north-south directions. There are a total of 196 cells within the grid, with each cell covering a 400-km² (154-square-mile) area or 20 km (12 miles) in the east-west and north-south directions. The southwest corner of the model domain is located at Universal Transverse Mercator (UTM) coordinates of 250,000 m East and 3,000,000 m North in UTM Zone 17. The Class I area and emission sources are located within the grid and generally are 100 km (62 miles) or more from the grid's edges.

The upper air data used in the analysis was read by the READ56 program to identify missing soundings and missing data for specific levels within a sounding. The program was modified to account for the data format changes that have occurred since the program originally was developed.

Meteorological data for the 5-year period of 1982 to 1986 from the NWS stations located within or near the grid were used in the analysis. This time period corresponds to the same period during which air dispersion modeling was performed using the ISCST2 model.

Upper air rawinsonde data from the following upper air NWS stations were used:

1. Ruskin, Florida (located within the grid) and
2. Waycross, Georgia (located to the north of the grid).

These stations were selected because they are the nearest upper air stations to the study area. The data were reduced into 1-year records suitable for input to the READ56 program. Each station-year was run with the READ56 model to determine any missing data. The missing data was filled in by assuming data persistence from the previous valid observation (e.g., if data for the 12Z sounding are missing, the 00Z sounding from the previous day was used) or persistence from a lower level. Because the program expects data from the mandatory levels of 850, 700, and 500 millibars (mb), data were inserted at these levels by persisting wind data from a lower level or temperature data for the same level from the previous sounding.

The MESOPAC II program was run to process the surface and upper air meteorological data for a format acceptable to the MESOPUFF II model. The program was modified to account for the data format changes that have occurred since the program originally was developed. The surface meteorological data were obtained for the 5-year period of 1982 to 1986, when available, from the following NWS stations, all located within the grid:

1. Tampa (located in the southwestern quadrant);
2. Orlando (located near the center of the grid); and
3. Gainesville (located in the northern portion of the grid) for 1984 to 1986 and Jacksonville (located to the northeast of the grid) for 1982 and 1983 because digitized data were not available from Gainesville for 1982 or 1983.

Hourly precipitation data also were obtained for each surface meteorological station and additional stations available within the model domain. The wet deposition option which uses the precipitation data was considered in the model runs. Land use data were developed for this grid from existing data developed by Argonne National Laboratory (*A Guide for Estimating Dry Deposition Velocities of Sulfur over the Eastern United States and Surrounding Regions*, C.M. Sheih, et al., 1979). Since the model allows only a single land use type to be specified for each grid square, the land use category covering the greatest fraction of the total area within each grid square was selected.

MESOPUFF II MODELING APPROACH

The MESOPUFF II model was used to predict ambient concentrations at the same PSD Class I receptor locations in the Chassahowitzka NWA described in Section 6.4. The model was run for select periods identified by the ISCST2 model as potential violations of the PSD Class I increment (see Section 7.4.1). Based on recommendations by IWAQM, the distance to which the Turner dispersion parameters apply was set to 10 km. After that distance, the dispersion parameters are based on time-dependent equations.

Emission and stack parameters for all SO₂ PSD increment consuming sources were processed into the MESOPUFF II model input format. This inventory consisted of the most current inventory available (see Section 6.3) with concurrence from FDEP for the Chassahowitzka NWA airshed plus the proposed Hardee Unit 3 facility. Concentrations were predicted at 13 discrete receptors along the boundary of the PSD Class I area which have been approved for use by FDEP.

For PSD Class I increment consumption purposes, an emission source is deemed not to have a significant impact in the Class I area if the predicted impacts are less than the recommended NPS significance levels for Class I areas. These recommended levels for SO₂ concentrations are 0.48, 0.07, and 0.025 µg/m³ for the 3-hour, 24-hour, and annual averaging periods, respectively. If a source's impacts are predicted to be less than the Class I significance levels, then a source's emissions are assumed to have a less than significant impact to a predicted violation and can be permitted regardless of the impacts from other sources.

The modeling approach followed general procedures to identify potential concentrations predicted to be in excess of the PSD Class I increment. This approach consisted of the following parts:

1. Concentrations were calculated at the Class I area using the ISCST2 model for the 5-year period of meteorological data collected at the NWS station in Tampa.
2. Based on the results of the ISCST2 model, concentrations that were predicted to violate the PSD Class I increment were identified at specific receptors and during specific time periods. The sources that contributed to the predicted violations were identified and grouped into two categories based on the distance from the applicable receptor. The first category included those sources at or within 50 km (30 miles) of the Class I area while the second category included those sources greater than 50 km (30 miles) from the Class I area. The proposed source's contribution were also identified and compared to the NPS significance levels. If the proposed source's impacts were predicted to be less than significant, no additional modeling was necessary. If the proposed source's predicted impacts were significant, additional modeling was performed with the MESOPUFF II model.
3. The MESOPUFF II model calculations were performed in this part using the approach recommended by IWAQM and included chemical transformation processes, wet deposition, and dry deposition.

Because model results for 1986 from the ISCST2 model indicated a significant number of potential violations, concentrations were predicted using MESOPUFF II model for the proposed source for the entire year. For other years, the MESOPUFF II model was used to predict impacts for the limited number of periods identified in Part 2, including 3 days before and 2 days after those periods. For the other years, concentrations were not evaluated for averaging times or receptors during which there were no predicted violations of the increments by the ISCST2

model. For example, if the ISCST2 model predicted impacts that violated the Class I increment for a specific receptor location and 24-hour averaging period in 1985, the MESOPUFF II model results were evaluated for that receptor location and 24-hour averaging period (including 3 days before and 2 days after) but not for the entire year.

These predicted concentrations for the proposed source were substituted for the ISCST2 model results and added to the predicted impacts produced for all other sources with the ISCST2 model. If the proposed source's impacts using MESOPUFF II model were less than the significant impact levels or the total predicted concentrations were less than the Class I increment, no additional modeling was required.

For 1986, when the proposed source was modeled with MESOPUFF II model, there was only one 24-hour period and no 3-hour periods during which the proposed source had a significant impact. Additional modeling was performed for that one 24-hour period with the MESOPUFF II model for those sources located more than 50 km (31 miles) from the Class I area. These predicted concentrations were substituted for the ISCST2 model results. These MESOPUFF II model concentrations were added to those produced with the ISCST2 model for sources located at or within 50 km (31 miles) of the Class I area and MESOPUFF II model results from the proposed source to determine the total PSD Class I increment consumption. Because the total predicted concentrations were less than the Class I increment, no additional modeling was required.

6.10 TOXIC AIR POLLUTANT ANALYSIS

Maximum air quality impacts of toxic air pollutants from the proposed power plant alone were modeled for comparison to the NTL levels for toxic air pollutants established by FDEP.

Table 6-1. Major Features of the ISCST2 Model

ISCST2 Model Features	
• Polar or Cartesian coordinate systems for receptor locations • Rural or one of three urban options which affect wind speed profile exponent, dispersion rates, and mixing height calculations • Plume rise due to momentum and buoyancy as a function of downwind distance for stack emissions (Briggs, 1969, 1971, 1973, and 1975) • Procedures suggested by Huber and Snyder (1976); Huber (1977); and Schulman and Scire (1980) for evaluating building wake effects • Procedures suggested by Briggs (1974) for evaluating stack-tip downwash • Separation of multiple point sources • Consideration of the effects of gravitational settling and dry deposition on ambient particulate concentrations • Capability of simulating point, line, volume and area sources • Capability to calculate dry deposition • Variation of wind speed with height (wind speed-profile exponent law) • Concentration estimates for 1-hour to annual average times • Terrain-adjustment procedures for elevated terrain including a terrain truncation algorithm • Consideration of time-dependent exponential decay of pollutants • The method of Pasquill (1976) to account for buoyancy-induced dispersion • A regulatory default option to set various model options and parameters to EPA recommended values (see text for regulatory options used) • Procedure for calm-wind processing • Wind speeds less than 1 m/s are set to 1 m/s.	

Note: ISCST2 = Industrial Source Complex Short-Term.

Source: EPA, 1992a.

Table 6-2. SO2 Screening Analysis for the AAQS and PSD Class II Inventories for Hardee Unit 3

Facility Name	UTM Coordinates(km)		Relative Coordinate to proposed Hardee Unit 3 (km)		Distance to Proposed Facility (km)	Direction (degrees)	Screening Emission Threshold (TPY)(a)	Maximum Allowable Emissions (TPY)	Included in AAQS and/or PSD Class II Modeling Analysis?
	E	N	X	Y					
TPS Hardee Station (295 MW) (b)	404.8	3057.3	-0.2	-0.4	0.4	207	(c)	2,412	YES
TECO - Polk Power Station (b)	402.5	3067.4	-2.5	9.7	10.0	345	100	2,010	YES
Imperial Phosphate (Brewer)(b)	404.8	3069.5	-0.2	11.8	11.8	359	136	275	YES
Gardinier Fort Meade	415.3	3063.3	10.3	5.6	11.7	61	134	1,173	YES
IMC-Agrico Chem - S. Pierce (b)	407.5	3071.3	2.5	13.6	13.8	10	177	4,377	YES
Mobil Mining - Big Four Mine (b)	394.8	3067.7	-10.2	10.0	14.3	314	186	589	YES
Borden Hillsborough (b)	394.6	3069.6	-10.4	11.9	15.8	319	216	-225	YES
U.S. Agri-Chemicals Ft. Meade (b)	416.0	3069.0	11.0	11.3	15.8	44	215	3,438	YES
Central Florida Power	416.2	3069.2	11.2	11.5	16.1	46	222	38	NO
City of Wauchula	418.4	3047.0	13.4	-10.7	17.1	129	243	180	NO
Estech/Swift (b)	411.5	3074.2	6.5	16.5	17.7	22	255	-4,853	YES
FPC - Polk (b)	414.3	3073.9	9.3	16.2	18.7	30	274	859	YES
Dolime(b)	404.8	3069.5	-0.2	11.8	11.8	359	136	-355	YES
IMC-Agrico Chem - Pierce (b)	404.1	3079.0	-0.9	21.3	21.3	358	326	-1,645	YES
Mobil Electrophosphate (b)	405.6	3079.4	0.6	21.7	21.7	2	334	-1,441	YES
Farmland Industries Green Bay (b)	409.5	3079.5	4.5	21.8	22.3	12	345	4,087	YES
IMC Agrico Chem- New Wales (b)	396.6	3078.9	-8.4	21.2	22.8	338	356	13,921	YES
Mulberry Cogeneration (b)	413.6	3080.6	8.6	22.9	24.5	21	389	464	YES
IMC Agrico Chem - Noralyn Mine Road	414.7	3080.3	9.7	22.6	24.6	23	392	505	YES
CF Industries Bartow Bonnie Mine Road(b)	408.4	3082.4	3.4	24.7	24.9	8	399	4,982	YES
Kaplan Industries	418.3	3079.3	13.3	21.6	25.4	32	407	398	NO
American Orange Corp.	429.8	3047.3	24.8	-10.4	26.9	113	438	198	NO
IMC Agrico/Conserve (b)	398.4	3084.2	-6.6	26.5	27.3	346	446	1,593	YES
Mulberry Phosphates (Royster) (b)	406.8	3085.1	1.8	27.4	27.5	4	449	2,013	YES
Geologic Recovery	401.8	3085.8	-3.2	28.1	28.3	354	466	98	NO
Mobil Mining -Nichols (b)	398.4	3085.3	-6.6	27.6	28.4	347	468	2,304	YES
Cargill/Seminole Fertilizer Bartow (b)	409.8	3087.0	4.8	29.3	29.7	9	494	5,000	YES
IMC Fertilizer - Prairie	402.9	3087.0	-2.1	29.3	29.4	356	488	109	NO
Orange Co.	418.7	3083.6	13.7	25.9	29.3	28	486	26	NO
Imperial/Pavex Corp - W Bartow	413.0	3086.2	8.0	28.5	29.6	16	492	75	NO
US-Agri Chemicals Bartow (b)	413.2	3086.3	8.2	28.6	29.8	16	495	-1,579	YES
FPL - Manatee	367.2	3054.1	-37.8	-3.6	38.0	265	659	83,351	YES
Laidlaw Env. Services	424.7	3091.9	19.7	34.2	39.5	30	689	240	NO
Consolidated Minerals Plant City	393.8	3096.3	-11.2	38.6	40.2	344	704	809	YES
Citrus Hill	447.9	3068.3	42.9	10.6	44.2	76	784	411	NO
Cargill Citro-America	447.9	3068.3	42.9	10.6	44.2	76	784	223	NO
Ridge Cogeneration (b)	416.7	3100.4	11.7	42.7	44.3	15	785	480	NO
Lakeland City Power Larsen (b)	409.2	3102.8	4.2	45.1	45.2	5	805	5,024	YES
TECO - Big Bend (b)	361.9	3075.0	-43.1	17.3	46.4	292	829	237,854	YES
FPL-Avon Park	451.4	3050.5	46.4	-7.2	47.0	99	839	67	NO

Table 6-2. SO2 Screening Analysis for the AAQS and PSD Class II Inventories for Hardee Unit 3

Facility Name	UTM Coordinates(km)		Relative Coordinate to proposed Hardee Unit 3 (km)		Distance to Proposed Facility (km)	Direction (degrees)	Screening Emission Threshold (TPY)(a)	Maximum Allowable Emissions (TPY)	Included in AAQS and/or PSD Class II Modeling Analysis?
	E	N	X	Y					
Macasphalt Winter Haven	423.1	3101.5	18.1	43.8	47.4	22	848	48	NO
Cargill/Gardinier Riverview (b)	363.4	3082.4	-41.6	24.7	48.4	301	868	5,872	YES
Lakeland City Power McIntosh (b)	408.5	3105.8	3.5	48.1	48.2	4	865	30,567	YES
Auburndale Cogen (b)	420.8	3103.3	15.8	45.6	48.3	19	865	222	NO
Owens-Brockway	423.4	3102.8	18.4	45.1	48.7	22	874	120	NO
Coca Cola Auburndale	421.6	3103.7	16.6	46.0	48.9	20	878	709	NO
Adams Packing Auburndale	421.1	3104.2	16.1	46.5	49.2	19	884	94	NO
SFE Processing	421.7	3104.2	16.7	46.5	49.4	20	888	188	NO
Hillsborough RRF	368.2	3092.7	-36.8	35.0	50.8	314	916	771	NO
Borden Polk (b)	414.5	3109	9.5	51.3	52.2	10	943	-184	NO
CLM/Pacific Chloride	361.8	3088.3	-43.2	30.6	52.9	305	959	702	NO
TECO - Gannon	360.0	3087.5	-45.0	29.8	54.0	304	979	93,265	YES
Gulf Coast Lead	364.0	3093.5	-41.0	35.8	54.4	311	989	1,498	YES
Alcoma Packing	451.6	3085.5	46.6	27.8	54.3	59	985	327	NO
<u>Additional Sources Outside 55km Considered in Modeling Analysis</u>									
Lafarge Corp.	357.7	3090.6	-47.3	32.9	57.6	305	1052	20,293	YES
TECO - Hookers Point	358.0	3091.0	-47.0	33.3	57.6	305	1052	13,524	YES
FPC - Bartow	342.4	3082.6	-62.6	24.9	67.4	292	1247	62,618	YES
FPC - Higgins	336.5	3098.4	-68.5	40.7	79.7	301	1494	19,619	YES
FPC - Intercession City (b)	446.3	3126.0	41.3	68.3	79.8	31	1496	17,667	YES

Note: All facilities with a total maximum allowable SO2 emissions of more than 20 TPY that are within 55 km of the proposed facility are included in the screening analysis.

- (a) Screening emissions threshold is $20 \times [\text{Distance (km) to facility} - 5\text{km}]$, based on North Carolina Screening Method. A significant impact distance of 5 km was assumed in order to include additional facilities into the inventory.
- (b) Indicates PSD sources at this facility
Proposed facility UTM coordinates(km 405 3057.7
Screening area is 55 km from the proposed facility.
- (c) Sources within 5 km of the proposed facility are modeled without regard to the screening criteria.

Table 6-3. PM Screening Analysis for the AAQS and PSD Class II Inventories for Hardee Unit 3

Facility/Source Name	UTM E (km)	UTM N (km)	Relative Location to Proposed Facility (km)		Distance to Proposed Facility (km)	Direction (degrees)	Screening Threshold Emissions (TPY) (a)	Maximum Allowable Emissions (TPY)	Included in AAQS and PSD Class II Modeling Analysis?
			X	Y					
TPS Hardee Power Station (295 MW) (b)	404.8	3057.3	-0.2	-0.4	0.4	207	(c)	33	YES
TECO Polk (b)	402.5	3067.4	-2.5	9.7	10.0	346	100	438	YES
Gardinier Fort Meade	415.3	3063.3	10.3	5.6	11.7	61	134	132	NO
Imperial Phosphate (Brewer)	404.8	3069.5	-0.2	11.8	11.8	359	136	162	YES
IMC-Agrico Chemical South Pierce (b)	407.5	3071.3	2.5	13.6	13.8	10	177	858	YES
Mobil Big Four Mine	394.8	3067.7	-10.2	10.0	14.3	314	186	68	NO
US Agri-Chemicals Fort Meade (b)	416.0	3069.0	11.0	11.3	15.8	44	215	1,066	YES
Central Florida Power	416.2	3069.2	11.2	11.5	16.1	46	222	47	NO
Florida Privatization Inc	418.3	3048.0	13.3	-9.7	16.5	126	229	281	YES
City of Wachula	418.4	3047.0	13.4	-10.7	17.1	129	243	21	NO
Estech/Swift	411.5	3074.2	6.5	16.5	17.7	22	255	311	YES
FPC-POLK (b)	414.3	3073.9	9.3	16.2	18.7	30	274	149	NO
Estech-Duette Phosphate Mine	388.9	3047.2	-16.1	-10.5	19.2	237	284	751	YES
IMC Kingsford	398.2	3075.7	-6.8	18.0	19.2	339	285	417	YES
C & M Products Co	405.5	3079.1	0.5	21.4	21.4	1	328	162	NO
Farmland Industries Green Bay Plant (b)	409.5	3079.5	4.5	21.8	22.3	12	345	503	YES
IMC-Agrico New Wales	396.6	3078.9	-8.4	21.2	22.8	338	356	1,427	YES
Ewell Ind Bonnie Mine Rd	407.7	3080.9	2.7	23.2	23.4	7	367	96	NO
Mulberry Cogeneration (b)	413.6	3080.6	8.6	22.9	24.5	21	389	70	NO
IMC-Agrico Noralyn Mine	414.7	3080.3	9.7	22.6	24.6	23	392	1,690	YES
Ridge Pallets Inc	419.1	3078.1	14.1	20.4	24.8	35	396	96	NO
C F Industries Bartow Bonnie Mine (b)	408.4	3082.4	3.4	24.7	24.9	8	399	1,748	YES
Bio-Medical Service Corp of GA	413.9	3081.3	8.9	23.6	25.2	21	404	46	NO
Kaplan Industries	418.3	3079.3	13.3	21.6	25.4	32	407	53	NO
American Orange Corp	429.8	3047.3	24.8	-10.4	26.9	113	438	181	NO
Orange Cogen (b)	414.8	3083.0	9.8	25.3	27.1	21	443	44	NO
IMC-Agrico/Conserve (Nichols) (b)	398.4	3084.2	-6.6	26.5	27.3	346	446	1,598	YES
Mulberry Phosphates (Royster)	406.8	3085.1	1.8	27.4	27.5	4	449	1,394	YES
Kaiser Aluminum	408.3	3085.5	3.3	27.8	28.0	7	460	106	NO
Mobil Mining & Minerals Nichols	398.4	3085.3	-6.6	27.6	28.4	347	468	991	YES
Orange Co of Florida	418.7	3083.6	13.7	25.9	29.3	28	486	119	NO
IMC Fertilizer Prairie	402.9	3087.0	-2.1	29.3	29.4	356	488	288	NO
Purina Mills	402.0	3087.0	-3.0	29.3	29.5	354	489	88	NO
Pavex	413.0	3086.2	8.0	28.5	29.6	16	492	44	NO
Cargill/Seminole Fertilizer (b)	409.8	3087.0	4.8	29.3	29.7	9	494	544	YES

Table 6-3. PM Screening Analysis for the AAQS and PSD Class II Inventories for Hardee Unit 3

Facility/Source Name	UTM E (km)	UTM N (km)	Relative Location to Proposed Facility (km)		Distance to Proposed Facility (km)	Direction (degrees)	Screening Threshold Emissions (TPY) (a)	Maximum Allowable Emissions (TPY)	Included in AAQS and PSD Class II Modeling Analysis?
			X	Y					
Ridge Pallets Inc.	418.6	3084.1	13.6	26.4	29.7	27	494	165	NO
US Agri-Chemicals Bartow (b)	413.2	3086.3	8.2	28.6	29.8	16	495	444	NO
Florida Rock Industries	416.8	3085.8	11.8	28.1	30.5	23	510	57	NO
Ewell Ind S Florida Ave	406.3	3092.9	1.3	35.2	35.2	2	604	348	NO
All Sun Products	413.5	3093.8	8.5	36.1	37.1	13	642	318	NO
FPL - Manatee	367.2	3054.1	-37.8	-3.6	38.0	265	659	40,765	YES
Manatee Scrap Processing	366.9	3053.8	-38.1	-3.9	38.3	264	666	108	NO
Sun Pac Foods	422.7	3092.6	17.7	34.9	39.1	27	683	62	NO
Lykes Pasco Packing	412.4	3096.5	7.4	38.8	39.5	11	690	48	NO
Consolidated Minerals Inc Plant City	393.8	3096.3	-11.2	38.6	40.2	344	704	749	YES
Pavers Incorporated	414.0	3098.2	9.0	40.5	41.5	13	730	479	NO
Schering Berlin Polymers	410.7	3098.9	5.7	41.2	41.6	8	732	30	NO
Rinker Cencon Corp	412.4	3099.0	7.4	41.3	42.0	10	739	159	NO
Quikrete of Florida	412.8	3099.0	7.8	41.3	42.0	11	741	253	NO
Zipperer S. Agape Mortuary Services	363.0	3064.7	-42.0	7.0	42.6	279	752	21	NO
Florida M&M	362.2	3066.2	-42.8	8.5	43.6	281	773	21	NO
Alumax Extrusions	385.6	3097.0	-19.4	39.3	43.8	334	777	172	NO
Ero Industries	427.5	3095.6	22.5	37.9	44.1	31	782	33	NO
Citrus Hill Mfg	447.9	3068.3	42.9	10.6	44.2	76	784	66	NO
Florida Brick & Clay Co	384.9	3097.1	-20.1	39.4	44.2	333	785	26	NO
Ridge Cogeneration (b)	416.7	3100.4	11.7	42.7	44.3	15	785	414	NO
Union Camp Corp	402.0	3102.0	-3.0	44.3	44.4	356	788	47	NO
Amcon Concrete	364.0	3075.0	-41.0	17.3	44.5	293	790	39	NO
Erly Juice Inc	399.0	3101.8	-6.0	44.1	44.5	352	790	117	NO
Florida Tile	405.4	3102.4	0.4	44.7	44.7	1	794	309	NO
C-Cure of Florida	386.0	3098.7	-19.0	41.0	45.2	335	804	21	NO
Lakeland City Power Larsen (b)	409.2	3102.8	4.2	45.1	45.3	5	806	107	NO
Monier Roof tile	414.0	3102.5	9.0	44.8	45.7	11	814	44	NO
Driggers Concrete	360.0	3065.9	-45.0	8.2	45.7	280	815	21	NO
Palm Harbor Homes	391.8	3101.5	-13.2	43.8	45.7	343	815	22	NO
Vigoro Industries	427.9	3097.4	22.9	39.7	45.8	30	817	136	NO
Westcon	375.3	3092.8	-29.7	35.1	46.0	320	820	21	NO
TECO Big Bend (b)	361.9	3075.0	-43.1	17.3	46.4	292	829	6,014	YES
Citrus World	441.0	3087.3	36.0	29.6	46.6	51	832	601	NO
IMC-Agrico Chemical Big Bend	362.1	3076.1	-42.9	18.4	46.7	293	834	195	NO

Table 6-3. PM Screening Analysis for the AAQS and PSD Class II Inventories for Hardee Unit 3

Facility/Source Name	UTM E (km)	UTM N (km)	Relative Location to Proposed Facility (km)		Distance to Proposed Facility (km)	Direction (degrees)	Screening Threshold Emissions (TPY) (a)	Maximum Allowable Emissions (TPY)	Included in AAQS and PSD Class II Modeling Analysis?
			X	Y					
Macasphalt	423.1	3101.5	18.1	43.8	47.4	22	848	70	NO
Florida Rock Industry	365.8	3085.0	-39.2	27.3	47.8	305	855	21	NO
Lakeland City Power McIntosh (b)	408.5	3105.8	3.5	48.1	48.2	4	865	15,151	YES
Auburndale Cogeneration (b)	420.8	3103.3	15.8	45.6	48.3	19	865	161	NO
Florida Mining & Materials Alabama Lan	420.8	3103.4	15.8	45.7	48.4	19	867	40	NO
Cargill/Gardinier Fertilizer Riverview	363.4	3082.4	-41.6	24.7	48.4	301	868	880	YES
Owens-Brockway Glass Container	423.4	3102.8	18.4	45.1	48.7	22	874	189	NO
Packaging Corp of America	423.4	3102.8	18.4	45.1	48.7	22	874	38	NO
Coca Cola	421.6	3103.7	16.6	46.0	48.9	20	878	387	NO
Adams Packing Association	421.1	3104.2	16.1	46.5	49.2	19	884	144	NO
Eger Concrete Lake Ida & 5th St	428.1	3102.0	23.1	44.3	50.0	28	899	49	NO
S I Lime Co Division of Longview Lime	362.9	3084.7	-42.1	27.0	50.0	303	900	48	NO
R C Martin Concrete Products	368.6	3092.1	-36.4	34.4	50.1	313	902	28	NO
Graves Enterprises Riverview	363.1	3085.3	-41.9	27.6	50.2	303	903	350	NO
The Florida Brewery	422.8	3104.7	17.8	47.0	50.3	21	905	121	NO
Hillsborough Co Resource Recovery	368.2	3092.7	-36.8	35.0	50.8	314	916	172	NO
John Carlos Florida	426.2	3104.1	21.2	46.4	51.0	25	920	29	NO
Reed Minerals Division	362.2	3085.5	-42.8	27.8	51.0	303	921	70	NO
Eastern Electric Apparatus Repair Cp	366.6	3092.0	-38.4	34.3	51.5	312	930	21	NO
Southeastern Galvanizing Division	368.5	3094.5	-36.5	36.8	51.8	315	937	21	NO
City of Tampa Dept.	364.0	3089.5	-41.0	31.8	51.9	308	938	48	NO
Kearney Development Company	368.7	3094.8	-36.3	37.1	51.9	316	938	21	NO
Gaylord Container Corp	366.3	3092.3	-38.7	34.6	51.9	312	938	108	NO
Southeastern Wire	368.3	3094.5	-36.7	36.8	52.0	315	939	21	NO
GAF Building Materials Corp	362.2	3087.2	-42.8	29.5	52.0	305	940	57	NO
Florida Rock Industries	428.0	3105.2	23.0	47.5	52.8	26	956	55	NO
Leisey Shell Corp	352.7	3064.8	-52.3	7.1	52.8	278	956	20	NO
Nitram	362.5	3089.0	-42.5	31.3	52.8	306	956	218	NO
GNB Inc (PAC CHL)	361.8	3088.3	-43.2	30.6	52.9	305	959	25	NO
Paktank Florida	360.8	3087.3	-44.2	29.6	53.2	304	964	178	NO
Florida Steel Corp	364.6	3092.8	-40.4	35.1	53.5	311	970	144	NO
Amcon Products	364.6	3092.8	-40.4	35.1	53.5	311	970	32	NO
Bay Concrete	365.1	3093.8	-39.9	36.1	53.8	312	976	37	NO
IMC Port Sutton Terminal	360.1	3087.5	-44.9	29.8	53.9	304	978	442	NO
TECO Gannon	360.0	3087.5	-45.0	29.8	54.0	304	979	5,855	YES

Table 6-3. PM Screening Analysis for the AAQS and PSD Class II Inventories for Hardee Unit 3

Facility/Source Name	UTM E (km)	UTM N (km)	Relative Location to Proposed Facility (km)		Distance to Proposed Facility (km)	Direction (degrees)	Screening Threshold Emissions (TPY) (a)	Maximum Allowable Emissions (TPY)	Included in AAQS and PSD Class II Modeling Analysis?
			X	Y					
Florida Mega-Mix	364.5	3093.4	-40.5	35.7	54.0	311	980	22	NO
CSX Transportation Inc	361.0	3089.0	-44.0	31.3	54.0	305	980	404	NO
David J Joseph Co	364.0	3092.9	-41.0	35.2	54.0	311	981	123	NO
The Gibson-Homans	365.5	3094.8	-39.5	37.1	54.2	313	984	21	NO
Holman Inc	359.5	3087.3	-45.5	29.6	54.3	303	986	55	NO
Holman Inc	359.3	3087.1	-45.7	29.4	54.3	303	987	54	NO
Gulf Coast Lead	364.0	3093.5	-41.0	35.8	54.4	311	989	25	NO
Eastern Association Terminal	360.2	3088.9	-44.8	31.2	54.6	305	992	534	NO
Glen-Mar Concrete Products	363.2	3093.3	-41.8	35.6	54.9	310	998	22	NO
<u>Additional Sources Outside 55 km Considered in the Modeling Analysis</u>									
TECO Hooker's Point	358.0	3091.0	-47.0	33.3	57.6	305	1,052	107	NO
LaFarge Corp	357.7	3090.6	-47.3	32.9	57.6	305	1,052	1,207	YES
CF Industries Zephyrhills	388.0	3116.0	-17.0	58.3	60.7	344	1,115	1,006	NO
FPC - Bartow	342.4	3082.6	-62.6	24.9	67.4	292	1,247	9,244	YES
FPC - Higgins	336.5	3098.4	-68.5	40.7	79.7	301	1,494	1,082	NO
FPC - Intercession City (b)	446.3	3126.0	41.3	68.3	79.8	31	1,496	809	NO

Note: All sources with the potential to emit more than 20 TPY of PM, based on maximum allowable within 55km of the proposed facility are included in the screening analysis.

Proposed Facility UTM coordinate 405.0 3057.7
Screening area is a 55 km circle centered on the proposed facility.

- (a) Screening emissions threshold is based on the North Carolina screening method, and is equal to $20 \times [\text{Distance (km) to facility} - 5 \text{ km}]$. A significant impact distance of 5 km was assumed in order to include additional facilities into the inventory. The distance may change pending the final design of the proposed plant.
- (b) PSD sources at this facility.
- (c) Sources within 5 km of the proposed facility are modeled without regard to the screening criteria.

Table 6--4. Summary of Facilities Included in the PSD Class I SO₂ Modeling Analysis for Hardee Unit 3

APIS ID #	Facility Description	UTM Location (km)		Maximum SO ₂ Emissions (TPY)	Distance to Nearest Class I Receptor (km)
		East	North		
40TPA270024	Asphalt Pavers 3	359.9	3162.4	78	20
40TPA270015	Asphalt Pavers 4	361.4	3168.4	78	20
40TPA530221	Auburndale Cogeneration	420.8	3103.3	222	102
NA	Borden Hillsborough	394.6	3069.6	-225	110
NA	Borden Polk	414.5	3109.0	-184	93
40HIL290008	Cargill/Gardinier Riverview	363.4	3082.4	-8430	86
40TPA530046	Cargill/Seminole Bartow	409.8	3087.0	1794	105
40TPA530052	CF Industries Bartow Bonnie Mine Rd	408.4	3082.4	-24445	108
40HIL290005	CF Industries Zephyrhills	388.0	3116.0	-292	69
NA	CLM Chemical	361.8	3088.3	731	80
40TPA510066	Couch Const-Zephyrhills (Asphalt)	390.3	3129.4	123	62
40TPA510041	Couch Const-Odesa (Asphalt)	340.7	3119.5	252	46
	Dris Paving (Asphalt)	340.6	3119.2	8	47
NA	Dolime	404.8	3069.5	-355	116
NA	Estech/Swift Polk	411.5	3074.2	-4853	116
NA	Evans Packing	383.3	3135.8	7	52
40TPA270017	E R Jahna (Lime Dryer)	386.7	3155.8	29	47
40TPA530053	Farmland Industries - Green Bay Plant	409.5	3079.5	1167	111
NA	FDOC Boiler #3	382.2	3166.1	104	40
40TPA270021	FL Crushed Stone Kiln 1	360.0	3162.4	3421	20
40TPA270010	FL Mining and Materials Kiln	356.2	3169.9	50	15
40TPA090004	FPC - Crystal River	334.2	3204.5	-5402	21
30ORL640028	FPC Debary	467.5	3197.2	16213	125
30ORL490014	FPC Intercession City	446.3	3126.0	8162	113
NA	FPC Polk County Site	414.3	3073.9	859	118
NA	General Portland Cement #4	358.0	3090.6	-2190	77
NA	General Portland Cement #5	358.0	3090.6	-2409	77
40HIL290261	Hillsborough Cty RRF	368.2	3092.7	771	78
NA	Hospital Corp of America	333.4	3141.0	6	26
40TPA530057	IMC-Agrico/Conserve Nichols	398.4	3084.2	797	100
40TPA530059	IMC-Agrico New Wales	396.6	3078.9	5050	103
NA	IMC-Agrico Pierce	404.1	3079.0	-1645	108
40TPA530055	IMC-Agrico South Pierce	407.5	3071.3	1471	116
40TPA530080	Imperial Phosphate	404.8	3069.5	-670	116
NA	Kissimmee Utilities	447.7	3127.9	1022	114
30ORL490001	Kissimmee Utilities Exist	460.1	3129.3	1116	125
40TPA530003	Lakeland Utilities Larsen CT	409.2	3102.8	1012	93
40TPA530004	Lakeland Utilities McIntosh 3	408.5	3105.8	17384	91
NA	Lake Cogen	434.0	3198.8	175	93
40HIL290127	McKay Bay RRF	360.0	3091.9	745	76
40TPA530060	Mobil Electrophos Division	405.6	3079.4	-3334	108
40HIL290102	Mobil Big Four Mine /AMAX	394.8	3067.7	589	112
40TPA530047	Mobil-Nichols	398.4	3085.3	-428	99
NA	Mulberry Cogeneration	413.6	3080.6	464	112
40TPA530048	Mulberry Phosphates (Royster)	406.8	3085.1	-7714	104
NA	New Pt Richey Hospital	331.2	3124.5	3	42
NA	Oman Construction	359.8	3164.9	73	20
30ORL480137	Orlando Utilities Commission - Stanton	483.5	3150.6	24083	143
40TPA510028	Overstreet Paving (Asphalt)	355.9	3143.7	128	27
40TPA510056	Pasco Cty RRF	347.1	3139.2	490	27
NA	Pasco Cogen	385.6	3139.0	175	53
40PNL520117	Pinellas RRF	335.3	3084.4	2234	81
30ORL48109	Reedy Creek Energy Services- EPCOT	442.0	3139.0	127	105
30ORL480110	Reedy Creek Energy Services	443.1	3144.3	5	105
NA	Ridge Cogeneration	416.7	3100.4	480	101
40PNL520042	Stauffer Shutdown	325.6	3116.7	-2263	51
40HIL290039	TECO Big Bend	361.9	3075.0	-104320	93

Table 6-4. Summary of Facilities Included in the PSD Class I SO₂ Modeling Analysis for Hardee Unit 3

APIS ID #	Facility Description	<u>UTM Location (km)</u>		Maximum SO ₂ Emissions (TPY)	Distance to Nearest Class I Receptor (km)
		East	North		
NA	TECO Polk Power	402.5	3067.4	2009	116
40TPA250015	TPS - Hardee (295 MW)	404.8	3057.3	2412	126
40TPA530050	US Agri-Chem Bartow	413.2	3086.3	-1579	108
40TPA530051	US Agri-Chem Ft Meade	416.0	3069.0	-160	123

Table 6-5. Property Boundary Receptors Used in the Modeling Analysis

Direction (deg)	Distance (m)	Direction (deg)	Distance (m)
10	212	190	100
20	221	200	104
30	240	210	113
40	328	220	128
50	389	230	152
60	373	240	196
70	344	250	270
80	393	260	258
90	387	270	254
100	393	280	86
110	412	290	44
120	196	300	31
130	152	310	35
140	128	320	87
150	113	330	110
160	104	340	157
170	100	350	185
180	98	360	203

Note: Distances are relative to the midpoint between the locations of the two proposed HRSG stacks.

deg = degree.

m = meter.

Table 6-6. Chassahowitzka Wilderness Area Receptors Used in the Modeling Analysis

UTM Coordinates	
East (km)	North (km)
340.3	3,165.7
340.3	3,167.7
340.3	3,169.8
340.7	3,171.9
342.0	3,174.0
343.0	3,176.2
343.7	3,178.3
342.4	3,180.6
341.1	3,183.4
339.0	3,183.4
336.5	3,183.4
334.0	3,183.4
331.5	3,183.4

Table 6-7. Dimensions of Major Plant Facilities for the Hardee Unit 3 Facility

Facility	Elevation ^a (ft)	Length (ft)	Width (ft)
CT Enclosure	30	110	35
Bypass Stack	75	—	23 ^b
Inlet Air Filter	60	40	40
HRSG Stack	90	—	19 ^b
HRSG	70	122	39
Steam Turbine	53	90	40
Service/Fire Water Tank	45	—	53 ^b
Demineralizer Tank	45	—	57 ^b
Fuel Oil Storage Tank	53	—	125 ^b
Service Building	36	90	90
Warehouse	20	40	80
Covered Laydown	25	25	60
Machine Shop	20	80	60
Water Treatment Building	20	75	40
Circulating Water Chemical Feed	16	50	25
Water Pump Building	16	60	20
Substation Control Building	16	30	15

Note: feet (ft) x 0.3 = meters (m).

^a Above ground surface.

^b Diameter.

Source: Black & Veatch, 1994.

7.0 AIR QUALITY IMPACT ANALYSIS RESULTS

7.1 PROPOSED HARDEE UNIT 3 FACILITY ONLY

7.1.1 LOAD ANALYSIS

Results of the air dispersion modeling analysis of regulated pollutants emitted above the significant emission rates by the proposed Hardee Unit 3 facility for 100 percent, 75 percent, and 50 percent operating loads are presented for the simple cycle and combined cycle operations in Tables 7-1 through 7-3. As discussed in Section 6.0, this analysis was evaluated for fuel oil combustion since the hourly emissions are generally higher with the use of fuel oil than natural gas. The modeling was performed based on the range of operating conditions and ambient temperatures that can produce the highest emissions or lowest flow rate for the proposed turbines. This approach ensured that the maximum impacts from the proposed facility were obtained, particularly for the annual averaging period, since fuel-oil firing will be limited to 2,000 hours per year for the combustion turbine.

The maximum potential impacts for the proposed turbines, based upon an emission rate of 10 g/s (79.365 lb/hr), are presented in Tables 7-1 and 7-2 for the simple cycle and combined cycle operation, respectively. These results are referred to as generic impacts since the emission rates used are not for a specific pollutant. Summaries of the generic impacts produced for each of the five years of modeling are presented in Attachment F. The maximum impacts for a specific pollutant are obtained by multiplying the maximum generic impact by the ratio of the pollutant-specific emission rate to the generic emission rate. For each pollutant, the results are presented for averaging times that are associated with applicable air quality threshold levels or standards, such as significant impact levels, AAQS and PSD increments.

Based upon the results of the generic screening modeling analysis, an overall summary of the maximum predicted impacts are presented for each load in Table 7-3. A review of these results shows that maximum potential pollutant impacts are produced for combined cycle operation. In general, the highest 1-hour, 8-hour, and 24-hour concentrations occur during 50 percent load conditions at an ambient temperature of 95°F; the highest 3-hour and annual concentrations occur during 75 percent load conditions.

The maximum predicted 3-hour, 24-hour and annual average SO₂ concentrations due to the proposed facility are 65.1, 27.8, and 0.18 µg/m³, respectively. Since the 3-hour and 24-hour maximum concentrations are above the significant impact levels, additional modeling analysis is necessary. Although there are slight variations in impacts among the operating loads for the 3-hour, subsequent modeling was performed using the emissions and operating parameters associated with the 50 percent load conditions at an ambient temperature of 95°F. This operating condition produced the highest 24-hour concentration which is higher than the maximum 3-hour concentration produced for other operating conditions relative to the applicable significant impact levels.

The maximum predicted annual NO₂ concentration due to the proposed facility is 0.59 µg/m³. Because this level of impact is below the significant impact levels, no further modeling analysis was performed.

The maximum predicted 1-hour and 8-hour average CO concentrations due to the proposed facility are 255 and 115 µg/m³, respectively. During power augmentation, the maximum 1-hour and 8-hour average concentrations are predicted to be 380 and 168 µg/m³, respectively. These maximum impacts are less than the CO significant impact levels. Because the maximum predicted impacts due to the proposed facility are less than the CO significant impact level, additional modeling is not required for this pollutant.

The maximum predicted 24-hour and annual average PM₁₀ concentrations due to the proposed facility are 21.5 and 0.12 µg/m³, respectively. Since the maximum 24-hour concentrations are above the significant impact levels, additional modeling analysis is necessary. Subsequent modeling was performed using the emissions and operating parameters associated with the 50 percent load conditions at an ambient temperature of 95°F. This operating condition produced the highest 24-hour concentration.

The maximum predicted 24-hour average Be concentration due to the proposed facility is 0.0014 µg/m³, which is above the *de minimis* monitoring concentration. This maximum concentration was predicted for 50-percent operating load; for baseload operation, the maximum predicted concentrations are less than the *de minimis* concentration. Although the maximum concentrations are predicted to be slightly greater than the *de minimis* level, the maximum

concentrations are less than the NTLs. Therefore, preconstruction monitoring is not warranted for this project.

No significance levels have been established for sulfuric acid mist or arsenic. There are also no ambient measurement methods established for these pollutants and, thus, no *de minimis* monitoring concentrations. Therefore, no further PSD modeling analyses were conducted. Sulfuric acid mist, As, and other pollutants were addressed as toxic air pollutants for comparison to the Florida NTLs (refer to Section 7.5).

A load analysis was also performed to determine the maximum SO₂, NO₂, and PM₁₀ concentrations from the proposed turbines in the PSD Class I area. The potential maximum generic impacts, based upon an emission rate of 10 g/s (79.365 lb/hr), are presented in Table 7-4 for the combined cycle operation. Impacts were not predicted for the simple cycle operation since the impacts for this operation are expected to be lower than those produced for the combined cycle operation. Summaries of the generic impacts produced for each of the five years of modeling are presented in Attachment G. For each pollutant, the results are presented for averaging times that are associated with the applicable significant impact levels and PSD increments.

Based upon the results of the generic screening modeling analysis, an overall summary of the maximum predicted impacts are presented for each load in Table 7-5. A review of these results shows that maximum potential pollutant impacts for the proposed turbines are produced during 100 percent load conditions at an ambient temperature of 32°F. Subsequent modeling was performed using the emissions and operating parameters associated with the 100 percent load conditions at an ambient temperature of 32°F.

The maximum predicted 3-hour, 24-hour and annual average SO₂ concentrations due to the proposed facility are 1.9, 0.3, and 0.012 µg/m³, respectively. Since the 3-hour and 24-hour maximum concentrations are above the NPS-significant impact levels of 0.48 and 0.07 µg/m³, respectively, additional modeling analysis was performed.

The maximum predicted annual NO₂ concentration due to the proposed facility is 0.042 µg/m³. This impact was based on the proposed turbines firing fuel oil for every hour in the year.

Subsequent modeling was performed with the 100 percent load conditions at an ambient temperature of 32°F but took into account that fuel oil-firing would occur for a maximum of 1,500 hours and natural gas-firing would occur for remaining hours in the year (i.e., 7,260 hours). The impacts produced for natural gas-firing accounted for 2,000 hours of operating under power augmentation conditions. These results produced a maximum annual impact of 0.022 $\mu\text{g}/\text{m}^3$, which is below the significant impact level of 0.025 $\mu\text{g}/\text{m}^3$; therefore, no further modeling analysis was performed.

The maximum predicted 24-hour and annual average PM10 concentrations due to the proposed facility are 0.2 and 0.008 $\mu\text{g}/\text{m}^3$, respectively. Since these concentrations are below the respective significant impact levels of 0.33 and 0.08 $\mu\text{g}/\text{m}^3$, additional modeling analysis was not necessary.

7.1.2 SIGNIFICANT IMPACT DISTANCE ANALYSIS

Based on the analyses performed in Section 7.1.1, the distances at which the maximum SO₂ and PM10 concentrations for the proposed Hardee Unit 3 were predicted to be below the applicable significant impact levels were developed. Modeling analyses were performed in which the interval between receptor spacing were 100 m. Based on these results, the significant impact distance of SO₂ and PM10 concentrations for the proposed turbines were predicted to be within approximately 1 km. As a result, maximum concentrations developed for comparison to AAQS and PSD Class II increments were predicted within a 1 km radius of the proposed facility and defines the modeling area for the project. Also, SO₂ and PM10 emission inventories were developed for the screening area which extends 50 km beyond the modeling area. For purposes of including more emission sources in the inventories, the significant impact distance was assumed to be 5 km which extended the distance to 55 km at which additional sources were considered in the modeling analyses.

7.2 AAQS ANALYSIS

7.2.1 SO₂ CONCENTRATIONS

The maximum predicted total SO₂ concentrations from the screening analysis for all modeled AAQS sources are presented in Table 7-6. The 3-hour and 24-hour results are based on the maximum concentrations predicted when the Hardee Unit 3 facility was predicted to have significant impacts. The maximum refined SO₂ concentrations for comparison to the AAQS are

presented in Table 7-7. Based upon the refined analysis results, the maximum total predicted SO₂ concentrations, including a non-modeled background concentration are as follows:

406 µg/m³, HSH 3-hour average, or 31 percent of the AAQS of 1,300 µg/m³

138 µg/m³, HSH 24-hour average, or 53 percent of the AAQS of 260 µg/m³

29 µg/m³, annual average, or 48 percent of the AAQS of 60 µg/m³

The AAQS modeling analysis indicates that the SO₂ air quality within the significant impact distance from the proposed plant will be in compliance with the AAQS, when the proposed unit was predicted to have a significant impact. The source contributions to the maximum predicted short-term average concentrations are provided in Attachment H.

Based on the highest predicted impacts of the proposed Hardee Unit 3 facility only (see Table 7-3), the plant will consume the following portions of the SO₂ AAQS:

65.1 µg/m³, 3-hour average, or 5 percent of the AAQS of 1,300 µg/m³

27.8 µg/m³, 24-hour average, or 11 percent of the AAQS of 260 µg/m³

0.18 µg/m³, annual average, or less than 1 percent of the AAQS of 60 µg/m³

Based on these results, the maximum impacts predicted by the proposed plant by itself and together with other emission sources (when the proposed plant's impacts are predicted to be significant), including non-modeled background concentrations, will ensure compliance and maintenance of the AAQS.

7.2.2 PM10 CONCENTRATIONS

The maximum predicted total PM10 concentrations from the screening analysis for all modeled AAQS sources are presented in Table 7-8. The maximum refined PM10 concentrations for comparison to the AAQS are presented in Table 7-9. Based upon the refined analysis results, the maximum total predicted PM10 concentrations, including a non-modeled background concentration are as follows:

101 µg/m³, HSH 24-hour average, or 67 percent of the AAQS of 150 µg/m³

24 µg/m³, annual average, or 48 percent of the AAQS of 50 µg/m³

The AAQS modeling analysis, therefore, indicates that the PM10 air quality within the significant impact distance from the proposed plant will be in compliance with the AAQS.

Based on the highest predicted impacts of the proposed Hardee Unit 3 facility only (see Table 7-3), the plant will consume the following portions of the PM10 AAQS:

21.5 $\mu\text{g}/\text{m}^3$, 24-hour average, or 15 percent of the AAQS of 150 $\mu\text{g}/\text{m}^3$

0.12 $\mu\text{g}/\text{m}^3$, annual average, or less than 1 percent of the AAQS of 50 $\mu\text{g}/\text{m}^3$

Based on these results, the maximum impacts predicted by the proposed plant by itself and together with other emission sources, including non-modeled background concentrations, will ensure compliance and maintenance of the AAQS.

7.3 PSD CLASS II ANALYSIS

7.3.1 SO₂ CONCENTRATIONS

Results of the PSD Class II screening analysis are presented in Table 7-10. The 3-hour and 24-hour results are based on the maximum concentrations predicted when the proposed Hardee Unit 3 was predicted to have a significant impact. Based on the screening analysis, refined modeling analyses were performed with the results presented in Table 7-11. The maximum predicted Class II increment consumptions due to all increment-consuming sources from the refined analyses are:

150 $\mu\text{g}/\text{m}^3$, HSH 3-hour average, or 29 percent of the allowable increment of 512 $\mu\text{g}/\text{m}^3$

45.4 $\mu\text{g}/\text{m}^3$, HSH 24-hour average, or 50 percent of the allowable increment of 91 $\mu\text{g}/\text{m}^3$

-4.0 $\mu\text{g}/\text{m}^3$, annual average, or less than 0 percent of the allowable increment of 20 $\mu\text{g}/\text{m}^3$

The PSD Class II modeling analysis indicates that the predicted maximum annual concentrations will be in compliance with the annual PSD Class II increment, when the proposed unit was predicted to have a significant impact. The source contributions to the maximum predicted short-term average concentrations are provided in Attachment H.

Based on the highest predicted impacts of the proposed Hardee Unit 3 facility only (see Table 7-3), the plant will consume the following portions of the PSD Class II increments:

65.1 $\mu\text{g}/\text{m}^3$, 3-hour average, or 13 percent of the allowable increment of 512 $\mu\text{g}/\text{m}^3$.

27.8 $\mu\text{g}/\text{m}^3$, 24-hour average, or 31 percent of the allowable increment of 91 $\mu\text{g}/\text{m}^3$.

0.18 $\mu\text{g}/\text{m}^3$, annual average, or less than 1 percent of the allowable increment of 20 $\mu\text{g}/\text{m}^3$.

Based on these results, the maximum impacts predicted by the proposed plant by itself and together with other emission sources (when the proposed plant's impacts are predicted to be significant) will ensure compliance and maintenance of PSD Class II increments.

7.3.2 PM10 CONCENTRATIONS

Results of the PSD Class II screening analysis are presented in Table 7-12. Based on the screening analysis, refined modeling analyses were performed with the results presented in Table 7-13. The maximum predicted Class II increment consumptions due to all increment consuming sources from the refined analysis are:

14 $\mu\text{g}/\text{m}^3$, HSH 24-hour average, or 47 percent of the allowable increment of 30 $\mu\text{g}/\text{m}^3$
0.6 $\mu\text{g}/\text{m}^3$, annual average, or 4 percent of the allowable increment of 17 $\mu\text{g}/\text{m}^3$

Based on the highest predicted impacts of the proposed Hardee Unit 3 facility only (see Table 7-3), the plant will consume the following portions of the PSD Class II increments:

21.5 $\mu\text{g}/\text{m}^3$, 24-hour average, or 72 percent of the allowable increment of 30 $\mu\text{g}/\text{m}^3$
0.12 $\mu\text{g}/\text{m}^3$, annual average, or less than 1 percent of the allowable increment of 17 $\mu\text{g}/\text{m}^3$

Based on these results, the maximum impacts predicted by the proposed plant by itself and together with other emission sources will ensure compliance and maintenance of PSD Class II increments.

7.4 SO₂ PSD CLASS I ANALYSIS

7.4.1 ISCST2 MODEL RESULTS

The maximum potential impacts from the proposed Hardee Unit 3 facility only was determined at the PSD Class I area of the Chassahowitzka NWA for SO₂, NO₂, PM(TSP), and PM10 concentrations (see Table 7-5). The maximum impacts for each pollutant were compared to the NPS-recommended significant impact levels for PSD Class I areas. The results indicated that SO₂ is the only pollutant that is predicted to exceed the NPS-recommended significant impact levels. Based on these results, a PSD Class I impact assessment for SO₂ concentrations was performed with other PSD increment consuming sources to determine compliance with allowable PSD Class I increments.

The results of the Class I screening analysis are presented in Table 7-14. The results indicate the maximum PSD increment consumed at the PSD Class I areas is predicted to be above the allowable PSD Class I increments for 3-hour and 24-hour averaging periods.

The maximum predicted Class I increment consumption due to all increment consuming sources from the refined analysis is:

- 26.4 $\mu\text{g}/\text{m}^3$, HSH 3-hour average, or 106 percent of the allowable increment of 25 $\mu\text{g}/\text{m}^3$
- 6.4 $\mu\text{g}/\text{m}^3$, HSH 24-hour average, or 130 percent of the allowable increment of 5 $\mu\text{g}/\text{m}^3$
- 0.3 $\mu\text{g}/\text{m}^3$, annual average, or less than 15 percent of the allowable increment of 2 $\mu\text{g}/\text{m}^3$

Based on the highest predicted impacts of the proposed Hardee Unit 3 facility only (see Table 7-5), the plant will consume the following portions of the PSD Class I increments:

- 1.9 $\mu\text{g}/\text{m}^3$, 3-hour average, or 8 percent of the allowable increment of 25 $\mu\text{g}/\text{m}^3$
- 0.3 $\mu\text{g}/\text{m}^3$, 24-hour average, or 6 percent of the allowable increment of 5 $\mu\text{g}/\text{m}^3$
- 0.012 $\mu\text{g}/\text{m}^3$, annual average, or less than 1 percent of the allowable increment of 2 $\mu\text{g}/\text{m}^3$

Additional modeling was performed with the ISCST2 model to determine the number of potential violations of the 3-hour and 24-hour PSD Class I increments and proposed project's contribution to those predicted violations. A summary of the results that show the number of predicted violations and the project's predicted contributions to those violations is presented in Table 7-15. Based on these results, additional modeling was performed using the MESOPUFF II model for the proposed project and other PSD emission sources located more than 50 km from the PSD Class I area. These results were added to the ISCST2 model results for sources located within 50 km of the Class I area to produce the total PSD Class I increment consumption.

7.4.2 MODEL RESULTS WITH THE MESOPUFF II MODEL

A summary of the maximum SO_2 concentrations predicted for the proposed Hardee Unit 3 plant at the PSD Class I area using the MESOPUFF II model is presented in Table 7-16. The MESOPUFF II results indicate that, for the periods during which the ISCST2 model predicted potential violations and the proposed project's contribution was greater than the NPS- significant impact levels, the proposed project's impacts are less the significant impact levels. When the proposed source was modeled for 1 year with the MESOPUFF II model, there were no 3-hour and only one 24-hour periods during which the proposed source was predicted to have a

significant impact. When other sources were modeled for this period (i.e., using the MESOPUFF II model for the PSD emission sources located more than 50 km and the ISCST2 model for sources located within 50 km of the Class I area), the total impacts were predicted to be less than the PSD Class I increment.

Based on these results, the maximum impacts predicted by the proposed Hardee Unit 3 facility by itself and together with other emission sources will ensure compliance and maintenance of PSD Class I increments.

7.5 TOXIC AIR POLLUTANTS

The maximum impacts of regulated and nonregulated toxic air pollutants that will be emitted by the proposed Hardee Unit 3 plant are presented in Table 7-17. These impacts represent the highest impacts predicted from the screening analysis for the combined cycle operation at 100, 75, and 50 percent load and for ambient temperatures of 32°F and 95°F.

The maximum 8-hour, 24-hour, and annual concentrations are compared to the Florida NTLs. As shown, the predicted impacts are below the NTLs for all pollutants and averaging times, except for sulfuric acid mist for the 8-hour and 24-hour averaging periods. The NTLs are not environmental standards but, rather, evaluation tools to determine if an apparent threat to the public health may exist. For sulfuric acid mist, the maximum concentrations are predicted to occur during 75-percent and 50-percent operating loads at locations along the fenced property around the Hardee Unit 3 site. Since the emission estimates are based on conservative assumptions (more than 10 percent of the SO₂ is assumed to be converted to sulfuric acid mist) and impacts at locations off of SECI's property will be much lower than the NTLs (where the public health would be of greatest concern), the predicted sulfuric acid mist impacts due to the proposed facility are not expected to pose a threat to public health. Therefore, the emissions from the proposed facility are not expected to pose a significant health risk to the public.

Table 7-1. Maximum Predicted Air Impact Analysis for the Proposed Hardee Unit 3, Simple Cycle--Westinghouse 501F, Distillate Oil at 100 Percent, 75 Percent and 50 Percent Loads

Pollutant	Emission Data (lb/hr)		Averaging Period	Maximum Predicted Impacts (ug/m³)		De Minimis Monitoring Concentration (ug/m³)	Significant Impact Level (ug/m³)
	32 °F	95 °F		32 °F	95 °F		
<u>100 Percent Operating Load</u>							
Generic	79.37	79.37	1-hour	8.39	17.39	--	--
			3-hour	3.70	8.66	--	--
			8-hour	1.39	3.31	--	--
			24-hour	0.55	1.54	--	--
			Annual	0.0079	0.0073	--	--
Sulfur Dioxide	200.4	170.2	3-hour	9.3	18.6	NA	25
			24-hour	1.4	3.3	13	5
			Annual	0.020	0.016	NA	1
Nitrogen Oxides	699.2	399.1	Annual	0.070	0.037	14	1
Carbon Monoxide	181.6	151.6	1-hour	19.2	33.2	NA	2,000
			8-hour	3.2	6.3	575	500
Particulate Matter	134.1	113.0	24-hour	0.93	2.19	10	5
			Annual	0.013	0.010	NA	1
Arsenic	0.0193	0.0164	24-hour	0.0001	0.0003	NE	NA
Beryllium	0.00986	0.00838	24-hour	0.0001	0.0002	0.001	NA
Sulfuric Acid Mist	30.7	26.1	24-hour	0.21	0.51	NM	NA
<u>75 Percent Operating Load</u>							
Generic	79.37	79.37	1-hour	27.08	37.93	--	--
			3-hour	14.63	21.25	--	--
			8-hour	5.73	8.58	--	--
			24-hour	3.00	4.95	--	--
			Annual	0.0092	0.015	--	--
Sulfur Dioxide	161.4	137.9	3-hour	29.7	36.9	NA	25
			24-hour	6.1	8.6	13	5
			Annual	0.019	0.026	NA	1
Nitrogen Oxides	536.0	316.5	Annual	0.062	0.060	14	1
Carbon Monoxide	171.8	152.2	1-hour	58.6	72.7	NA	2,000
			8-hour	12.4	16.5	575	500
Particulate Matter	107.8	94.6	24-hour	4.1	5.9	10	5
			Annual	0.012	0.018	NA	1

Table 7-1. Maximum Predicted Air Impact Analysis for the Proposed Hardee Unit 3, Simple Cycle--Westinghouse 501F, Distillate Oil at 100 Percent, 75 Percent and 50 Percent Loads

Pollutant	Emission Data (lb/hr)		Averaging Period	Maximum Predicted Impacts (ug/m ³)		De Minimis Monitoring Concentration (ug/m ³)	Significant Impact Level (ug/m ³)
	32 °F	95 °F		32 °F	95 °F		
Arsenic	0.0156	0.0133	24-hour	0.0006	0.0008	NE	NA
Beryllium	0.00794	0.00679	24-hour	0.0003	0.0004	0.001	NA
Sulfuric Acid Mist	24.7	21.1	24-hour	0.93	1.32	NM	NA
<u>50 Percent Operating Load</u>							
Generic	79.37	79.37	1-hour	53.96	65.40	--	--
			3-hour	30.27	36.71	--	--
			8-hour	12.75	16.63	--	--
			24-hour	8.00	10.73	--	--
			Annual	0.026	0.036	--	--
Sulfur Dioxide	116.5	101.6	3-hour	44.4	47.0	NA	25
			24-hour	11.7	13.7	13	5
			Annual	0.038	0.046	NA	1
Nitrogen Oxides	398.1	240.4	Annual	0.13	0.11	14	1
Carbon Monoxide	234.2	205.6	1-hour	159.2	169.4	NA	2,000
			8-hour	37.6	43.1	575	500
Particulate Matter	89.9	78.6	24-hour	9.1	10.6	10	5
			Annual	0.029	0.036	NA	1
Arsenic	0.0112	0.0098	24-hour	0.0011	0.0013	NE	NA
Beryllium	0.00573	0.00500	24-hour	0.0006	0.0007	0.001	NA
Sulfuric Acid Mist	17.8	15.6	24-hour	1.80	2.10	NM	NA

Note: NA = not applicable; NM = no ambient measurement method; NE = no monitoring method yet established.

Table 7-2. Maximum Predicted Air Impact Analysis for the Proposed Hardee Unit 3, Combined Cycle--Westinghouse 501F, Distillate Oil, at 100 Percent, 75 Percent, and 50 Percent Loads

Pollutant	Emission Data (lb/hr)		Averaging Period	Maximum Predicted Impacts (ug/m³)		De Minimis Monitoring Concentration (ug/m³)	Significant Impact Level (ug/m³)
	32 °F	95 °F		32 °F	95 °F		
<u>100 Percent Operating Load</u>							
Generic	79.37	79.37	1-hour	27.26	47.62	--	--
			3-hour	12.65	22.61	--	--
			8-hour	7.51	16.02	--	--
			24-hour	3.27	7.03	--	--
			Annual	0.065	0.078	--	--
Sulfur Dioxide	200.4	170.2	3-hour	31.9	48.5	NA	25
			24-hour	8.3	15.1	13	5
			Annual	0.16	0.17	NA	1
Nitrogen Oxides	699.2	399.1	Annual	0.57	0.39	14	1
Carbon Monoxide (a)	181.6	151.6	1-hour	62.4	91.0	NA	2,000
			8-hour	17.2	30.6	575	500
Particulate Matter	134.1	113.0	24-hour	5.53	10.01	10	5
			Annual	0.11	0.11	NA	1
Arsenic	0.0193	0.0164	24-hour	0.0008	0.0015	NE	NA
Beryllium	0.00986	0.00838	24-hour	0.0004	0.0007	0.001	NA
Sulfuric Acid Mist	44.5	37.8	24-hour	1.83	3.35	NM	NA
<u>75 Percent Operating Load</u>							
Generic	79.37	79.37	1-hour	63.70	77.47	--	--
			3-hour	30.54	37.44	--	--
			8-hour	23.92	31.48	--	--
			24-hour	10.74	14.55	--	--
			Annual	0.088	0.097	--	--
Sulfur Dioxide	161.4	137.9	3-hour	62.1	65.1	NA	25
			24-hour	21.8	25.3	13	5
			Annual	0.18	0.17	NA	1
Nitrogen Oxides	536.0	316.5	Annual	0.59	0.39	14	1
Carbon Monoxide	171.8	152.2	1-hour	137.9	148.6	NA	2,000
			8-hour	51.8	60.4	575	500
Particulate Matter	107.8	94.6	24-hour	14.6	17.3	10	5
			Annual	0.12	0.12	NA	1

Table 7-2. Maximum Predicted Air Impact Analysis for the Proposed Hardee Unit 3, Combined Cycle--Westinghouse 501F, Distillate Oil, at 100 Percent, 75 Percent, and 50 Percent Loads

Pollutant	Emission Data (lb/hr)		Averaging Period	Maximum Predicted Impacts (ug/m ³)		De Minimis Monitoring Concentration (ug/m ³)	Significant Impact Level (ug/m ³)
	32 °F	95 °F		32 °F	95 °F		
Arsenic	0.0156	0.0133	24-hour	0.0021	0.0024	NE	NA
Beryllium	0.00794	0.00679	24-hour	0.0011	0.0012	0.001	NA
Sulfuric Acid Mist	35.8	30.6	24-hour	4.84	5.61	NM	NA
<u>50 Percent Operating Load</u>							
Generic	79.37	79.37	1-hour	84.67	98.55	--	--
			3-hour	41.09	48.18	--	--
			8-hour	35.71	44.35	--	--
			24-hour	16.81	21.70	--	--
			Annual	0.103	0.115	--	--
Sulfur Dioxide	116.5	101.6	3-hour	60.3	61.7	NA	25
			24-hour	24.7	27.8	13	5
			Annual	0.15	0.15	NA	1
Nitrogen Oxides	398.1	240.4	Annual	0.52	0.35	14	1
Carbon Monoxide	234.2	205.6	1-hour	249.9	255.3	NA	2,000
			8-hour	105.4	114.9	575	500
Particulate Matter	89.9	78.6	24-hour	19.0	21.5	10	5
			Annual	0.12	0.11	NA	1
Arsenic	0.0112	0.0098	24-hour	0.0024	0.0027	NE	NA
Beryllium	0.00573	0.00500	24-hour	0.0012	0.0014	0.001	NA
Sulfuric Acid Mist	25.9	22.6	24-hour	5.49	6.18	NM	NA

Note: NA = not applicable; NM = no ambient measurement method; NE = no monitoring method yet established.

- (a) During power augmentation (80°F), the maximum 1-hour and 8-hour average concentrations are predicted to be 380 and 168 ug/m³, respectively, with an emission rate of 313.4 lb/hr.

Table 7-3. Summary of Maximum Predicted Impacts for the Proposed Hardee Unit 3, Combined and Simple Cycle--Westinghouse 501F, Distillate Oil at 100 Percent, 75 Percent, and 50 Percent Operating Loads

Pollutant	Averaging Period	Maximum Predicted Impacts (ug/m³)						De Minimis Monitoring Concentration (ug/m³)	Significant Impact Level (ug/m³)
		100 Percent Load		75 Percent Load		50 Percent Load			
		32 °F	95 °F	32 °F	95 °F	32 °F	95 °F		
<u>Combined Cycle</u>									
Sulfur Dioxide	3-hour	31.9	48.5	62.1	65.1	60.3	61.7	NA	25
	24-hour	8.3	15.1	21.8	25.3	24.7	27.8	13	5
	Annual	0.16	0.17	0.18	0.17	0.15	0.15	NA	1
Nitrogen Oxides	Annual	0.57	0.39	0.59	0.39	0.52	0.35	14	1
Carbon Monoxide (a)	1-hour	62.4	91.0	137.9	148.6	249.9	255.3	NA	2,000
	8-hour	17.2	30.6	51.8	60.4	105.4	114.9	575	500
Particulate Matter	24-hour	5.5	10.0	14.6	17.3	19.0	21.5	10	5
	Annual	0.11	0.11	0.12	0.12	0.12	0.11	NA	1
Arsenic	24-hour	0.0008	0.0015	0.0021	0.0024	0.0024	0.0027	NE	NA
Beryllium	24-hour	0.0004	0.0007	0.0011	0.0012	0.0012	0.0014	0.001	NA
Sulfuric Acid Mist	24-hour	1.83	3.35	4.84	5.61	5.49	6.18	NM	NA
<u>Simple Cycle</u>									
Sulfur Dioxide	3-hour	9.3	18.6	29.7	36.9	44.4	47.0	NA	25
	24-hour	1.4	3.3	6.1	8.6	11.7	13.7	13	5
	Annual	0.02	0.02	0.02	0.03	0.04	0.05	NA	1
Nitrogen Oxides	Annual	0.07	0.04	0.06	0.06	0.13	0.11	14	1
Carbon Monoxide	1-hour	19.2	33.2	58.6	72.7	159.2	169.4	NA	2,000
	8-hour	3.2	6.3	12.4	16.5	37.6	43.1	575	500
Particulate Matter	24-hour	0.9	2.2	4.1	5.9	9.1	10.6	10	5
	Annual	0.01	0.01	0.01	0.02	0.03	0.04	NA	1
Arsenic	24-hour	0.0001	0.0003	0.0006	0.0008	0.0011	0.0013	NE	NA
Beryllium	24-hour	0.0001	0.0002	0.0003	0.0004	0.0006	0.0007	0.001	NA
Sulfuric Acid Mist	24-hour	0.21	0.51	0.93	1.32	1.80	2.10	NM	NA

Note: NA= not applicable; NM= no ambient measurement method; NE= no monitoring method yet established.

(a) During power augmentation (80°F), the maximum 1-hour and 8-hour average concentrations are predicted to be 380 and 168 ug/m³, respectively, with an emission rate of 313.4 lb/hr.

Table 7-4. Maximum Predicted Air Impact Analysis for the Proposed Hardee Unit 3, Combined Cycle at the PSD Class I Area - Westinghouse 501F, Distillate Oil, at 100 Percent, 75 Percent and 50 Percent Loads

Pollutant	Emission Data		Averaging Period	Maximum Predicted Impacts		Significant Impact Level (ug/m³)
	(lb/hr)			(ug/m³)		
	32 °F	95 °F		32 °F	95 °F	
<u>100 Percent Operating Load</u>						
Generic	79.37	79.37	1-hour	1.144	1.238	--
			3-hour	0.763	0.825	--
			8-hour	0.379	0.465	--
			24-hour	0.121	0.130	--
			Annual	0.005	0.005	--
Sulfur Dioxide	200.4	170.2	3-hour	1.9	1.8	0.48
			24-hour	0.30	0.28	0.07
			Annual	0.012	0.011	0.025
Nitrogen Oxides	699.2	399.1	Annual	0.042	0.026	0.025
Particulate Matter	134.1	113.0	24-hour	0.20	0.19	0.33
			Annual	0.008	0.007	0.08
<u>75 Percent Operating Load</u>						
Generic	79.37	79.37	1-hour	1.304	1.362	--
			3-hour	0.870	0.908	--
			8-hour	0.490	0.510	--
			24-hour	0.137	0.143	--
			Annual	0.005	0.006	--
Sulfur Dioxide	161.4	137.9	3-hour	1.8	1.6	0.48
			24-hour	0.28	0.25	0.07
			Annual	0.011	0.010	0.025
Nitrogen Oxides	536.0	316.5	Annual	0.037	0.023	0.025
Particulate Matter	107.8	94.6	24-hour	0.19	0.17	0.33
			Annual	0.007	0.007	0.08
<u>50 Percent Operating Load</u>						
Generic	79.37	79.37	1-hour	1.393	1.502	--
			3-hour	0.929	1.002	--
			8-hour	0.521	0.542	--
			24-hour	0.147	0.164	--
			Annual	0.006	0.006	--
Sulfur Dioxide	116.5	101.6	3-hour	1.4	1.3	0.48
			24-hour	0.22	0.21	0.07
			Annual	0.008	0.008	0.025
Nitrogen Oxides	398.1	240.4	Annual	0.029	0.018	0.025
Particulate Matter	89.9	78.6	24-hour	0.17	0.16	0.33
			Annual	0.007	0.006	0.08

Table 7-5. Summary of Maximum Predicted Impacts for the Proposed Hardee Unit 3, Combined Cycle, at the PSD Class I Area—Westinghouse 501F, Distillate Oil at 100 Percent, 75 Percent, and 50 Percent Operating Loads

Pollutant	Averaging Period	Maximum Predicted Impacts (ug/m³)						Significant Impact Level (ug/m³)
		100 Percent Load		75 Percent Load		50 Percent Load		
		32 °F	95 °F	32 °F	95 °F	32 °F	95 °F	
<u>Combined Cycle</u>								
Sulfur Dioxide	3-hour	1.9	1.8	1.8	1.6	1.4	1.3	0.48
	24-hour	0.30	0.28	0.28	0.25	0.22	0.21	0.07
	Annual	0.012	0.011	0.011	0.010	0.008	0.008	0.025
Nitrogen Oxides	Annual	0.042 (a)	0.026	0.037	0.023	0.029	0.018	0.025
Particulate Matter	24-hour	0.20	0.19	0.19	0.17	0.17	0.16	0.33
	Annual	0.008	0.007	0.007	0.007	0.007	0.006	0.08

(a) Subsequent modeling was performed to account for fuel oil—firing for 1,500 hours and natural gas—firing for 7,260 hours, including 2,000 hours for power augmentation. The maximum annual impact was predicted to be 0.022 ug/m³ by adding: (0.042 ug/m³ x 1,500/8,760 hrs) [oil] + (0.016 ug/m³ x 5,760/8,760 hrs) [gas] + (0.019 ug/m³ x 2,000/8,760 hrs) [power augmentation]. The impacts for other temperatures and operating loads would be lower.

Table 7-6. Maximum Predicted SO₂ Concentrations for the AAQS Screening Analysis

Averaging Time	Modeled Sources' Concentration (µg/m ³)	Receptor Location ^a		Period Ending (YYMMDDHH)
		Direction (degrees)	Distance (m)	
Annual	15	70	1,000	82-----
	17	20	1,000	83-----
	18	90	1,000	84-----
	18	80	1,000	85-----
	18	90	1,000	86-----
24-Hour HSH	35.7	130	200	82011424
	74.3	120	196	83020324
	85.4	130	200	84032924
	88.3	120	196	85021224
	NS	--	--	86-----
3-Hour HSH	97.5	130	152	82011418
	30.5	350	185	83040212
	137	140	128	84032915
	142	20	221	85083121
	48.6	10	212	86031412

Note: YY = year.
MM = month.
DD = day.
HH = hour.
HSH = highest, second-highest.
NS = not significant, Hardee Unit 3.

^a Relative to the midpoint between the locations of the two proposed HRSG stacks.

Table 7-7. Maximum Predicted SO₂ Concentrations Compared With AAQS--Refined Analysis

Averaging Time	Year	Concentration ($\mu\text{g}/\text{m}^3$)			Receptor Location*		Period Ending (YYMMDDHH)	Florida AAQS ($\mu\text{g}/\text{m}^3$)
		Total	Modeled Sources	Background	Direction (degrees)	Distance (m)		
Annual	1984	29	18	11	90	1,000	84-----	60
24-Hour HSH	1983	125	75.1	50	124	175	83020324	260
	1984	138	87.9	50	136	136	84032924	
	1985	138	88.3	50	120	196	85021224	
3-Hour HSH	1982	356	99.6	256	132	146	82011418	1,300
	1984	397	141	256	138	132	84032915	
	1985	406	150	256	16	217	85083121	

Note: YY = year.
MM = month.
DD = day.
HH = hour.
HSH = highest, second-highest.

* Relative to the midpoint between the locations of the two proposed HRSG stacks.

Source: KBN, 1994.

Table 7-8. Maximum Predicted PM10 Concentrations for the AAQS Screening Analysis

Averaging Time	Concentration ($\mu\text{g}/\text{m}^3$)	Receptor Location*		Period Ending (YYMMDDHH)
		Direction (degrees)	Distance (m)	
Annual	4	320	1,000	82-----
	4	10	1,000	83-----
	4	340	1,000	84-----
	4	360	1,000	85-----
	4	350	1,000	86-----
24-Hour HSH	20	100	1,000	82031224
	31	30	1,000	83041724
	26	350	600	84030824
	21	360	203	85083124
	26	10	1,000	86042324

Note: YY = year.
MM = month.
DD = day.
HH = hour.
HSH = highest, second-highest.

* Relative to the midpoint between the locations of the two proposed HRSG stacks.

Table 7-9. Maximum Predicted PM10 Concentrations Compared With AAQS--Refined Analysis

Averaging Time	Year	Concentration ($\mu\text{g}/\text{m}^3$)			Receptor Location*		Period Ending (YYMMDDHH)	Florida AAQS ($\mu\text{g}/\text{m}^3$)
		Total	Modeled Sources	Background	Direction (degrees)	Distance (m)		
Annual	1984	24	4	20	336	1,000	84-----	50
	1986	24	4	20	352	1,000	86-----	
24-Hour HSH	1983	101	31	70	30	1,000	83041724	150
	1984	96	26	70	352	800	84030824	

Note: YY = year.
MM = month.
DD = day.
HH = hour.
HSH = highest, second-highest.

* Relative to the midpoint between the locations of the two proposed HRSG stacks.

Source: KBN, 1994.

Table 7-10. Maximum Predicted SO₂ Concentrations for the PSD Class II Screening Analysis

Averaging Time	Modeled Source Concentration ($\mu\text{g}/\text{m}^3$)	Receptor Location ^a		Period Ending (YYMMDDHH)
		Direction (degrees)	Distance (m)	
Annual	-5	90	1,000	82-----
	-5	90	1,000	83-----
	-6	180	500	84-----
	-4	90	1,000	85-----
	-5	100	1,000	86-----
24-Hour HSH	6.9	130	200	82011424
	-6.0	120	196	83020324
	22.6	140	128	84022824
	45.4	360	203	85083124
	NS	--	--	86-----
3-Hour HSH	44.9	130	220	82011415
	30.4	350	185	83040212
	61.0	120	196	84022812
	141	20	221	85083121
	9.4	10	212	86031412

Note: YY = year.

MM = month.

DD = day.

HH = hour.

HSH = highest, second-highest.

NS = not significant, Hardee Unit 3.

^a Relative to the midpoint between the locations of the two proposed HRSG stacks.

Table 7-11. Maximum Predicted SO₂ Concentrations Compared with PSD Class II Increments--
Refined Analysis

Averaging Time	Modeled Source Concentration ($\mu\text{g}/\text{m}^3$)	Receptor Location ^a		Period Ending (YYMMDDHH)	Allowable PSD Increment ($\mu\text{g}/\text{m}^3$)
		Direction (degrees)	Distance (m)		
Annual	-4	90	1,000	85-----	20
24-Hour HSH	45.4	360	203	85083124	91
3-Hour HSH	150	16	217	85083121	512

Note: YY = year.
MM = month.
DD = day.
HH = hour.
HSH = highest, second-highest.

^a Relative to the midpoint between the locations of the proposed HRSG stacks.

Table 7-12. Maximum Predicted PM PSD Class II Increment Consumption - Screening Analysis

Averaging Time	Concentration ($\mu\text{g}/\text{m}^3$)	Receptor Location ^a		Period Ending (YYMMDDHH)
		Direction (degrees)	Distance (m)	
Annual	0.5	70	1,000	82----
	0.6	310	1,000	83----
	0.6	320	1,000	84----
	0.5	30	1,000	85----
	0.5	70	1,000	86----
24-Hour HSH	6	130	200	82121824
	7	30	1,000	83041724
	11	130	200	84032924
	6	360	203	85121824
	6	150	1,000	86123024

Note: YY = year.
MM = month.
DD = day.
HH = hour.
HSH = highest, second-highest.

^a Relative to the midpoint of the locations of the proposed HRSG stacks.

Table 7-13. Maximum PM10 Concentrations Compared With PSD Class II Increments--Refined Analysis

Averaging Time	Concentration ($\mu\text{g}/\text{m}^3$)	Receptor Location ^a		Period Ending (YYMMDDHH)	Allowable PSD Increment ($\mu\text{g}/\text{m}^3$)
		Direction (degrees)	Distance (m)		
Annual	0.6	140	128	84-----	17
24-Hour HSH	14	136	136	84032924	30

Note: YY = year.
MM = month.
DD = day.
HH = hour.
HSH = highest, second-highest.

^a Relative to the midpoint between the locations of the two proposed HRSG stacks.

Table 7-14. Maximum SO₂ Concentrations Compared with PSD Class I Increments

Averaging Time	Concentration (µg/m ³)	Receptor Location ^a		Period Ending (YYMMDDHH)	Allowable PSD Increment (µg/m ³)
		UTM-E (m)	UTM-N (m)		
Annual	-0.4	341100	3183400	82-----	2
	-0.6	341100	3183400	83-----	
	0.3	343700	3178300	84-----	
	-0.4	340300	3165700	85-----	
	-0.3	342000	3174000	86-----	
24-Hour HSH	5.7	340700	3171900	82071524	5
	5.4	340300	3165700	83103024	
	5.4	342000	3174000	84061724	
	5.5	340300	3169800	85112724	
	6.4	343000	3176200	86053124	
3-Hour HSH	22.1	340300	3169800	82011724	25
	21.7	340300	3167700	83081006	
	18.4	340300	3169800	84071703	
	21.3	339000	3183400	85110806	
	26.4	341100	3183400	86111706	

Note: YY = year.
MM = month.
DD = day.
HH = hour.
HSH = highest, second-highest.

^a All receptor coordinates are reported in Universal Transverse Mercator (UTM) coordinates.

Table 7-15. Predicted 3-Hour and 24-Hour Violations of the SO₂ PSD Class I Increments and Source Contributions from the Proposed Facility

<u>Date Ending</u>		<u>Receptor UTM Location (km)</u>		<u>Predicted Impacts (ug/m³) (a)</u>		
<u>Year</u>	<u>Date (MM/DD)</u>	<u>(E)</u>	<u>(N)</u>	<u>Total Impact</u>	<u>Contribution from Proposed</u>	
					<u>ISCST2</u>	<u>MESOPUFF 5.10 (b)</u>
<u>24-Hour</u>						
1982	6/10	340300	3169800	5.45	0.232	0.004
1982	6/10	340300	3167700	5.08	0.216	0.004
1982	7/15	340700	3171900	5.65	0	NA
1982	9/9	340700	3171900	5.27	0.011	NA
1983	7/30	340300	3165700	5.12	0.005	NA
1983	7/30	340300	3167700	5.06	0.005	NA
1983	10/30	340300	3165700	5.39	0	NA
1984	3/23	340300	3169800	5.09	0.024	NA
1984	3/23	340300	3167700	5.20	0.03	NA
1984	6/17	342000	3174000	5.40	0	NA
1985	11/12	340300	3167700	5.48	0	NA
1985	11/12	340700	3171900	5.14	0	NA
1985	11/16	340300	3165700	5.54	0	NA
1985	11/27	340300	3169800	5.55	0	NA
1986	2/1	340300	3165700	5.72	0	NA
1986	2/1	340300	3169800	5.45	0	NA
1986	3/8	343000	3176200	5.11	0	NA
1986	5/31	343000	3176200	6.42	0.217	0.0001
1986	6/1	340700	3171900	5.32	0	NA
1986	6/1	342000	3174000	6.15	0	NA
1986	6/1	343000	3176200	5.56	0	NA
1986	6/14	340300	3167700	5.14	0.150	0.002
1986	6/24	340700	3171900	5.20	0.098	0.001
1986	7/5	342000	3174000	5.46	0.061	NA
1986	7/12	339000	3183400	5.14	0.19	0.0002
1986	9/27	340300	3169800	5.35	0	NA
1986	9/27	340700	3171900	5.22	0	NA
1986	11/5	340700	3171900	5.54	0	NA
1986	11/5	342000	3174000	5.16	0	NA
1986	11/7	340300	3165700	5.26	0.008	NA
1986	11/11	343700	3178300	5.13	0	NA
1986	12/19	342000	3174000	5.20	0.065	NA
1986	12/19	343000	3176200	5.69	0.065	NA
<u>3-Hour</u>						
1986	11/17	341100	3183400	26.4	0.788	0.0002

Note: The 3-hour and 24-hour PSD Class I increments are 25 and 5 ug/m³, respectively.

- (a) Violations predicted by the ISCST2 model were for the 3-hour and 24-hour averaging times only. No annual violations were predicted.
- (b) MESOPUFF results generated only for events where ISCST2 model predicted the proposed facility to have impacts greater than the National Park Service Recommended Significance Levels for the 3-hour (0.48 ug/m³) and 24-hour (0.07 ug/m³) averaging periods.

Table 7-16. Summary of PSD Class I SO₂ Impacts for the Proposed Hardee Unit 3 and Other PSD Sources

ISCST2 Model Results								MESOPUFF Modeling for ISCST Periods(a) (Violations and Prop. Sig. Imp.) Proposed Only(b) (ug/m ³)	
Averaging Period	Exceedances		Violations		Violations with Sig. Impact from Proposed Unit		Total (ug/m ³)	Proposed (ug/m ³)	
	Number	Periods	Number	Periods	Number	Periods			
24-hour									
1982	9	5	4	3	2	1	5.08	0.216	0.004
							5.45	0.232	0.004
1983	8	5	3	2	0	0	NA	NA	NA
1984	9	5	3	2	0	0	NA	NA	NA
1985	8	4	4	3	0	0	NA	NA	NA
1986	30	14	19	13	4	4	6.42	0.217	0.0001
							5.14	0.150	0.002
							5.20	0.098	0.001
							5.14	0.190	0.0002
3-hour									
1982	2	1	0	0	0	0	NA	NA	NA
1983	0	0	0	0	0	0	NA	NA	NA
1984	0	0	0	0	0	0	NA	NA	NA
1985	5	1	0	0	0	0	NA	NA	NA
1986	4	3	1	1	1	1	26.4	0.79	0.0002

(a) The periods in MESOPUFF included 3 days before and 2 days after the violation period identified in ISCST.

(b) For 1986, the proposed source was also modeled in MESOPUFF for the entire year.

The proposed source was predicted to have a significant impact for one 24-hour period (0.099 ug/m³) and no 3-hour periods.

By modeling all sources for that one 24-hour period, the highest impact was predicted to be -5.4 ug/m³

(modeling was based on ISCST2 model results for sources within 50 km, MESOPUFF results for sources beyond 50 km of the Class I area).

Table 7-17. Toxic Air Pollutant Impact Analysis for Proposed Hardee Unit 3 Plant--Maximum Concentrations

Constituent	Averaging Period	Predicted Impacts (ug/m³)						Florida NTL (ug/m³)
		Base Load		75 Percent Load		50 Percent Load		
		32 °F	95 °F	32 °F	95 °F	32 °F	95 °F	
Generic	Annual	6.50E-02	7.80E-02	8.80E-02	9.70E-02	1.03E-01	1.15E-01	NA
	24-hour	3.27E+00	7.03E+00	1.07E+01	1.46E+01	1.68E+01	2.17E+01	NA
	8-Hour	7.51E+00	1.60E+01	2.39E+01	3.15E+01	3.57E+01	4.44E+01	NA
Arsenic	Annual	1.58E-05	1.61E-05	1.73E-05	1.63E-05	1.45E-05	1.42E-05	2.30E-04
	24-hour	7.95E-04	1.45E-03	2.10E-03	2.45E-03	2.37E-03	2.68E-03	4.80E-01
	8-Hour	1.83E-03	3.31E-03	4.70E-03	5.28E-03	5.04E-03	5.48E-03	2.00E+00
Beryllium	Annual	8.07E-06	8.24E-06	8.80E-06	8.30E-06	7.44E-06	7.24E-06	4.20E-04
	24-hour	4.06E-04	7.42E-04	1.07E-03	1.25E-03	1.21E-03	1.37E-03	4.80E-03
	8-Hour	9.33E-04	1.69E-03	2.39E-03	2.69E-03	2.58E-03	2.80E-03	2.00E-02
Fluoride	Annual	1.05E-04	1.07E-04	1.14E-04	1.08E-04	9.68E-05	9.43E-05	NA
	24-hour	5.27E-03	9.65E-03	1.39E-02	1.62E-02	1.58E-02	1.78E-02	6.00E+00
	8-Hour	1.21E-02	2.20E-02	3.10E-02	3.50E-02	3.36E-02	3.64E-02	2.50E+01
Mercury	Annual	2.84E-05	2.90E-05	3.09E-05	2.92E-05	2.62E-05	2.55E-05	3.00E-01
	24-hour	1.43E-03	2.61E-03	3.76E-03	4.40E-03	4.28E-03	4.81E-03	1.20E-01
	8-Hour	3.28E-03	5.95E-03	8.40E-03	9.49E-03	9.09E-03	9.85E-03	5.00E-01
Sulfuric acid	Annual	3.64E-02	3.71E-02	3.97E-02	3.74E-02	3.36E-02	3.27E-02	NA
	24-hour	1.83E+00	3.35E+00	4.83E+00	5.63E+00	5.48E+00	6.18E+00	2.40E+00
	8-Hour	4.21E+00	7.63E+00	1.08E+01	1.21E+01	1.16E+01	1.26E+01	1.00E+01
Antimony	Annual	7.06E-05	7.19E-05	7.69E-05	7.25E-05	6.50E-05	6.33E-05	3.00E-01
	24-hour	3.55E-03	6.48E-03	9.35E-03	1.09E-02	1.06E-02	1.19E-02	1.20E+00
	8-Hour	8.15E-03	1.48E-02	2.09E-02	2.35E-02	2.25E-02	2.44E-02	5.00E+00
Barium	Annual	6.31E-05	6.43E-05	6.87E-05	6.48E-05	5.81E-05	5.66E-05	5.00E+01
	24-hour	3.17E-03	5.79E-03	8.36E-03	9.75E-03	9.47E-03	1.07E-02	1.20E+00
	8-Hour	7.29E-03	1.32E-02	1.87E-02	2.10E-02	2.01E-02	2.18E-02	5.00E+00
Cadmium	Annual	3.39E-05	3.46E-05	3.70E-05	3.48E-05	3.12E-05	3.04E-05	5.60E-04
	24-hour	1.71E-03	3.12E-03	4.50E-03	5.24E-03	5.09E-03	5.74E-03	1.20E-01
	8-Hour	3.92E-03	7.10E-03	1.00E-02	1.13E-02	1.08E-02	1.17E-02	5.00E-01
Chlorine	Annual	8.21E-05	8.36E-05	8.95E-05	8.43E-05	7.56E-05	7.36E-05	4.00E-01
	24-hour	4.13E-03	7.54E-03	1.09E-02	1.27E-02	1.23E-02	1.39E-02	3.60E+00
	8-Hour	9.48E-03	1.72E-02	2.43E-02	2.74E-02	2.62E-02	2.84E-02	1.50E+01

Table 7-17. Toxic Air Pollutant Impact Analysis for Proposed Hardee Unit 3 Plant--Maximum Concentrations

Constituent	Averaging Period	Predicted Impacts (ug/m³)						Florida NTL (ug/m³)
		Base Load		75 Percent Load		50 Percent Load		
		32 °F	95 °F	32 °F	95 °F	32 °F	95 °F	
Chromium	Annual (a)	2.63E-05	2.68E-05	2.86E-05	2.70E-05	2.42E-05	2.36E-05	8.30E-05
	24-hour	7.72E-03	1.41E-02	2.03E-02	2.37E-02	2.30E-02	2.60E-02	1.20E-01
	8-Hour	1.77E-02	3.21E-02	4.54E-02	5.12E-02	4.90E-02	5.31E-02	5.00E-01
Cobalt	Annual	2.93E-05	2.98E-05	3.19E-05	3.01E-05	2.70E-05	2.63E-05	NA
	24-hour	1.47E-03	2.69E-03	3.88E-03	4.52E-03	4.40E-03	4.96E-03	1.20E-01
	8-Hour	3.38E-03	6.13E-03	8.67E-03	9.76E-03	9.34E-03	1.01E-02	5.00E-01
Copper	Annual	4.20E-03	4.28E-03	4.58E-03	4.31E-03	3.87E-03	3.77E-03	NA
	24-hour	2.11E-01	3.86E-01	5.57E-01	6.49E-01	6.31E-01	7.11E-01	4.80E-01
	8-Hour	4.85E-01	8.80E-01	1.24E+00	1.40E+00	1.34E+00	1.45E+00	2.00E+00
Formaldehyde	Annual	1.31E-03	1.33E-03	1.43E-03	1.34E-03	1.20E-03	1.17E-03	7.70E-02
	24-hour	6.58E-02	1.20E-01	1.73E-01	2.02E-01	1.96E-01	2.21E-01	2.88E+00
	8-Hour	1.51E-01	2.74E-01	3.87E-01	4.36E-01	4.18E-01	4.53E-01	1.20E+01
Manganese	Annual	1.10E-03	1.12E-03	1.20E-03	1.13E-03	1.01E-03	9.85E-04	4.00E-01
	24-hour	5.52E-02	1.01E-01	1.46E-01	1.70E-01	1.65E-01	1.86E-01	1.20E+01
	8-Hour	1.27E-01	2.30E-01	3.25E-01	3.66E-01	3.50E-01	3.80E-01	5.00E+01
Nickel	Annual (a)	6.63E-04	6.76E-04	7.23E-04	6.82E-04	6.11E-04	5.95E-04	4.20E-03
	24-hour	1.95E-01	3.56E-01	5.14E-01	6.00E-01	5.82E-01	6.56E-01	2.40E+00
	8-Hour	4.48E-01	8.11E-01	1.15E+00	1.29E+00	1.24E+00	1.34E+00	1.00E+01
Polycyclic Organic Matter	Annual	8.98E-07	9.15E-07	9.79E-07	9.22E-07	8.27E-07	8.06E-07	NA
	24-hour	4.52E-05	8.25E-05	1.19E-04	1.39E-04	1.35E-04	1.52E-04	NA
	8-Hour	1.04E-04	1.88E-04	2.66E-04	2.99E-04	2.87E-04	3.11E-04	NA
Selenium	Annual	7.56E-05	7.71E-05	8.25E-05	7.77E-05	6.97E-05	6.79E-05	NA
	24-hour	3.81E-03	6.95E-03	1.00E-02	1.17E-02	1.14E-02	1.28E-02	2.00E+00
	8-Hour	8.74E-03	1.58E-02	2.24E-02	2.52E-02	2.41E-02	2.62E-02	4.80E-01
Vanadium	Annual	2.24E-04	2.29E-04	2.45E-04	2.31E-04	2.07E-04	2.01E-04	2.00E+01
	24-hour	1.13E-02	2.06E-02	2.98E-02	3.47E-02	3.37E-02	3.80E-02	1.20E-01
	8-Hour	2.59E-02	4.70E-02	6.65E-02	7.49E-02	7.16E-02	7.78E-02	5.00E-01
Zinc	Annual	5.10E-03	5.20E-03	5.57E-03	5.24E-03	4.70E-03	4.58E-03	NA
	24-hour	2.57E-01	4.69E-01	6.77E-01	7.89E-01	7.66E-01	8.64E-01	NA
	8-Hour	5.89E-01	1.07E+00	1.51E+00	1.70E+00	1.63E+00	1.77E+00	NA

(a) Based on firing fuel oil for 1,500 hours (for other pollutants, fuel oil was assumed to be fired for entire year).

8.0 ADDITIONAL AIR QUALITY IMPACT ANALYSIS

8.1 IMPACTS DUE TO DIRECT GROWTH

The purpose of the growth impact analysis is to quantify potential expansion resulting from the proposed Hardee Unit 3 facility and to qualitatively assess air quality impacts that would result from that growth. Construction of Hardee Unit 3 will require approximately 229 laborers and tradespersons, on average, but this employment will be of a temporary nature. Permanent employment at the power plant will be approximately 35 persons working in three shifts during each day. The permanent staffing requirements are well below the levels required during the construction phase, and impacts on air quality will be correspondingly less.

Additional truck traffic to the site will result from the delivery of fuel oil. On the average, highway trucks can haul 8,000 gallons of oil per delivery. Assuming that each of the CTs operates at maximum operating conditions for 1,500 hours by combusting fuel oil, the annual fuel oil requirement for two CTs is approximately 38,900,000 gallons. Therefore, during the year, approximately 13 trucks per day would be required to deliver fuel oil. The capacity and operational impact of adding this traffic is expected to be minimal.

At present, EPA has not presented any definitive guidance on addressing NO_x increment consumption due to mobile sources. However, EPA did indicate that mobile source emissions in rural areas should not have a significant impact on increment consumption (see Federal Register, Vol. 53, No. 25, February 8, 1988). Although vehicle-miles-traveled (VMT) may increase, emission limits imposed by the CAAA of 1990 will lower emissions from light-duty vehicles in 1994 and gas- and diesel-fueled heavy-duty vehicles in 1998. As a result, total vehicular emissions are estimated to be lower in the next 10 to 15 years. Therefore, existing air quality is not expected to be adversely affected by the increase in vehicular traffic.

8.2 POTENTIAL IMPACTS ON SOILS, VEGETATION AND WILDLIFE

A large number of elements and compounds may be emitted from the proposed facility (see Table 7-21). Since the predicted levels of all elements and compounds are below the levels to cause biological effects, this analysis will focus on representative elements and compounds including SO₂, NO_x, CO, TSP, Be, and mercury.

8.2.1 SOILS

Many of the soils in the region and a large portion of the site have been disturbed and altered by phosphate mining. They were originally sandy, siliceous hyperthermic Haploquods with very strongly acid subsoils. The undisturbed soils of the Payne Creek floodplain have formed in unconsolidated loamy textured sediment influenced by calcareous material (Robbins *et al.*, 1984). They are mapped as coarse-loamy siliceous, hyperthermic Typic Ochraqualfs.

SO₂ and NO₂ that reach the soil by deposition from the air are converted by physical and biotic processes to sulfates and nitrates. (CO, particulates, and metals have no effect on soils at the levels predicted.) The effects can be beneficial to plants if either sulfates or nitrates in native soils are less than plant requirements for optimum growth. However, sulfates and nitrates can also increase acidity of unbuffered soils, causing adverse effects due to changes in nutrient availability and cycling. The predicted concentrations of SO₂ and NO₂ from stack emissions are not expected to have a significant adverse effect on soils in the vicinity because (1) the predicted concentrations of both gases are low, and (2) Payne Creek floodplain and other wetland soils contain organic matter and/or calcium carbonate nodules that buffer changes in acidity. Therefore, the predicted emissions from the Hardee Unit 3 facility are not expected to have a significant adverse impact on regional soils.

8.2.2 VEGETATION AND WILDLIFE

The response of vegetation and wildlife to atmospheric pollutants is influenced by the concentration of the pollutant, duration of exposure, and frequency of exposures. 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 and animals 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. The impact of the HPS facility including the Hardee Unit 3 facility on regional vegetation and wildlife was assessed by comparing pollutant doses that are predicted from modeling with threshold doses reported from the scientific literature which could adversely affect plant or animal species typical of those present in the region.

Sulfur Dioxide

Plants can be grouped into three levels of sensitivity to SO₂ based on concentration and exposure (EPA, 1982a). Sensitive crop species include legumes and blackberries. Ranges of concentrations reported to cause visible injury in sensitive species are 1,310 to 2,620 µg/m³ (0.5 to 1.0 ppm) for 1-hour exposure and 790 to 1,570 µg/m³ (0.3 to 0.6 ppm) for 3-hour exposures. Intermediate resistant species include many crops and garden species. Ranges of concentrations reported to cause visible injury in intermediate species are 2,620 to 5,240 µg/m³ (1.0 to 2.0 ppm) for 1-hour exposure and 1,570 to 2,100 µg/m³ (0.6 to 0.8 ppm) for 3-hour exposures. Resistant species include potato and corn. Ranges of concentrations reported to cause visible injury in intermediate species are >5,240 µg/m³ (>2.0 ppm) for 1-hour exposure and >2,100 µg/m³ (>0.8 ppm) for 3-hour exposures. Chronic effects to forest growth have been reported where SO₂ annual ambient concentrations averaged 45 or 115 µg/m³ (0.02 or 0.05 ppm) (EPA, 1982a).

The maximum 1-hour, 3-hour, 24-hour average, and annual SO₂ concentrations predicted for Hardee Unit 3 within the modeling area of Hardee Unit 3 are 135, 65.1, 27.8, and 0.18 µg/m³, respectively. These concentrations are predicted to occur within 1 km (0.62 mile) of the stacks and represent the concentrations that occur during worst-case meteorological conditions of the 5 years considered in the air dispersion modeling. By adding background concentrations developed from monitoring data (see Section 5.0) to impacts from all sources (see Tables 7-7 and 7-9) (when the proposed source has a significant impact), the total 1-hour, 3-hour, 24-hour, and annual average concentrations are predicted to be 458, 401, 138, and 29 µg/m³, respectively. These predicted doses from operation of Hardee Unit 3 combined with background sources are much lower than doses known to cause a detrimental effect on vegetation and wildlife (Table 8-1).

Nitrogen Oxides

A review of the literature (EPA, 1982e) indicates greater variability in the NO₂ dose-response relationship in vegetation, and no threshold effect levels are supported. The NO₂ doses known to adversely affect some animals and plants are shown in Tables 8-1 and 8-2, respectively. The maximum predicted 3-hour and annual average NO₂ concentrations due to Hardee Unit 3 is predicted to be 206 and 0.59 µg/m³, respectively. The predicted doses of NO₂ due to the proposed facility are far lower than the doses reported to injure vegetation and animals; therefore, the proposed facility's NO₂ emissions are not expected to have an adverse effect on vegetation and wildlife.

Combined Effects of Sulfur Dioxide and Nitrogen Dioxide

SO₂ in combination with NO₂ can cause vegetation effects although the studies are not as extensive as studies on single pollutant effects. Plants show varying sensitivities at various SO₂ and NO₂ concentration combinations for various exposure periods. A review of the literature (EPA, 1982c) indicates that a lower visible-injury threshold may occur at 2-hour SO₂ and NO₂ exposures of 1,310 µg/m³ (0.5 ppm) and 940 µg/m³ (0.5 ppm), respectively. Air dispersion modeling has shown that this threshold exposure condition does not occur.

Total Suspended Particulates

High deposition of particulates on plant leaves can reduce photosynthesis through shading and impede diffusion of gases. However, at least 5 g/m² leaf surface of particulates are required to cause these impacts (Thompson et al. 1984). This concentration is not expected due to the maximum predicted impacts from the HPS. The maximum 24-hour and annual average concentrations for modeled sources are predicted to be 31 and 4 µg/m³, respectively. These concentrations are predicted to occur between 0.6 and 1 km to the north of the stacks. By adding background concentrations developed from monitoring data (see Section 5.0) to these modeled sources' impacts, the total 24-hour and annual average concentrations are predicted to be 101 and 24 µg/m³, respectively. Predicted particulate levels are lower than reported effects levels in animals (Newman, 1975).

Carbon Monoxide

Soil microorganisms can use carbon monoxide as a carbon source and are a major sink for this pollutant (Bennett and Hill, 1975). Plants are not known to be injured by CO. The maximum predicted 1-hour and 8-hour average CO concentrations due to the facility are 380 and 168 µg/m³, respectively. No adverse impacts to vegetation are expected from CO emissions from the Hardee Power Station. Predicted carbon monoxide levels are lower than levels known to affect animals (Newman, 1975).

Beryllium

The maximum 24-hour average Be concentration due to the proposed facility is predicted to be 0.0014 µg/m³. Levels of Be greater than 2 µg/g in nutrient solution have been found to reduce growth of experimental plants (Gough et al. 1979). Therefore, the low levels of Be predicted from plant operation are not expected to adversely affect vegetation. Inhalation of levels of Be

greater than $35 \mu\text{g}/\text{m}^3$ for 6 months produced respiratory changes in rats. These levels are significantly greater than predicted values, therefore no effects are predicted to occur (Newman, 1975).

Mercury

The maximum 24-hour average Hg concentration due to the proposed facility is predicted to be $0.0048 \mu\text{g}/\text{m}^3$. Siegle et al. (1984) reported that 7 days of exposure to $50 \mu\text{g}/\text{m}^3$ Hg vapor resulted in massive leaf abscission in 15 plant species and cultivars. This dose is orders of magnitude higher than the dose expected from operation of the Hardee Power Station. Therefore, the predicted Hg concentrations due to the proposed facility are not expected to adversely affect vegetation.

Of all the trace metals, only mercury is known to be a problem contaminant in Florida, particularly in the Everglades. Mercury readily biomagnifies at higher trophic levels. Mercury bioaccumulates more readily in animals than in plants and biomagnifies through both the terrestrial and aquatic food webs (Eisler, 1987). The sources of mercury contamination in Florida are not known. Potential sources include natural sources such as natural fires, volcanic activity, natural degassing from oceans, land surfaces, and other water bodies. Potential manmade sources include past use of mercuric pesticides and mercury-based paints, emissions from municipal and medical waste incinerators, and fossil fuel power plants. Regional and historical studies are presently being conducted in the state to define the sources, amount, and timing of mercury deposition and accumulation. Because of the uncertainty regarding the contribution of various mercury sources, the risk to local fish and wildlife from this facility cannot be precisely determined. Because the potential mercury emissions from Hardee Unit 3 are very low relative to other mercury-emitting sources (FDEP, 1992), no significant adverse effects to fish and wildlife are anticipated.

8.3 VISIBILITY

Potential impacts to local visibility due to the proposed power plant will be minimal. The proposed plant will meet all applicable emission standards including opacity.

8.4 AIR QUALITY RELATED VALUES ANALYSIS: VEGETATION, SOILS, AND WILDLIFE

The vegetation and soils components of the additional impacts analysis have been expanded to constitute an air quality-related values (AQRVs) analysis to assess the potential risk to AQRVs of the Chassahowitzka NWA due to the development of the Hardee Unit 3 project. Potential air quality impacts of the proposed project were predicted at the PSD Class I area portion of the Chassahowitzka NWA. 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.

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.

Except for visibility, AQRVs have not been specifically defined by the U.S. Fish and Wildlife Service (USFWS) for Chassahowitzka NWR. However, soil, flora, fauna, cultural resources, geological features, water, and climate potentially affected by air quality have been identified by land managers as general AQRVs to be addressed in these types of analyses. This AQRV analysis evaluates the effects of air quality on general vegetation types and wildlife found on the Chassahowitzka NWR, which are the AQRVs directly affected by air quality.

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, and 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 have been defined as endangered species, waterfowl, marsh and waterbirds, shorebirds, reptiles, and mammals.

A screening approach was used that 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 that 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, and species of the hardwood swamplands and mangrove forest found in the Chassahowitzka NWR, no specific air quality citations were found that addressed these species. Therefore, studies on general vegetation effects and other similar Florida species can be used as indicators of effects. In conducting the assessment, both direct (fumigation) and indirect (soil accumulation/uptake) exposures were considered for flora, and direct exposure (inhalation) was considered for wildlife.

8.4.1 VEGETATION

The effects of air contaminants on vegetation occur primarily from SO₂, NO₂, O₃, and particulates. Effects from minor air contaminants such as fluoride, chlorine, hydrogen chloride, ethylene, ammonia, hydrogen sulfide, CO, and pesticides have been reported in the literature. However, most of these air contaminants have not resulted in major effects (e.g., crop damage).

As stated earlier, the effects of contaminants are dependent both on the concentration of the contaminant and the duration of the exposure. The term "injury," as opposed to damage, is commonly used to describe all plant responses to air contaminants and will be used in the context of this analysis. Air contaminants are thought to interact primarily with plant foliage, which is considered to be the major pathway of exposure. For purposes of this analysis, it is assumed that 100 percent of each air contaminant of concern is accessible to the plants. The maximum predicted impacts due to proposed project for the applicable 1-hour, 3-hour, 8-hour, 24-hour, and annual averaging periods are presented in Table 8-3.

Injury to vegetation from exposure to various levels of air contaminants can be termed acute, physiological, and 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. 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.

8.4.1.1 Effects of Sulfur Dioxide

SO₂ concentrations at elevated levels have long been known to cause injury to plants. Acute SO₂ injury usually develops within a few hours or days of exposure and symptoms include marginal, flecked, and/or intercostal necrotic areas which 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). Phytotoxic symptoms demonstrated by plants can occur as low as 88 µg/m³ (USDHEW, 1971). However, this occurs with the more primitive plants (i.e., mosses, ferns, lichens).

A study of native Floridian species (Woltz and Howe, 1981) demonstrated that cypress, slash pine, live oak, and mangrove exposed to 1,300 µg/m³ SO₂ for 8 hours were not visibly damaged. This supports the levels cited by other researchers on the effects of SO₂ 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 were visibly injured at 3-hour SO₂ concentrations of 920 µg/m³.

Jack pine seedlings exposed to SO₂ concentrations from 470 to 520 µg/m³ for 24 hours demonstrated inhibition of foliar lipid synthesis; however, this inhibition was reversible (Malhotra and Kahn, 1978). Black oak exposed to 1,310 µg/m³ SO₂ for 24 hours a day for 1 week demonstrated a 48 percent reduction in photosynthesis (Carlson, 1979). By comparison of these levels, it is apparent that the maximum predicted 24-hour concentrations are well below the concentrations that cause damage in SO₂-sensitive plants.

Plants can be grouped into three levels of sensitivity to SO₂ based on concentration and exposure (EPA, 1982). Sensitive crop species include legumes and blackberries. Ranges of concentrations reported to cause visible injury in sensitive species are 1,310 to 2,620 µg/m³ (0.5 to 1.0 ppm) for 1-hour exposure and 790 to 1,570 µg/m³ (0.3 to 0.6 ppm) for 3-hour exposures. Intermediate resistant species include many crops and garden species. Ranges of concentrations reported to

cause visible injury in intermediate species are 2,620 to 5,240 $\mu\text{g}/\text{m}^3$ (1.0 to 2.0 ppm) for 1-hour exposure and 1,570 to 2,100 $\mu\text{g}/\text{m}^3$ (0.6 to 0.8 ppm) for 3-hour exposures. Resistant species include potato and corn. Ranges of concentrations reported to cause visible injury in intermediate species are $> 5,240 \mu\text{g}/\text{m}^3$ (> 2.0 ppm) for 1-hour exposure and $> 2,100 \mu\text{g}/\text{m}^3$ (> 0.8 ppm) for 3-hour exposures. Chronic effects to forest growth have been reported where SO_2 annual ambient concentrations averaged 45 or 115 $\mu\text{g}/\text{m}^3$ (0.02 or 0.05 ppm) (EPA, 1982a).

In order to assess the total air quality SO_2 impacts at the Class I area that can be compared to the reported effects levels, the predicted SO_2 impacts due to Hardee Unit 3 were added to applicable background concentrations. The background concentrations, assumed to be representative of impacts from sources not modeled, were developed from existing ambient monitoring data. In this analysis, the highest 3-hour, 24-hour, and annual concentrations of 335, 67, and 7 $\mu\text{g}/\text{m}^3$, respectively [collected in 1991 and 1992 from monitoring stations (Nos. 058-003-J02, 058-003-J09, and 058-005-J02) located about 20 km from the Class I area], were used to represent background concentrations. The 3-hour concentration of 335 $\mu\text{g}/\text{m}^3$ was also used to represent the 1-hour and 8-hour background levels since data for these averaging times were not available.

The maximum total 3-hour, 24-hour, and annual SO_2 concentrations of 336.9, 67.3, and 7.0 $\mu\text{g}/\text{m}^3$, respectively, that would be predicted within the Class I area represent levels which are lower than those known to cause damage to test species (see Table 8-1). The expected doses from operation of Hardee Unit 3 combined with background sources are much lower than doses known to cause a detrimental effect on vegetation AQRVs at Chassahowitzka NWR.

8.4.1.2 Effects of Nitrogen Dioxide

Acute NO_2 injury symptoms are manifest as water-soaked lesions, which first appear on the upper surface, followed by rapid tissue collapse. Low-concentration, long-term exposures do not induce the lesions associated with acute exposures but may still result in some growth suppression. A review of the literature (EPA, 1982e) indicates greater variability in the NO_2 dose-response relationship in vegetation, and no threshold effect levels are supported. The NO_2 doses known to adversely affect some plants are shown in Table 8-2.

The maximum predicted annual average NO_2 concentration due to Hardee Unit 3 is predicted to be 0.03 $\mu\text{g}/\text{m}^3$. No representative nearby NO_2 monitoring data is available to provide background

conditions. The predicted doses of NO₂ in the Chassahowitzka NWA due to the proposed facility are far lower than the doses reported to injure vegetation and animals; therefore, the proposed facility's NO₂ emissions are not expected to have an adverse effect on vegetation AQRVs at Chassahowitzka NWA.

8.4.1.3 Combined Effects of Sulfur Dioxide and Nitrogen Dioxide

SO₂ in combination with NO₂ can cause vegetation effects below injury threshold for each of these pollutants individually. Plants show varying sensitivities at various SO₂ and NO₂ concentration combinations for various exposure periods. A review of the literature (EPA, 1982c) indicates that a lower visible-injury threshold may occur at 2-hour SO₂ and NO₂ exposures of 1,310 µg/m³ (0.5 ppm) and 940 µg/m³ (0.5 ppm), respectively. Air dispersion modeling has shown that this threshold exposure condition will not occur at Chassahowitzka NWA.

8.4.2 SOILS

8.4.2.1 Sulfur Dioxide

The majority of the soil in the Class I area is classified as Weekiwachee-Durbin muck. This is an euic, hyperthermic typic sulfhemist that is characterized by high levels of sulfur and organic matter. This soil is flooded daily with the advent of high tide and the pH ranges between 6.1 and 7.8. The upper level of this soil may contain as much as 4 percent sulfur (USDA, 1991).

The greatest threat to soils from increased SO₂ deposition (in the form of sulfate) is a decrease in pH or an increase of sulfur to levels considered unnatural or potentially toxic. The ground deposition of sulfate from the proposed unit was calculated to be 2.69 gm/ha/yr. The results from the Florida Acid Deposition Study (FADS) network for two sampling stations (Sites 8 and 5) located at the north of the Class I area indicate that the average sulfate deposition ranges from 14.5 to 17.7 kg/ha/yr (Pollman, 1994). The predicted amount of sulfate deposited is inconsequential in light of the sulfate deposition measured in the area and the inherent sulfur content of the soils. The regular flooding of these soils by the Gulf of Mexico regulates the pH and any rise in acidity in the soil would be buffered by this activity.

8.4.2.2 Trace Metals

The annual deposition (g/m²) of lead, arsenic, beryllium, mercury, manganese, nickel, cadmium, chromium, copper, vanadium, selenium, antimony, barium, cobalt, and zinc were assumed to

partition into the soil (bulk density of 1.25 g/cc) to a depth of 10 cm. From this soil concentration, it was assumed that equal partitioning would ensue into dry plant matter. These values are considered to be quite conservative due to the assumption that all of the elements would be 100 percent available for plant uptake and would be internalized in plant tissue at a concentration equal to that of the soil.

Maximum depositions were predicted using the ISCST2 model using particle size distribution for large, uncontrolled gas turbines firing distillate oil as presented in EPA's document, Compilation of Air Pollutant Emission Factors, AP-42. This distribution assumes that 100 percent of the particles have a diameter of 1 μm or less. The maximum depositions to the Class I area due to the proposed sources are described in the following section.

Arsenic

Naturally occurring levels of As in plants range from 0.01 to 5.0 $\mu\text{g/g}$ (EPA, 1989). A concentration of 5 to 20 $\mu\text{g/g}$ in plants is considered excessive (Gough et al., 1979). The annual amount of 1.38×10^{-7} $\mu\text{g/g}$ predicted for the proposed Hardee Unit 3 to be absorbed by vegetation is 6.9×10^{-9} to 2.8×10^{-8} of the values that are considered excessive.

Barium

Naturally occurring levels of barium in plants range from 7.5 to 165 $\mu\text{g/g}$ (Lawrey, 1978). The annual amount of 5.51×10^{-7} $\mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 3.3×10^{-9} to 7.4×10^{-8} of the values at which no phytotoxic observations were noted.

Beryllium

Toxicity of plants has been reported at concentrations of 2 $\mu\text{g/g}$ in liquid culture (Gough et al., 1979). The annual amount of 7.06×10^{-8} $\mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 3.6×10^{-8} of the value at which retardation of growth occurred.

Cadmium

Cadmium is a relatively rare element that resides in nature at levels of 0.15 to 0.2 $\mu\text{g/g}$.

Generally, 3 to 5 $\mu\text{g/g}$ retards the growth of plants (Gough et al., 1979). The annual amount of 2.96×10^{-7} $\mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 5.9×10^{-8} to 9.9×10^{-8} of the values at which retardation of growth occurred.

Chromium

A soil concentration of 1,370 to 2,740 $\mu\text{g/g}$ chromium was reported to cause chlorosis in citrus (Gough et al., 1979), but liquid cultures that contained 150 $\mu\text{g/g}$ were toxic to citrus seedlings.

The annual amount of 1.34×10^{-6} $\mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 8.9×10^{-9} of the value at which toxic symptoms were observed.

Cobalt

Plant concentrations as high as 2,000 to 10,000 $\mu\text{g/g}$ cobalt have been detected in leaves of persimmon and ash, respectively (Gough et al., 1979). Cobalt was reported to cause chlorosis and stunting in a variety of plants at levels from 6 to 142 $\mu\text{g/g}$ in soils (Aller et al., 1990). The annual amount of 2.56×10^{-7} $\mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 1.8×10^{-9} to 4.3×10^{-8} of the values at which toxic symptoms were observed.

Copper

Copper is an essential element for plant growth. Vary few instances of toxicity have been reported, and copper deficiency is more often a problem than toxicity. Citrus seedlings that were exposed to approximately 150 $\mu\text{g/g}$ of copper demonstrated appreciable chlorosis (Gough et al., 1979). The annual amount of 3.67×10^{-5} $\mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 2.5×10^{-7} of the value at which toxic symptoms were observed.

Lead

Naturally occurring levels of lead in plants range from 0.1 to 10 $\mu\text{g/g}$ with an average of 2.0 $\mu\text{g/g}$ (Kabata-Pendias and Pendias, 1984). A lead soil concentration of 30 to 100 $\mu\text{g/g}$ generally retards the growth of plants (Gough et al., 1979). The annual amount of 1.64×10^{-6} $\mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 1.6×10^{-8} to 5.5×10^{-8} of the values at which growth retardation was observed.

Manganese

Manganese is another element that is essential for plant growth. However, toxicity does occur at elevated levels and a generally toxic concentration of manganese is reported to be greater than 400 to 500 $\mu\text{g/g}$ (Gough et al., 1979). The annual amount of $9.59 \times 10^9 \mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 2.4×10^{-8} of the level at which toxicity was observed.

Mercury

Although mercury compounds are toxic to bacteria and fungi, higher plants are relatively resistant to mercury poisoning. Tea plants growing above mercury-rich deposits contained as much as 3.5 $\mu\text{g/g}$ without showing signs of toxicity. Apparently healthy spanish moss plants collected had a mercury content of 0.5 $\mu\text{g/g}$ (Gough et al., 1979). From the few studies available on the effects of mercury on plants, it seems as if mercury is not concentrated to a great extent (Gough et al., 1979). The annual amount of $2.48 \times 10^7 \mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 7.1×10^{-8} to 5.0×10^{-7} of the values at which no signs of toxicity were observed.

Nickel

The general range of excessive or toxic amounts of nickel in most plant species varies from 10 to 100 ppm (Kabata-Pendias and Pendias, 1984). The annual amount of $3.39 \times 10^5 \mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 3.4×10^{-7} to 3.4×10^{-6} times the values at which growth retardation was observed.

Selenium

No recorded instances of naturally occurring selenium damage have been documented to date (Gough et al., 1979). Plants absorb and accumulate selenium, but the general responses of these plants vary over such a wide range of concentrations, a level considered toxic to plants is hard to determine (Gough et al., 1979). Concentrations of selenium in plants are known to range from 3 to 4,190 $\mu\text{g/g}$. The annual amount of $6.61 \times 10^7 \mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 1.6×10^{-10} to 2.2×10^{-7} times the values at which no effects have been observed.

Vanadium

Plants absorb and accumulate vanadium differentially, with concentrations in various plants ranging from 20 to 700 $\mu\text{g/g}$ (Gough et al., 1979). However, phytotoxic responses were observed in some plants grown in soils at a concentration of 140 $\mu\text{g/g}$ (Aller et al., 1990). The annual amount of 1.96×10^{-6} $\mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 1.4×10^{-8} of the value at which phytotoxicity occurred.

Zinc

Zinc is another element that is essential for plant growth. However, toxicity does occur at elevated levels and a generally toxic concentration of zinc is reported to be greater than 300 $\mu\text{g/g}$ (Fischer and Luttge, 1978). The annual amount of 4.46×10^{-5} $\mu\text{g/g}$ predicted for the proposed unit to be absorbed by vegetation is 1.5×10^{-7} of the value at which toxicity was observed.

8.4.3 WILDLIFE

The predicted SO_2 , NO_x , and particulate concentrations are well below the lowest observed effects levels in animals (Table 8-1). Given these conditions, the proposed source's emissions poses no risk to wildlife AQRVs at Chassahowitzka NWR. Because predicted levels are below those known to cause effect to vegetation, there is also no risk to their habitat.

A review of literature (Eisler, 1985a, b; 1986; 1987; 1988a, b; and 1993) shows that the USFWS's recommended safety levels for As, Cd, chromium (Cr), Hg, Pb, Se, and Zn for threshold effects for these metals are several orders of magnitude higher than the concentrations predicted to occur in plants. Although these metals bioaccumulate, the predicted levels are so low that adverse effects to fish and wildlife of Chassahowitzka NWA through the food web are not expected.

8.4.4 SUMMARY

In summary, no toxic effects from proposed plant emissions are expected. Safety factors as great as 900 million have been demonstrated in this assessment. For the trace metal assessment, it is important to note that the elements were modeled with the assumption that 100 percent was available for plant uptake which is rarely the case in a natural ecosystem.

8.5 PSD CLASS I VISIBILITY ANALYSIS

The visibility analysis required by PSD regulations is directed primarily toward PSD Class I areas. 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 caused by various pollutants. There are no PSD Class I areas located within 100 km of the Hardee Unit 3 facility. The nearest Class I area to the plant site is the Chassahowitzka NWA located approximately 130 km to the northwest of the plant site.

A Level-1 visibility screening analysis was performed to determine the potential adverse visibility effects using the approach suggested in the *Workbook for Plume Visual Impact Screening and Analysis* (EPA, 1988b). The Level-1 screening analysis is designed to provide a conservative estimate of plume visual impacts (i.e., impacts higher than expected). The EPA model, VISCREEN, was used for this analysis. Model input and output results are presented in Figure 8-1. The PM, NO_x, and sulfuric acid mist (assumed to be sulfate) emissions from the proposed plant were used as input to the model.

As indicated in Figure 8-1, the maximum visibility impacts caused by the proposed plant do not exceed the screening criteria inside or outside the Class I area. As a result, the proposed plant is predicted to have no adverse effects on the Class I area.

As a result, there will be no impact to visibility in such areas.

Table 8-1. Examples of Lowest Observed Effect Levels of Air Pollutants

Pollutant	Reported Effect	Concentration ($\mu\text{g}/\text{m}^3$)	Exposure
Sulfur Dioxide	Respiratory stress in guinea pigs	427 to 854	1 hour
	Respiratory stress in rats	267	7 hours/day ^a ; 5 day/week for 10 weeks
	Decreased abundance in deer mice	13-157	continually ^b for 5 months
Nitrogen Dioxide	Respiratory stress in mice	1,917	3 hours
	Respiratory stress in guinea pigs	95 to 950	8 hr/day for ^a 122 days

^a Used to compare as a range between 3-hour and 24-hour averaging times.

^b Used to compare with annual averaging times.

Source: Adapted from Newman (1981) and Newman and Schreiber (1988)

Table 8-2. NO₂ Doses Reported to Affect Plant Species Similar to Vegetation in the Region of Hardee Unit 3

Species	Dose and Effect	Reference
Ryegrass	39.5 $\mu\text{g}/\text{m}^3$ for 6 minutes had no effect on shoot weight	Lane and Bell, 1984
Citrus	470 $\mu\text{g}/\text{m}^3$ for 290 days injured trees	Thompson <i>et al.</i> , 1970
Sphagnum	11.7 $\mu\text{g}/\text{m}^3$ averaged over 18 months compared with control of 4.8 $\mu\text{g}/\text{m}^3$ (exceeded 15 $\mu\text{g}/\text{m}^3$ 4 times) reduced growth	Press <i>et al.</i> , 1986

Table 8-3. Summary of Maximum Predicted Impacts for the Proposed Hardee Unit 3 at PSD Class I Area for the AQRV Analysis

Pollutant	Averaging Period	Maximum Predicted Impacts ($\mu\text{g}/\text{m}^3$)		
		Project Only	Background Concentration	Total
<u>Combined Cycle</u>				
Sulfur Dioxide	1-Hour	2.9	335	337.9
	3-Hour	1.9	335	336.9
	8-Hour	1.0	335	336.0
	24-Hour	0.30	67	67.3
	Annual	0.012	7	7.0
Nitrogen Dioxides	Annual	0.042	NA	NA
Particulate Matter	24-Hour	0.20	NA	NA
	Annual	0.008	NA	NA

Visual Effects Screening Analysis for
Source: HARDEE UNIT 3
Class I Area: CHASSAHOWITZKA NWA

*** Level-1 Screening ***
Input Emissions for

Particulates	134.10	LB /HR
NOx (as NO2)	699.20	LB /HR
Primary NO2	.00	LB /HR
Soot	.00	LB /HR
Primary SO4	44.50	LB /HR

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	.04 ppm
Background Visual Range:	25.00 km
Source-Observer Distance:	126.00 km
Min. Source-Class I Distance:	126.00 km
Max. Source-Class I Distance:	146.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

Backgrnd	Theta	Azi	Distance	Alpha	Delta E		Contrast	
					Crit	Plume	Crit	Plume
SKY	10.	84.	126.0	84.	2.00	.048	.05	.000
SKY	140.	84.	126.0	84.	2.00	.014	.05	-.001
TERRAIN	10.	84.	126.0	84.	2.00	.004	.05	.000
TERRAIN	140.	84.	126.0	84.	2.00	.001	.05	.000

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

Backgrnd	Theta	Azi	Distance	Alpha	Delta E		Contrast	
					Crit	Plume	Crit	Plume
SKY	10.	75.	122.0	94.	2.00	.051	.05	.000
SKY	140.	75.	122.0	94.	2.00	.015	.05	-.001
TERRAIN	10.	65.	117.6	104.	2.00	.006	.05	.000
TERRAIN	140.	65.	117.6	104.	2.00	.002	.05	.000

Figure 8-1
Visual Effects Screening Analysis for Hardee Unit 3

Source: KBN, 1994.



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ATTACHMENT A

**STACK, OPERATING, AND EMISSION DATA FOR THE
PROPOSED HARDEE UNIT 3**

Table A1B-1. Design Information and Stack Parameters for Hardee Power Station Unit 3, Simple and Combined Cycle—
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, Base Load

Data	Gas Turbine Natural Gas 32 °F	Gas Turbine Natural Gas 59 °F	Gas Turbine Natural Gas 72 °F	Gas Turbine Natural Gas 95 °F
General				
Power (MW)	173.3	156.3	148.6	134.8
Heat Input (MMBtu/hr, HHV)	1,799	1,677	1,623	1,528
Heat Input (MMBtu/hr, LHV)	1,622	1,512	1,463	1,378
Estimated Heat Rate (Btu/kwh, LHV)	9,361	9,673	9,852	10,219
Relative Humidity (Percent)	30	60	80	80
CT Exhaust Flow				
Mass Flow (lb/hr)	3,715,820	3,508,260	3,396,840	3,191,900
Mass Flow (lb/hr) ^a	3,901,611	3,683,673	3,566,682	3,351,495
Temperature (oF)	1,070	1,087	1,098	1,121
Moisture (% Vol.)	6.94	7.63	8.67	10.89
Oxygen (% Vol.)	13.23	13.18	12.99	12.56
Molecular Weight	28.54	28.46	28.35	28.10
Natural Gas Consumption (lb/hr) = Heat Input (MMBtu/hr) x 1,000,000 Btu/MMBtu + Fuel Heat Content, LHV (Btu/lb)				
(cf/hr) = Heat Input (MMBtu/hr) x 1,000,000 Btu/MMBtu + Fuel Heat Content, LHV (Btu/cf)				
Heat Input (MMBtu/hr, HHV)	1,799	1,677	1,623	1,528
Heat Content (Btu/lb, HHV)	23,170	23,170	23,170	23,170
Natural Gas (lb/hr)	77,644	72,378	70,047	65,947
Heat Content, LHV (Btu/cf)	1,000	1,000	1,000	1,000
Natural Gas (cf/hr)	1,799,000	1,677,000	1,623,000	1,528,000
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)	3,901,611	3,683,673	3,566,682	3,351,495
Temperature (°F)	1,070	1,087	1,098	1,121
Molecular Weight	28.54	28.46	28.35	28.10
Volume Flow (acfm)	2,544,388	2,435,831	2,384,687	2,293,952
Volume Flow (dscfm) = [(Mass Flow (lb/hr) x 1,545 x (68°F + 460°F)] + [Molecular weight x 2116.8] + 60 min/hr				
[(1 - Moisture(%)/100)]				
Mass Flow (lb/hr)	3,901,611	3,683,673	3,566,682	3,351,495
Temperature (°F)	68	68	68	68
Molecular Weight	28.54	28.46	28.35	28.10
Moisture (% Vol.)	6.94	7.63	8.67	10.89
Volume Flow (dscfm)	817,126	767,930	738,094	682,673
Bypass Stack Data				
Stack Height (ft)	75	75	75	75
Diameter (ft)	23.0	23.0	23.0	23.0
Velocity (ft/sec) = Volume flow (acfm) from CT + [((diameter) ² + 4) x 3.14159] + 60 sec/min				
Volume Flow (acfm) from CT	2,544,388	2,435,831	2,384,687	2,293,952
Diameter (ft)	23.0	23.0	23.0	23.0
Velocity (ft/sec)	102.1	97.7	95.7	92.0
HRSG Stack Data				
Stack Height (ft)	90	90	90	90
Diameter (ft)	19.0	19.0	19.0	19.0
Volume Flow (acfm) from HRSG = [Volume flow (acfm) x (HRSG temp. (°F) + 460°F)] + [CT temp. (°F) + 460°F]				
Volume Flow (acfm) from CT	2,544,388	2,435,831	2,384,687	2,293,952
CT Temperature (°F)	1,070	1,087	1,098	1,121
HRSG Temperature (°F)	190	190	190	190
Volume Flow (acfm) from HRSG	1,080,949	1,023,458	994,895	943,117
Velocity (ft/sec) = Volume flow (acfm) from HRSG + [((diameter) ² + 4) x 3.14159] + 60 sec/min				
Volume Flow (acfm) from HRSG	1,080,949	1,023,458	994,895	943,117
Diameter (ft)	19.0	19.0	19.0	19.0
Velocity (ft/sec)	63.5	60.2	58.5	55.4

^a: Universal gas constant = 1,545 ft-lb(force)/°R; atmospheric pressure = 2,116.8 lb(force)/ft²

^a A 5 percent margin has been added to maximize emissions since operating history has been limited.

Source: Westinghouse, 1993.

Table A1B-2. Maximum Emissions for Criteria Pollutants for Hardee Power Station Unit 3, Simple and Combined Cycle--
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, Base Load

Pollutant	Gas Turbine Natural Gas 32 °F	Gas Turbine Natural Gas 59 °F	Gas Turbine Natural Gas 72 °F	Gas Turbine Natural Gas 95 °F
Hours of Operation	5260	5260	5260	5260
Particulate (lb/hr) = Emission rate (lb/hr) from manufacturer				
Basis (including H ₂ SO ₄), lb/hr	7.4	6.9	6.8	6.4
lb/hr	7.4	6.9	6.8	6.4
TPY	19.5	18.3	17.9	16.7
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				
Natural Gas (cf/hr)	1,799,000	1,677,000	1,623,000	1,528,000
Basis, gr/100 cf	1.0	1.0	1.0	1.0
lb SO ₂ /lb S (64/32)	2.0	2.0	2.0	2.0
lb/hr	5.14	4.79	4.64	4.37
TPY	13.52	12.60	12.20	11.48
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 , ISO (1)	15	15	15	15
Basis, ppmvd @15% O ₂ (1)	15.7	15.0	13.7	10.8
Moisture (%)	6.94	7.63	8.67	10.89
Oxygen (%)	13.23	13.18	12.99	12.56
Volume Flow (acfm)	2,544,388	2,435,831	2,384,687	2,293,952
Temperature (°F)	1,070	1,087	1,098	1,121
lb/hr	104.1	92.7	82.0	60.9
TPY	273.7	243.9	215.5	160.2
Carbon Monoxide (lb/hr) = CO(ppm) x [1 - Moisture(%)/100] x 2116.8 lb/ft ² 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 (1)	20	20	20	20
Moisture (%)	6.94	7.63	8.67	10.89
Volume Flow (acfm)	2,544,388	2,435,831	2,384,687	2,293,952
Temperature (°F)	1,070	1,087	1,098	1,121
lb/hr	71.2	67.0	64.4	59.5
TPY	187.4	176.1	169.2	156.5
VOCs (lb/hr) = VOC(ppm) x [1 - Moisture(%)/100] x 2116.8 lb/ft ² 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 (1)	5.0	5.0	5.0	5.0
Moisture (%)	6.94	7.63	8.67	10.89
Volume Flow (acfm)	2,544,388	2,435,831	2,384,687	2,293,952
Temperature (°F)	1,070	1,087	1,098	1,121
lb/hr	10.2	9.6	9.2	8.5
TPY	26.77	25.16	24.18	22.36
Lead (lb/hr) = Negligible				
Basis, lb/10E+12 Btu	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA
TPY	NA	NA	NA	NA

Note: ppmvd = parts per million, volume dry; O₂ = oxygen; ISO = ISO conditions

Source: (1) Westinghouse, 1993

Table A1B-3. Maximum Emissions of Other Regulated Pollutants for Hardee Power Station Unit No. 3, Simple and Combined Cycle-
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, Base Load

Pollutant	Units	Gas Turbine Natural Gas 32 °F	Gas Turbine Natural Gas 59 °F	Gas Turbine Natural Gas 72 °F	Gas Turbine Natural Gas 95 °F
Hours of Operation		5260	5260	5260	5260
Arsenic (lb/hr) = Negligible					
Basis, lb/10E+12 Btu	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Beryllium (lb/hr) = Negligible					
Basis, lb/10E+12 Btu	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Fluoride (lb/hr) = Negligible					
Basis, pg/J	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Mercury (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (1)	0.027	0.027	0.027	0.027	0.027
HIR (MMBtu/hr)	1,799	1,677	1,623	1,528	1,528
lb/hr	4.86E-05	4.53E-05	4.38E-05	4.13E-05	4.13E-05
TPY	1.28E-04	1.19E-04	1.15E-04	1.09E-04	1.09E-04
Sulfuric Acid Mist (lb/hr) = From CT Exhaust [Fuel consumption (lb/hr) x sulfur content (%) x (Conversion (fraction) of S to H2SO4) x lb H2SO4/lb S] + HRSG Effect [Fuel consumption (lb/hr) x sulfur content (fraction) x Fraction Fuel S to SO2 x (Conversion (fraction) of SO2 to H2SO4) x lb H2SO4/lb S]					
Fuel consumption (lb/hr)	77,644	72,378	70,047	65,947	65,947
Sulfur Content (gr/100 cf)	1.0	1.0	1.0	1.0	1.0
Fuel density (lb/scf)	0.0486	0.0486	0.0486	0.0486	0.0486
Sulfur content (%) ^ a	0.00294	0.00294	0.00294	0.00294	0.00294
lb H2SO4/lb S (98/32)	3.06	3.06	3.06	3.06	3.06
CT Exhaust- % S Conversion to H2SO4 (2)	10	10	10	10	10
lb/hr	0.70	0.65	0.63	0.59	0.59
TPY	1.84	1.71	1.66	1.56	1.56
HRSG Effect- Fuel (%) to SO2 (2)	90	90	90	90	90
% SO2 Conversion to H2SO4	5	5	5	5	5
lb/hr	0.31	0.29	0.28	0.27	0.27
TPY	0.83	0.77	0.75	0.70	0.70
Total lb/hr	1.01	0.94	0.91	0.86	0.86
Total TPY	2.67	2.48	2.40	2.26	2.26

Sources: (1) FDEP, 1992; (2) Westinghouse, 1993

^ a Sulfur content (%) = [sulfur content (gr/100 cf) x 1 lb/7,000 gr + fuel density (lb/scf)] x 100

Table A1B-4. Maximum Emissions of Non-Regulated Pollutants for Hardee Power station Unit 3, Simple and Combined Cycle-
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, Base Load

Pollutant	Units	Gas Turbine Natural Gas 32 °F	Gas Turbine Natural Gas 59 °F	Gas Turbine Natural Gas 72 °F	Gas Turbine Natural Gas 95 °F
Hours of Operation		5260	5260	5260	5260
Antimony (lb/hr) = Negligible					
Basis, pg/J	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Barium (lb/hr) = Negligible					
Basis, pg/J	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Cadmium (lb/hr) = Negligible					
Basis, lb/10E+12 Btu	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Chlorine (lb/hr) = Negligible					
Basis, ppm	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Chromium (lb/hr) = Negligible					
Basis, lb/10E+12 Btu	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Cobalt (lb/hr) = Negligible					
Basis, pg/J	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Copper (lb/hr) = Negligible					
Basis, lb/10E+12 Btu	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Formaldehyde (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (1)	88.12	88.12	88.12	88.12	88.12
HIR (MMBtu/hr)	1,799	1,677	1,623	1,528	1,528
lb/hr	1.59E-01	1.48E-01	1.43E-01	1.35E-01	1.35E-01
TPY	4.17E-01	3.89E-01	3.76E-01	3.54E-01	3.54E-01
Manganese (lb/hr) = Negligible					
Basis, lb/10E+12 Btu	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Nickel (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Polycyclic Organic Matter (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (1)	1.113	1.113	1.113	1.113	1.113
HIR (MMBtu/hr)	1,799	1,677	1,623	1,528	1,528
lb/hr	2.00E-03	1.87E-03	1.81E-03	1.70E-03	1.70E-03
TPY	5.27E-03	4.91E-03	4.75E-03	4.47E-03	4.47E-03
Selenium (lb/hr) = Negligible					
Basis, lb/10E+12 Btu	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Vanadium (lb/hr) = Negligible					
Basis, pg/J	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Zinc (lb/hr) = Negligible					
Basis, pg/J	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA

Table A1B-1A. Design Information and Stack Parameters for Hardee Power Station Unit 3, Simple and Combined Cycle – Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, Base Load – Steam for Power Augmentation

Data	Gas Turbine Natural Gas 80 °F	Gas Turbine Natural Gas 95 °F
General		
Power (MW)	149.0	149.0
Heat Input (MMBtu/hr, HHV)	1,631	1,624
Heat Input (MMBtu/hr, LHV)	1,471	1,464
Estimated Heat Rate (Btu/kwh, LHV)	9,870	9,828
Relative Humidity (Percent)	80	80
CT Exhaust Flow		
Mass Flow (lb/hr)	3,361,820	3,281,570
Mass Flow (lb/hr) ^a	3,529,911	3,445,649
Temperature (oF)	1,124	1,106
Moisture (% Vol.)	10.89	13.64
Oxygen (% Vol.)	12.48	11.85
Molecular Weight	28.10	27.81
Steam Augmentation Flow (lb/hr)	35,210	56,090
Natural Gas Consumption (lb/hr) = Heat Input (MMBtu/hr) x 1,000,000 Btu/MMBtu + Fuel Heat Content, LHV (Btu/lb)		
(cf/hr) = Heat Input (MMBtu/hr) x 1,000,000 Btu/MMBtu + Fuel Heat Content, LHV (Btu/cf)		
Heat Input (MMBtu/hr, HHV)	1,631	1,624
Heat Content (Btu/lb, HHV)	23,170	23,170
Natural Gas (lb/hr)	70,393	70,091
Heat Content, LHV (Btu/cf)	1,000	1,000
Natural Gas (cf/hr)	1,631,000	1,624,000
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)	3,529,911	3,445,649
Temperature (°F)	1,124	1,106
Molecular Weight	28.10	27.81
Volume Flow (acfm)	2,420,240	2,360,519
Volume Flow (dscfm) = [(Mass Flow (lb/hr) x 1,545 x (68°F + 460°F)] + [Molecular weight x 2116.8] + 60 min/hr		
[(1 - Moisture(%)/100)]		
Mass Flow (lb/hr)	3,529,911	3,445,649
Temperature (°F)	68	68
Molecular Weight	28.10	27.81
Moisture (% Vol.)	10.89	13.64
Volume Flow (dscfm)	718,892	687,325
Bypass Stack Data		
Stack Height (ft)	75	75
Diameter (ft)	23.0	23.0
Velocity (ft/sec) = Volume flow (acfm) from CT + [((diameter) ² + 4) x 3.14159] + 60 sec/min		
Volume Flow (acfm) from CT	2,420,240	2,360,519
Diameter (ft)	23.0	23.0
Velocity (ft/sec)	97.1	94.7
HRSG Stack Data		
Stack Height (ft)	90	90
Diameter (ft)	19.0	19.0
Volume Flow (acfm) from HRSG = [Volume flow (acfm) x (HRSG temp.(°F) + 460°F)] + [CT temp.(°F) + 460°F]		
Volume Flow (acfm) from CT	2,420,240	2,360,519
CT Temperature (°F)	1,124	1,106
HRSG Temperature (°F)	190	190
Volume Flow (acfm) from HRSG	993,154	979,781
Velocity (ft/sec) = Volume flow (acfm) from HRSG + [((diameter) ² + 4) x 3.14159] + 60 sec/min		
Volume Flow (acfm) from HRSG	993,154	979,781
Diameter (ft)	19.0	19.0
Velocity (ft/sec)	58.4	57.6

Note: Universal gas constant = 1,545 ft-lb(force)/°R; atmospheric pressure = 2,116.8 lb(force)/ft²

^a A 5 percent margin has been added to maximize emissions since operating history has been limited.

Source: Westinghouse, 1993.

Table A1B-2A. Maximum Emissions for Criteria Pollutants for Hardee Power Station Unit 3, Simple and Combined Cycle-
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, Base Load- Steam for Power Augmentation

Pollutant	Gas Turbine Natural Gas 80 °F	Gas Turbine Natural Gas 95 °F
Hours of Operation	2000	2000
Particulate (lb/hr) = Emission rate (lb/hr) from manufacturer		
Basis (Including H ₂ SO ₄), lb/hr	7.22	7.11
lb/hr	7.22	7.11
TPY	7.22	7.11
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		
Natural Gas (cf/hr)	1,631,000	1,624,000
Basis, gr/100 cf	1.0	1.0
lb SO ₂ /lb S (64/32)	2.0	2.0
lb/hr	4.66	4.64
TPY	4.66	4.64
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 , ISO (1)	25	25
Basis, ppmvd @15% O ₂ (1)	20.9	17.7
Moisture (%)	10.89	13.64
Oxygen (%)	12.48	11.85
Volume Flow (acfm)	2,420,240	2,360,519
Temperature (°F)	1,124	1,106
lb/hr	125.8	106.0
TPY	125.8	106.0
Carbon Monoxide (lb/hr) = CO(ppm) x [1 - Moisture%]/100 x 2116.8 lb/ft ² 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 (1)	50.0	50.0
Moisture (%)	10.89	13.64
Volume Flow (acfm)	2,420,240	2,360,519
Temperature (°F)	1,124	1,106
lb/hr	156.7	149.8
TPY	156.7	149.8
VOCs (lb/hr) = VOC(ppm) x [1 - Moisture%]/100 x 2116.8 lb/ft ² 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 (1)	5.00	5.25
Moisture (%)	10.89	13.64
Volume Flow (acfm)	2,420,240	2,360,519
Temperature (°F)	1,124	1,106
lb/hr	9.0	9.0
TPY	8.95	8.99
Lead (lb/hr) = Negligible		
Basis, lb/10E+12 Btu	NA	NA
HIR (MMBtu/hr)	NA	NA
lb/hr	NA	NA
TPY	NA	NA

Note: ppmvd = parts per million, volume dry; O₂ = oxygen; ISO = ISO conditions

Source: (1) Westinghouse, 1993

Table A1B-3A. Maximum Emissions of Other Regulated Pollutants for Hardee Power Station Unit No. 3, Simple and Combined Cycle-
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, Base Load- Steam for Power Augmentation

Pollutant	Units	Gas Turbine Natural Gas 80 °F	Gas Turbine Natural Gas 95 °F
Hours of Operation		2000	2000
Arsenic (lb/hr) = Negligible			
Basis, lb/10E+12 Btu		NA	NA
HIR (MMBtu/hr)		NA	NA
lb/hr		NA	NA
TPY		NA	NA
Beryllium (lb/hr) = Negligible			
Basis, lb/10E+12 Btu		NA	NA
HIR (MMBtu/hr)		NA	NA
lb/hr		NA	NA
TPY		NA	NA
Fluoride (lb/hr) = Negligible			
Basis, pg/J		NA	NA
HIR (MMBtu/hr)		NA	NA
lb/hr		NA	NA
TPY		NA	NA
Mercury (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu			
Basis, lb/10E+12 Btu (1)		0.027	0.027
HIR (MMBtu/hr)		1,631	1,624
lb/hr		4.40E-05	4.38E-05
TPY		4.40E-05	4.38E-05
Sulfuric Acid Mist (lb/hr) = From CT Exhaust [Fuel consumption (lb/hr) x sulfur content (%) x (Conversion (fraction) of S to H2SO4) x lb H2SO4/lb S] + HRSG Effect [Fuel consumption (lb/hr) x sulfur content (fraction) x Fraction Fuel S to SO2 x (Conversion (fraction) of SO2 to H2SO4) x lb H2SO4/lb S]			
Fuel consumption (lb/hr)		70,393	70,091
Sulfur Content (gr/100 cf)		1.0	1.0
Fuel density (lb/scf)		0.0486	0.0486
Sulfur content (%) ^ a		0.00294	0.00294
lb H2SO4/lb S (98/32)		3.06	3.06
CT Exhaust- % S Conversion to H2SO4 (2)		10	10
lb/hr		0.63	0.63
TPY		0.63	0.63
HRSG Effect- Fuel (%) to SO2 (2)		90	90
% SO2 Conversion to H2SO4		5	5
lb/hr		0.29	0.28
TPY		0.29	0.28
Total lb/hr		0.92	0.91
Total TPY		0.92	0.91

Sources: (1) FDEP, 1992; (2) Westinghouse, 1993

^ a Sulfur content (%) = [sulfur content (gr/100 cf) x 1 lb/7,000 gr + fuel density (lb/scf)] x 100

Table A1B-4A. Maximum Emissions of Non-Regulated Pollutants for Hardee Power station Unit 3, Simple and Combined Cycle-
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, Base Load- Steam for Power Augmentation

Pollutant	Units	Gas Turbine Natural Gas 80 °F	Gas Turbine Natural Gas 95 °F
Hours of Operation		2000	2000
Antimony (lb/hr) = Negligible			
Basis, pg/J		NA	NA
HIR (MMBtu/hr)		NA	NA
lb/hr		NA	NA
TPY		NA	NA
Barium (lb/hr) = Negligible			
Basis, pg/J		NA	NA
HIR (MMBtu/hr)		NA	NA
lb/hr		NA	NA
TPY		NA	NA
Cadmium (lb/hr) = Negligible			
Basis, lb/10E+12 Btu		NA	NA
HIR (MMBtu/hr)		NA	NA
lb/hr		NA	NA
TPY		NA	NA
Chlorine (lb/hr) = Negligible			
Basis, ppm		NA	NA
HIR (MMBtu/hr)		NA	NA
lb/hr		NA	NA
TPY		NA	NA
Chromium (lb/hr) = Negligible			
Basis, lb/10E+12 Btu		NA	NA
HIR (MMBtu/hr)		NA	NA
lb/hr		NA	NA
TPY		NA	NA
Cobalt (lb/hr) = Negligible			
Basis, pg/J		NA	NA
HIR (MMBtu/hr)		NA	NA
lb/hr		NA	NA
TPY		NA	NA
Copper (lb/hr) = Negligible			
Basis, lb/10E+12 Btu		NA	NA
HIR (MMBtu/hr)		NA	NA
lb/hr		NA	NA
TPY		NA	NA
Formaldehyde (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu			
Basis, lb/10E+12 Btu (1)		88.12	88.12
HIR (MMBtu/hr)		1,631	1,624
lb/hr		1.44E-01	1.43E-01
TPY		1.44E-01	1.43E-01
Manganese (lb/hr) = Negligible			
Basis, lb/10E+12 Btu		NA	NA
HIR (MMBtu/hr)		NA	NA
lb/hr		NA	NA
TPY		NA	NA
Nickel (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu			
Basis, lb/10E+12 Btu		NA	NA
HIR (MMBtu/hr)		NA	NA
lb/hr		NA	NA
TPY		NA	NA
Polycyclic Organic Matter (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu			
Basis, lb/10E+12 Btu (1)		1.113	1.113
HIR (MMBtu/hr)		1,631	1,624
lb/hr		1.82E-03	1.81E-03
TPY		1.82E-03	1.81E-03
Selenium (lb/hr) = Negligible			
Basis, lb/10E+12 Btu		NA	NA
HIR (MMBtu/hr)		NA	NA
lb/hr		NA	NA
TPY		NA	NA
Vanadium (lb/hr) = Negligible			
Basis, pg/J		NA	NA
HIR (MMBtu/hr)		NA	NA
lb/hr		NA	NA
TPY		NA	NA
Zinc (lb/hr) = Negligible			
Basis, pg/J		NA	NA
HIR (MMBtu/hr)		NA	NA
lb/hr		NA	NA
TPY		NA	NA

Table A2B-1. Design Information and Stack Parameters for Hardee Power Station Unit 3, Simple and Combined Cycle--
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, 75 Percent Load

Data	Gas Turbine Natural Gas 32 °F	Gas Turbine Natural Gas 59 °F	Gas Turbine Natural Gas 72 °F	Gas Turbine Natural Gas 95 °F
General				
Power (MW)	129.9	117.1	111.3	100.9
Heat Input (MMBtu/hr, HHV)	1,462	1,365	1,323	1,246
Heat Input (MMBtu/hr, LHV)	1,318	1,231	1,193	1,124
Estimated Heat Rate (Btu/kwh, LHV)	10,149	10,511	10,718	11,135
Relative Humidity (Percent)	30	60	80	80
CT Exhaust Flow				
Mass Flow (lb/hr)	2,947,220	2,838,090	2,781,950	2,677,360
Mass Flow (lb/hr) ^ a	3,094,581	2,979,995	2,921,048	2,811,228
Temperature (oF)	1,130	1,130	1,130	1,130
Moisture (% Vol.)	7.02	7.61	8.57	10.66
Oxygen (% Vol.)	13.15	13.23	13.13	12.86
Molecular Weight	28.53	28.46	28.35	28.11
Natural Gas Consumption (lb/hr) = Heat Input (MMBtu/hr) x 1,000,000 Btu/MMBtu + Fuel Heat Content, LHV (Btu/lb) (cf/hr) = Heat Input (MMBtu/hr) x 1,000,000 Btu/MMBtu + Fuel Heat Content, LHV (Btu/cf)				
Heat Input (MMBtu/hr, HHV)	1,462	1,365	1,323	1,246
Heat Content (Btu/lb, HHV)	23,170	23,170	23,170	23,170
Natural Gas (lb/hr)	63,099	58,912	57,100	53,776
Heat Content, LHV (Btu/cf)	1,000	1,000	1,000	1,000
Natural Gas (cf/hr)	1,462,000	1,365,000	1,323,000	1,246,000
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)	3,094,581	2,979,995	2,921,048	2,811,228
Temperature (°F)	1,130	1,130	1,130	1,130
Molecular Weight	28.53	28.46	28.35	28.11
Volume Flow (acfm)	2,097,704	2,025,353	1,992,933	1,934,252
Volume Flow (dscfm) = [(Mass Flow (lb/hr) x 1,545 x (68°F + 460°F)] + [Molecular weight x 2116.8] + 60 min/hr [(1 - Moisture(%)/100)]				
Mass Flow (lb/hr)	3,094,581	2,979,995	2,921,048	2,811,228
Temperature (°F)	68	68	68	68
Molecular Weight	28.53	28.46	28.35	28.11
Moisture (% Vol.)	7.02	7.61	8.57	10.66
Volume Flow (dscfm)	647,695	621,387	605,088	573,847
Bypass Stack Data				
Stack Height (ft)	75	75	75	75
Diameter (ft)	23.0	23.0	23.0	23.0
Velocity (ft/sec) = Volume flow (acfm) from CT + [((diameter)² + 4) x 3.14159] + 60 sec/min				
Volume Flow (acfm) from CT	2,097,704	2,025,353	1,992,933	1,934,252
Diameter (ft)	23.0	23.0	23.0	23.0
Velocity (ft/sec)	84.1	81.2	79.9	77.6
HRSG Stack Data				
Stack Height (ft)	90	90	90	90
Diameter (ft)	19.0	19.0	19.0	19.0
Volume Flow (acfm) from HRSG = [Volume flow (acfm) x (HRSG temp.(°F) + 460°F)] + [CT temp.(°F) + 460°F]				
Volume Flow (acfm) from CT	2,097,704	2,025,353	1,992,933	1,934,252
CT Temperature (°F)	1,130	1,130	1,130	1,130
HRSG Temperature (°F)	190	190	190	190
Volume Flow (acfm) from HRSG	857,552	827,974	814,721	790,732
Velocity (ft/sec) = Volume flow (acfm) from HRSG + [((diameter)² + 4) x 3.14159] + 60 sec/min				
Volume Flow (acfm) from HRSG	857,552	827,974	814,721	790,732
Diameter (ft)	19.0	19.0	19.0	19.0
Velocity (ft/sec)	50.4	48.7	47.9	46.5

Note: Universal gas constant= 1,545 ft-lb(force)/°R; atmospheric pressure= 2,116.8 lb(force)/ft²

^ a A 5 percent margin has been added to maximize emissions since operating history has been limited.

Table A2B-2. Maximum Emissions for Criteria Pollutants for Hardee Power Station Unit 3, Simple and Combined Cycle--
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, 75 Percent Load

Pollutant	Gas Turbine Natural Gas 32 °F	Gas Turbine Natural Gas 59 °F	Gas Turbine Natural Gas 72 °F	Gas Turbine Natural Gas 95 °F
Hours of Operation	5260	5260	5260	5260
Particulate (lb/hr) = Emission rate (lb/hr) from manufacturer				
Basis (including H ₂ SO ₄), lb/hr	5.8	5.7	5.5	5.3
lb/hr	5.8	5.7	5.5	5.3
TPY	15.3	14.9	14.6	13.9
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				
Natural Gas (cf/hr)	1,462,000	1,365,000	1,323,000	1,246,000
Basis, gr/100 cf	1.0	1.0	1.0	1.0
lb SO ₂ /lb S (64/32)	2.0	2.0	2.0	2.0
lb/hr	4.18	3.90	3.78	3.56
TPY	10.99	10.26	9.94	9.36
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 , ISO (1)	15	15	15	15
Basis, ppmvd @15% O ₂ (1)	15.7	15.1	13.5	10.9
Moisture (%)	7.02	7.61	8.57	10.66
Oxygen (%)	13.15	13.23	13.13	12.86
Volume Flow (acfm)	2,097,704	2,025,353	1,992,933	1,934,252
Temperature (°F)	1,130	1,130	1,130	1,130
lb/hr	83.4	74.9	64.8	49.4
TPY	219.4	197.1	170.5	129.9
Carbon Monoxide (lb/hr) = CO(ppm) x [1 - Moisture(%)/100] x 2116.8 lb/ft ² 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 (1)	20	20	20	20
Moisture (%)	7.02	7.61	8.57	10.66
Volume Flow (acfm)	2,097,704	2,025,353	1,992,933	1,934,252
Temperature (°F)	1,130	1,130	1,130	1,130
lb/hr	56.5	54.2	52.8	50.0
TPY	148.5	142.5	138.7	131.6
VOCs (lb/hr) = VOC(ppm) x [1 - Moisture(%)/100] x 2116.8 lb/ft ² 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 (1)	5.0	5.0	5.0	5.0
Moisture (%)	7.02	7.61	8.57	10.66
Volume Flow (acfm)	2,097,704	2,025,353	1,992,933	1,934,252
Temperature (°F)	1,130	1,130	1,130	1,130
lb/hr	8.1	7.7	7.5	7.1
TPY	21.22	20.36	19.82	18.80
Lead (lb/hr) = Negligible				
Basis, lb/10E+12 Btu	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA
TPY	NA	NA	NA	NA

Note: ppmvd = parts per million, volume dry; O₂ = oxygen; ISO = ISO conditions

Source: (1) Westinghouse, 1993

Table A2B-3. Maximum Emissions of Other Regulated Pollutants for Hardee Power Station Unit No. 3, Simple and Combined Cycle--
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, 75 Percent Load

Pollutant	Units	Gas Turbine Natural Gas 32 °F	Gas Turbine Natural Gas 59 °F	Gas Turbine Natural Gas 72 °F	Gas Turbine Natural Gas 95 °F
Hours of Operation		5260	5260	5260	5260
Arsenic (lb/hr) = Negligible					
Basis, lb/10E+12 Btu		NA	NA	NA	NA
HIR (MMBtu/hr)		NA	NA	NA	NA
lb/hr		NA	NA	NA	NA
TPY		NA	NA	NA	NA
Beryllium (lb/hr) = Negligible					
Basis, lb/10E+12 Btu		NA	NA	NA	NA
HIR (MMBtu/hr)		NA	NA	NA	NA
lb/hr		NA	NA	NA	NA
TPY		NA	NA	NA	NA
Fluoride (lb/hr) = Negligible					
Basis, pg/J		NA	NA	NA	NA
HIR (MMBtu/hr)		NA	NA	NA	NA
lb/hr		NA	NA	NA	NA
TPY		NA	NA	NA	NA
Mercury (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (1)		0.027	0.027	0.027	0.027
HIR (MMBtu/hr)		1,462	1,365	1,323	1,246
lb/hr		3.95E-05	3.69E-05	3.57E-05	3.36E-05
TPY		1.04E-04	9.69E-05	9.39E-05	8.85E-05
Sulfuric Acid Mist (lb/hr) = From CT Exhaust [Fuel consumption (lb/hr) x sulfur content (%) x (Conversion (fraction) of S to H2SO4) x lb H2SO4/lb S] + HRSG Effect [Fuel consumption (lb/hr) x sulfur content (fraction) x Fraction Fuel S to SO2 x (Conversion (fraction) of SO2 to H2SO4) x lb H2SO4/lb S]					
Fuel consumption (lb/hr)		63,099	58,912	57,100	53,776
Sulfur Content (gr/100 cf)		1.0	1.0	1.0	1.0
Fuel density (lb/scf)		0.0486	0.0486	0.0486	0.0486
Sulfur content (%) ^ a		0.00294	0.00294	0.00294	0.00294
lb H2SO4/lb S (98/32)		3.06	3.06	3.06	3.06
CT Exhaust- % S Conversion to H2SO4 (2)		10	10	10	10
lb/hr		0.57	0.53	0.51	0.48
TPY		1.49	1.39	1.35	1.27
HRSG Effect- Fuel (%) to SO2 (2)		90	90	90	90
% SO2 Conversion to H2SO4		5	5	5	5
lb/hr		0.26	0.24	0.23	0.22
TPY		0.67	0.63	0.61	0.57
Total lb/hr		0.82	0.77	0.75	0.70
Total TPY		2.17	2.02	1.96	1.85

Sources: (1) FDEP, 1992; (2) Westinghouse, 1993

^ a Sulfur content (%) = [sulfur content (gr/100 cf) x 1 lb/7,000 gr + fuel density (lb/scf)] x 100

Table A2B-4. Maximum Emissions of Non-Regulated Pollutants for Hardee Power station Unit 3, Simple and Combined Cycle-
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, 75 Percent Load

Pollutant	Units	Gas Turbine Natural Gas 32 °F	Gas Turbine Natural Gas 59 °F	Gas Turbine Natural Gas 72 °F	Gas Turbine Natural Gas 95 °F
Hours of Operation		5260	5260	5260	5260
Antimony (lb/hr) = Negligible					
Basis, pg/J	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Barium (lb/hr) = Negligible					
Basis, pg/J	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Cadmium (lb/hr) = Negligible					
Basis, lb/10E+12 Btu	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Chlorine (lb/hr) = Negligible					
Basis, ppm	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Chromium (lb/hr) = Negligible					
Basis, lb/10E+12 Btu	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Cobalt (lb/hr) = Negligible					
Basis, pg/J	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Copper (lb/hr) = Negligible					
Basis, lb/10E+12 Btu	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Formaldehyde (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (1)	88.12	88.12	88.12	88.12	88.12
HIR (MMBtu/hr)	1,462	1,365	1,323	1,246	1,246
lb/hr	1.29E-01	1.20E-01	1.17E-01	1.10E-01	1.10E-01
TPY	3.39E-01	3.16E-01	3.07E-01	2.89E-01	2.89E-01
Manganese (lb/hr) = Negligible					
Basis, lb/10E+12 Btu	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Nickel (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Polycyclic Organic Matter (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (1)	1.113	1.113	1.113	1.113	1.113
HIR (MMBtu/hr)	1,462	1,365	1,323	1,246	1,246
lb/hr	1.63E-03	1.52E-03	1.47E-03	1.39E-03	1.39E-03
TPY	4.28E-03	4.00E-03	3.87E-03	3.65E-03	3.65E-03
Selenium (lb/hr) = Negligible					
Basis, lb/10E+12 Btu	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Vanadium (lb/hr) = Negligible					
Basis, pg/J	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Zinc (lb/hr) = Negligible					
Basis, pg/J	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA

Table A3B-1. Design Information and Stack Parameters for Hardee Power Station Unit 3, Simple and Combined Cycle-
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, 50 Percent Load

Data	Gas Turbine Natural Gas 32 °F	Gas Turbine Natural Gas 59 °F	Gas Turbine Natural Gas 72 °F	Gas Turbine Natural Gas 95 °F
General				
Power (MW)	86.3	77.8	73.8	66.9
Heat Input (MMBtu/hr, HHV)	1,084	1,021	994	943
Heat Input (MMBtu/hr, LHV)	977	921	896	850
Estimated Heat Rate (Btu/kwh, LHV)	11,326	11,834	12,145	12,710
Relative Humidity (Percent)	30	60	80	80
CT Exhaust Flow				
Mass Flow (lb/hr)	2,642,320	2,537,250	2,481,860	2,381,770
Mass Flow (lb/hr) ^ a	2,774,436	2,664,113	2,605,953	2,500,859
Temperature (°F)	1,020	1,033	1,040	1,050
Moisture (% Vol.)	5.91	6.60	7.63	9.79
Oxygen (% Vol.)	14.40	14.37	14.20	13.84
Molecular Weight	28.60	28.52	28.40	28.16
Natural Gas Consumption (lb/hr) = Heat Input (MMBtu/hr) x 1,000,000 Btu/MMBtu + Fuel Heat Content, LHV (Btu/lb)				
(cf/hr) = Heat Input (MMBtu/hr) x 1,000,000 Btu/MMBtu + Fuel Heat Content, LHV (Btu/cf)				
Heat Input (MMBtu/hr, HHV)	1,084	1,021	994	943
Heat Content (Btu/lb, HHV)	23,170	23,170	23,170	23,170
Natural Gas (lb/hr)	46,785	44,066	42,900	40,699
Heat Content, LHV (Btu/cf)	1,000	1,000	1,000	1,000
Natural Gas (cf/hr)	1,084,000	1,021,000	994,000	943,000
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)	2,774,436	2,664,113	2,605,953	2,500,859
Temperature (°F)	1,020	1,033	1,040	1,050
Molecular Weight	28.60	28.52	28.40	28.16
Volume Flow (acfm)	1,746,343	1,696,528	1,674,066	1,631,084
Volume Flow (dscfm) = [(Mass Flow (lb/hr) x 1,545 x (68°F + 460°F)] + [Molecular weight x 2116.8] + 60 min/hr				
[(1 - Moisture(%)/100)]				
Mass Flow (lb/hr)	2,774,436	2,664,113	2,605,953	2,500,859
Temperature (°F)	68	68	68	68
Molecular Weight	28.60	28.52	28.40	28.16
Moisture (% Vol.)	5.91	6.6	7.63	9.79
Volume Flow (dscfm)	586,199	560,379	544,310	514,503
Bypass Stack Data				
Stack Height (ft)	75	75	75	75
Diameter (ft)	23.0	23.0	23.0	23.0
Velocity (ft/sec) = Volume flow (acfm) from CT + [((diameter) ² + 4) x 3.14159] + 60 sec/min				
Volume Flow (acfm) from CT	1,746,343	1,696,528	1,674,066	1,631,084
Diameter (ft)	23.0	23.0	23.0	23.0
Velocity (ft/sec)	70.1	68.1	67.2	65.4
HRSG Stack Data				
Stack Height (ft)	90	90	90	90
Diameter (ft)	19.0	19.0	19.0	19.0
Volume Flow (acfm) from HRSG = [Volume flow (acfm) x (HRSG temp.(°F) + 460°F)] + [CT temp.(°F) + 460°F]				
Volume Flow (acfm) from CT	1,746,343	1,696,528	1,674,066	1,631,084
CT Temperature (°F)	1,020	1,033	1,040	1,050
HRSG Temperature (°F)	190	190	190	190
Volume Flow (acfm) from HRSG	766,975	738,609	725,429	702,122
Velocity (ft/sec) = Volume flow (acfm) from HRSG + [((diameter) ² + 4) x 3.14159] + 60 sec/min				
Volume Flow (acfm) from HRSG	766,975	738,609	725,429	702,122
Diameter (ft)	19.0	19.0	19.0	19.0
Velocity (ft/sec)	45.1	43.4	42.6	41.3

Note: Universal gas constant = 1,545 ft-lb(force)/°R; atmospheric pressure = 2,116.8 lb(force)/ft²

^ a A 5 percent margin has been added to maximize emissions since operating history has been limited.

Source: Westinghouse, 1993.

Table A3B-2. Maximum Emissions for Criteria Pollutants for Hardee Power Station Unit 3, Simple and Combined Cycle-
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, 50 Percent Load

Pollutant	Gas Turbine Natural Gas 32 °F	Gas Turbine Natural Gas 59 °F	Gas Turbine Natural Gas 72 °F	Gas Turbine Natural Gas 95 °F
Hours of Operation	5260	5260	5260	5260
Particulate (lb/hr) = Emission rate (lb/hr) from manufacturer				
Basis (including H ₂ SO ₄), lb/hr	5.1	4.9	4.9	4.6
lb/hr	5.1	4.9	4.9	4.6
TPY	13.4	12.8	12.8	12.2
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				
Natural Gas (cf/hr)	1,084,000	1,021,000	994,000	943,000
Basis, gr/100 cf	1.0	1.0	1.0	1.0
lb SO ₂ /lb S (64/32)	2.0	2.0	2.0	2.0
lb/hr	3.10	2.92	2.84	2.69
TPY	8.15	7.67	7.47	7.09
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 , ISO (1)	15	15	15	15
Basis, ppmvd @15% O ₂ (1)	15.6	15.2	13.9	10.6
Moisture (%)	5.91	6.6	7.63	9.79
Oxygen (%)	14.4	14.37	14.2	13.84
Volume Flow (acfm)	1,746,343	1,696,528	1,674,066	1,631,084
Temperature (°F)	1,020	1,033	1,040	1,050
lb/hr	62.1	57.0	50.8	36.8
TPY	163.4	150.0	133.5	96.8
Carbon Monoxide (lb/hr) = CO(ppm) x [1 - Moisture(%)/100] x 2116.8 lb/ft ² 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 (1)	30	30	30	30
Moisture (%)	5.91	6.6	7.63	9.79
Volume Flow (acfm)	1,746,343	1,696,528	1,674,066	1,631,084
Temperature (°F)	1,020	1,033	1,040	1,050
lb/hr	76.7	73.3	71.2	67.3
TPY	201.6	192.7	187.2	177.0
VOCs (lb/hr) = VOC(ppm) x [1 - Moisture(%)/100] x 2116.8 lb/ft ² 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 (1)	10.0	10.0	10.0	10.0
Moisture (%)	5.91	6.6	7.63	9.79
Volume Flow (acfm)	1,746,343	1,696,528	1,674,066	1,631,084
Temperature (°F)	1,020	1,033	1,040	1,050
lb/hr	14.6	14.0	13.6	12.8
TPY	38.41	36.71	35.66	33.71
Lead (lb/hr) = Negligible				
Basis, lb/10E+12 Btu	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA
TPY	NA	NA	NA	NA

Note: ppmvd = parts per million, volume dry; O₂ = oxygen; ISO = ISO conditions

Source: (1) Westinghouse, 1993

Table A3B-3. Maximum Emissions of Other Regulated Pollutants for Hardee Power Station Unit No. 3, Simple and Combined Cycle--
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, 50 Percent Load

Pollutant	Units	Gas Turbine Natural Gas 32 °F	Gas Turbine Natural Gas 59 °F	Gas Turbine Natural Gas 72 °F	Gas Turbine Natural Gas 95 °F
Hours of Operation		5260	5260	5260	5260
Arsenic (lb/hr) = Negligible					
Basis, lb/10E+12 Btu	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Beryllium (lb/hr) = Negligible					
Basis, lb/10E+12 Btu	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Fluoride (lb/hr) = Negligible					
Basis, pg/J	NA	NA	NA	NA	NA
HIR (MMBtu/hr)	NA	NA	NA	NA	NA
lb/hr	NA	NA	NA	NA	NA
TPY	NA	NA	NA	NA	NA
Mercury (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (1)	0.027	0.027	0.027	0.027	0.027
HIR (MMBtu/hr)	1,084	1,021	994	943	943
lb/hr	2.93E-05	2.76E-05	2.68E-05	2.55E-05	2.55E-05
TPY	7.70E-05	7.25E-05	7.06E-05	6.70E-05	6.70E-05
Sulfuric Acid Mist (lb/hr) = From CT Exhaust [Fuel consumption (lb/hr) x sulfur content (%) x (Conversion (fraction) of S to H2SO4) x lb H2SO4/lb S] + HRSG Effect [Fuel consumption (lb/hr) x sulfur content (fraction) x Fraction Fuel S to SO2 x (Conversion (fraction) of SO2 to H2SO4) x lb H2SO4/lb S]					
Fuel consumption (lb/hr)	46,785	44,066	42,900	40,699	40,699
Sulfur Content (gr/100 cf)	1.0	1.0	1.0	1.0	1.0
Fuel density (lb/scf)	0.0486	0.0486	0.0486	0.0486	0.0486
Sulfur content (%) ^ a	0.00294	0.00294	0.00294	0.00294	0.00294
lb H2SO4/lb S (98/32)	3.06	3.06	3.06	3.06	3.06
CT Exhaust- % S Conversion to H2SO4 (2)	10	10	10	10	10
lb/hr	0.42	0.40	0.39	0.37	0.37
TPY	1.11	1.04	1.02	0.96	0.96
HRSG Effect- Fuel (%) to SO2 (2)	90	90	90	90	90
% SO2 Conversion to H2SO4	5	5	5	5	5
lb/hr	0.19	0.18	0.17	0.16	0.16
TPY	0.50	0.47	0.46	0.43	0.43
Total lb/hr	0.61	0.58	0.56	0.53	0.53
Total TPY	1.61	1.51	1.47	1.40	1.40

Sources: (1) FDEP, 1992; (2) Westinghouse, 1993

^ a Sulfur content (%) = [sulfur content (gr/100 cf) x 1 lb/7,000 gr + fuel density (lb/scf)] x 100

Table A3B-4. Maximum Emissions of Non-Regulated Pollutants for Hardee Power station Unit 3, Simple and Combined Cycle-
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, 50 Percent Load

Pollutant	Units	Gas Turbine Natural Gas 32 °F	Gas Turbine Natural Gas 59 °F	Gas Turbine Natural Gas 72 °F	Gas Turbine Natural Gas 95 °F
Hours of Operation		5260	5260	5260	5260
Antimony (lb/hr) = Negligible					
Basis, pg/J		NA	NA	NA	NA
HIR (MMBtu/hr)		NA	NA	NA	NA
lb/hr		NA	NA	NA	NA
TPY		NA	NA	NA	NA
Barium (lb/hr) = Negligible					
Basis, pg/J		NA	NA	NA	NA
HIR (MMBtu/hr)		NA	NA	NA	NA
lb/hr		NA	NA	NA	NA
TPY		NA	NA	NA	NA
Cadmium (lb/hr) = Negligible					
Basis, lb/10E+12 Btu		NA	NA	NA	NA
HIR (MMBtu/hr)		NA	NA	NA	NA
lb/hr		NA	NA	NA	NA
TPY		NA	NA	NA	NA
Chlorine (lb/hr) = Negligible					
Basis, ppm		NA	NA	NA	NA
HIR (MMBtu/hr)		NA	NA	NA	NA
lb/hr		NA	NA	NA	NA
TPY		NA	NA	NA	NA
Chromium (lb/hr) = Negligible					
Basis, lb/10E+12 Btu		NA	NA	NA	NA
HIR (MMBtu/hr)		NA	NA	NA	NA
lb/hr		NA	NA	NA	NA
TPY		NA	NA	NA	NA
Cobalt (lb/hr) = Negligible					
Basis, pg/J		NA	NA	NA	NA
HIR (MMBtu/hr)		NA	NA	NA	NA
lb/hr		NA	NA	NA	NA
TPY		NA	NA	NA	NA
Copper (lb/hr) = Negligible					
Basis, lb/10E+12 Btu		NA	NA	NA	NA
HIR (MMBtu/hr)		NA	NA	NA	NA
lb/hr		NA	NA	NA	NA
TPY		NA	NA	NA	NA
Formaldehyde (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu		88.12	88.12	88.12	88.12
HIR (MMBtu/hr)		1,084	1,021	994	943
lb/hr		9.55E-02	9.00E-02	8.76E-02	8.31E-02
TPY		2.51E-01	2.37E-01	2.30E-01	2.19E-01
Manganese (lb/hr) = Negligible					
Basis, lb/10E+12 Btu		NA	NA	NA	NA
HIR (MMBtu/hr)		NA	NA	NA	NA
lb/hr		NA	NA	NA	NA
TPY		NA	NA	NA	NA
Nickel (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu		NA	NA	NA	NA
HIR (MMBtu/hr)		NA	NA	NA	NA
lb/hr		NA	NA	NA	NA
TPY		NA	NA	NA	NA
Polycyclic Organic Matter (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (1)		1.113	1.113	1.113	1.113
HIR (MMBtu/hr)		1,084	1,021	994	943
lb/hr		1.21E-03	1.14E-03	1.11E-03	1.05E-03
TPY		3.17E-03	2.99E-03	2.91E-03	2.76E-03
Selenium (lb/hr) = Negligible					
Basis, lb/10E+12 Btu		NA	NA	NA	NA
HIR (MMBtu/hr)		NA	NA	NA	NA
lb/hr		NA	NA	NA	NA
TPY		NA	NA	NA	NA
Vanadium (lb/hr) = Negligible					
Basis, pg/J		NA	NA	NA	NA
HIR (MMBtu/hr)		NA	NA	NA	NA
lb/hr		NA	NA	NA	NA
TPY		NA	NA	NA	NA
Zinc (lb/hr) = Negligible					
Basis, pg/J		NA	NA	NA	NA
HIR (MMBtu/hr)		NA	NA	NA	NA
lb/hr		NA	NA	NA	NA
TPY		NA	NA	NA	NA

Table A4-1. Design Information and Stack Parameters for Hardee Power Station Unit 3, Simple and Combined Cycle—
Westinghouse 501F, Dry Low NOx Combustor, Distillate Oil (Water Injection), Base Load

Data	Gas Turbine Fuel Oil 32 °F	Gas Turbine Fuel Oil 59 °F	Gas Turbine Fuel Oil 72 °F	Gas Turbine Fuel Oil 95 °F
General				
Power (MW)	183.8	166.6	158.4	144.5
Heat Input (MMBtu/hr, HHV)	1,972	1,838	1,778	1,675
Heat Input (MMBtu/hr, LHV)	1,852	1,726	1,669	1,573
Estimated Heat Rate (Btu/kwh, LHV)	10,074	10,357	10,538	10,886
Relative Humidity (Percent)	30	60	80	80
CT Exhaust Flow				
Mass Flow (lb/hr)	3,887,550	3,668,760	3,551,470	3,336,190
Mass Flow (lb/hr) ^ a	4,081,928	3,852,198	3,729,044	3,503,000
Temperature (oF)	1,073	1,088	1,099	1,121
Moisture (% Vol.)	9.52	10.15	11.15	13.27
Oxygen (% Vol.)	11.80	11.78	11.60	11.20
Molecular Weight	28.48	28.41	28.29	28.06
Water Injection (lb/hr)	110,240	102,730	99,360	93,630
Fuel Oil Consumption (lb/hr) = Heat Input (MMBtu/hr) x 1,000,000 Btu/MMBtu + Fuel Heat Content, LHV (Btu/lb)				
Heat Input (MMBtu/hr, HHV)	1,972	1,838	1,778	1,675
Heat Content (Btu/lb, HHV)	19,680	19,680	19,680	19,680
Fuel Oil (lb/hr)	100,203	93,394	90,346	85,112
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)	4,081,928	3,852,198	3,729,044	3,503,000
Temperature (°F)	1,073	1,088	1,099	1,121
Molecular Weight	28.48	28.41	28.29	28.06
Volume Flow (acfm)	2,672,758	2,553,740	2,499,514	2,400,880
Volume Flow (dscfm) = [(Mass Flow (lb/hr) x 1,545 x (68°F + 460°F)] + [Molecular weight x 2116.8] + 60 min/hr x [(1 - Moisture(%)/100)]				
Mass Flow (lb/hr)	4,081,928	3,852,198	3,729,044	3,503,000
Temperature (°F)	68	68	68	68
Molecular Weight	28.48	28.41	28.29	28.06
Moisture (% Vol.)	9.52	10.15	11.15	13.27
Volume Flow (dscfm)	832,921	782,632	752,144	695,411
Bypass Stack Data				
Stack Height (ft)	75	75	75	75
Diameter (ft)	23.0	23.0	23.0	23.0
Velocity (ft/sec) = Volume flow (acfm) from CT + [((diameter) ² + 4) x 3.14159] + 60 sec/min				
Volume Flow (acfm) from CT	2,672,758	2,553,740	2,499,514	2,400,880
Diameter (ft)	23.0	23.0	23.0	23.0
Velocity (ft/sec)	107.2	102.4	100.3	96.3
HRSG Stack Data				
Stack Height (ft)	90	90	90	90
Diameter (ft)	19.0	19.0	19.0	19.0
Volume Flow (acfm) from HRSG = [Volume flow (acfm) x (HRSG temp.(°F) + 460°F)] + [CT temp.(°F) + 460°F]				
Volume Flow (acfm) from CT	2,672,758	2,553,740	2,499,514	2,400,880
CT Temperature (°F)	1,073	1,088	1,099	1,121
HRSG Temperature (°F)	285	285	285	285
Volume Flow (acfm) from HRSG	1,298,894	1,229,028	1,194,444	1,131,344
Velocity (ft/sec) = Volume flow (acfm) from HRSG + [((diameter) ² + 4) x 3.14159] + 60 sec/min				
Volume Flow (acfm) from HRSG	1,298,894	1,229,028	1,194,444	1,131,344
Diameter (ft)	19.0	19.0	19.0	19.0
Velocity (ft/sec)	76.4	72.2	70.2	66.5

Note: Universal gas constant = 1,545 ft-lb(force)/°R; atmospheric pressure = 2,116.8 lb(force)/ft²

^ a A 5 percent margin has been added to maximize emissions since operating history has been limited.

Source: Westinghouse, 1993.

Table A4-2. Maximum Emissions for Criteria Pollutants for Hardee Power Station Unit 3, Simple and Combined Cycle--
Westinghouse 501F, Dry Low NOx Combustor, Distillate Oil (Water Injection), Base Load

Pollutant	Gas Turbine Fuel Oil 32 °F	Gas Turbine Fuel Oil 59 °F	Gas Turbine Fuel Oil 72 °F	Gas Turbine Fuel Oil 95 °F
Hours of Operation	1500	1500	1500	1500
Particulate (lb/hr) = Emission rate (lb/hr) from manufacturer				
Basis (including H ₂ SO ₄), lb/hr	67.0	62.7	60.6	56.5
lb/hr	67.0	62.7	60.6	56.5
TPY	50.3	47.1	45.4	42.4
Sulfur Dioxide (lb/hr) = Fuel oil (lb/hr) x sulfur content(fraction) x (lb SO ₂ /lb S)				
Fuel Oil (lb/hr)	100,203	93,394	90,346	85,112
Sulfur content (%)	0.05	0.05	0.05	0.05
lb SO ₂ /lb S (64/32)	2.0	2.00	2.00	2.00
lb/hr	100.20	93.39	90.35	85.11
TPY	75.2	70.0	67.8	63.8
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 , ISO	42	42	42	42
Basis, ppmvd @15% O ₂	44.0	42.0	37.6	29.6
Moisture (%)	9.52	10.15	11.15	13.27
Oxygen (%)	11.8	11.78	11.6	11.2
Volume Flow (acfm)	2,672,758	2,553,740	2,499,514	2,400,880
Temperature (°F)	1,073	1,088	1,099	1,121
lb/hr	349.6	310.8	269.3	199.6
TPY	262.2	233.1	202.0	149.7
Carbon Monoxide (lb/hr) = CO(ppm) x [1 - Moisture(%)/100] x 2116.8 lb/ft ² 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	25	25	25	25
Moisture (%)	9.52	10.15	11.15	13.27
Volume Flow (acfm)	2,672,758	2,553,740	2,499,514	2,400,880
Temperature (°F)	1,073	1,088	1,099	1,121
lb/hr	90.8	85.3	82.0	75.8
TPY	68.1	64.0	61.5	56.8
VOCs (lb/hr) = VOC(ppm) x [1 - Moisture(%)/100] x 2116.8 lb/ft ² 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	10.0	10.0	10.0	10.0
Moisture (%)	9.52	10.15	11.15	13.27
Volume Flow (acfm)	2,672,758	2,553,740	2,499,514	2,400,880
Temperature (°F)	1,073	1,088	1,099	1,121
lb/hr	20.7	19.5	18.7	17.3
TPY	15.6	14.6	14.1	13.0
Lead (lb/hr) = Lead (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Emission Rate Basis, lb/10E+12 Btu	58	58	58	58
HIR (MMBtu/hr)	1,972	1,838	1,778	1,675
lb/hr	1.14E-01	1.07E-01	1.03E-01	9.72E-02
TPY	8.58E-02	8.00E-02	7.73E-02	7.29E-02

Note: ppmvd = parts per million, volume dry; O₂ = oxygen; ISO = ISO conditions

Source: Westinghouse, 1993; EPA, 1993

Table A4-3. Maximum Emissions of Other Regulated Pollutants for Hardee Power Station Unit No. 3, Simple and Combined Cycle--Westinghouse 501F, Dry Low NOx Combustor, Distillate Oil (Water Injection), Base Load

Pollutant	Units	Gas Turbine Fuel Oil 32 °F	Gas Turbine Fuel Oil 59 °F	Gas Turbine Fuel Oil 72 °F	Gas Turbine Fuel Oil 95 °F
Hours of Operation		1500	1500	1500	1500
Arsenic (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (1)		4.9	4.9	4.9	4.9
HIR (MMBtu/hr)		1,972	1,838	1,778	1,675
lb/hr		9.66E-03	9.01E-03	8.71E-03	8.21E-03
TPY		7.25E-03	6.75E-03	6.53E-03	6.16E-03
Beryllium (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (5)		2.5	2.5	2.5	2.5
HIR (MMBtu/hr)		1,972	1,838	1,778	1,675
lb/hr		4.93E-03	4.60E-03	4.45E-03	4.19E-03
TPY		3.70E-03	3.45E-03	3.33E-03	3.14E-03
Fluoride (lb/hr) = Basis (pg/J) x 2.324 x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, pg/J (2)		14	14	14	14
HIR (MMBtu/hr)		1,972	1,838	1,778	1,675
lb/hr		6.42E-02	5.98E-02	5.78E-02	5.45E-02
TPY		4.81E-02	4.49E-02	4.34E-02	4.09E-02
Mercury (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (3)		8.8	8.8	8.8	8.8
HIR (MMBtu/hr)		1,972	1,838	1,778	1,675
lb/hr		1.74E-02	1.62E-02	1.56E-02	1.47E-02
TPY		1.30E-02	1.21E-02	1.17E-02	1.11E-02
Sulfuric Acid Mist (lb/hr) = From CT Exhaust [Fuel consumption (lb/hr) x sulfur content (fraction) x (Conversion (fraction) of S to H2SO4) x lb H2SO4/lb S] + HRSG Effect [Fuel consumption (lb/hr) x sulfur content (fraction) x Fraction Fuel S to SO2 x (Conversion (fraction) of SO2 to H2SO4) x lb H2SO4/lb S]					
Fuel consumption (lb/hr)		100,203	93,394	90,346	85,112
Sulfur Content (%)		0.05	0.05	0.05	0.05
lb H2SO4/lb S (98/32)		3.06	3.0625	3.0625	3.0625
CT Exhaust- % S Conversion to H2SO4 (4)		10	10	10	10
lb/hr		15.34	14.30	13.83	13.03
TPY		11.51	10.73	10.38	9.77
HRSG Effect- Fuel Sulfur (%) to SO2 (4)		90	90	90	90
% SO2 Conversion to H2SO4		5	5	5	5
lb/hr		6.90	6.44	6.23	5.86
TPY		5.18	4.83	4.67	4.40
Total lb/hr		22.25	20.74	20.06	18.90
Total TPY		16.69	15.55	15.04	14.17

Note: Multiply by 2.324 to convert picogram/Joule (pg/J) to lb/10E+12 Btu.

Sources: (1) EPA, 1993; (2) EPA, 1981; (3) FDEP, 1992; (4) Westinghouse, 1993; (5) EPA, 1990

Table A4-4. Maximum Emissions of Non-Regulated Pollutants for Hardee Power station Unit 3, Simple and Combined Cycle-
Westinghouse 501F, Dry Low NOx Combustor, Distillate Oil (Water Injection), Base Load

Pollutant	Units	Gas Turbine Fuel Oil 32 °F	Gas Turbine Fuel Oil 59 °F	Gas Turbine Fuel Oil 72 °F	Gas Turbine Fuel Oil 95 °F
Hours of Operation		1500	1500	1500	1500
Antimony (lb/hr) = Basis (pg/J) x 2.324 x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, pg/J (1)		9.4	9.4	9.4	9.4
HIR (MMBtu/hr)		1,972	1,838	1,778	1,675
lb/hr		4.31E-02	4.02E-02	3.88E-02	3.68E-02
TPY		3.23E-02	3.01E-02	2.91E-02	2.74E-02
Barium (lb/hr) = Basis (pg/J) x 2.324 x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, pg/J (1)		8.4	8.4	8.4	8.4
HIR (MMBtu/hr)		1,972	1,838	1,778	1,675
lb/hr		3.85E-02	3.59E-02	3.47E-02	3.27E-02
TPY		2.89E-02	2.68E-02	2.60E-02	2.45E-02
Cadmium (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (2)		10.5	10.5	10.5	10.5
HIR (MMBtu/hr)		1,972	1,838	1,778	1,675
lb/hr		2.07E-02	1.93E-02	1.87E-02	1.78E-02
TPY		1.55E-02	1.45E-02	1.40E-02	1.32E-02
Chlorine (lb/hr) = Basis (ppm) x Fuel oil (lb/hr) + 1,000,000 (adj. for ppm)					
Basis, ppm		0.5	0.5	0.5	0.5
Fuel Oil (lb/hr)		100,203.3	93,394.3	90,345.5	85,111.8
lb/hr		5.01E-02	4.67E-02	4.52E-02	4.28E-02
TPY		3.78E-02	3.50E-02	3.39E-02	3.19E-02
Chromium (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (2)		47.5	47.5	47.5	47.5
HIR (MMBtu/hr)		1,972	1,838	1,778	1,675
lb/hr		9.37E-02	8.73E-02	8.45E-02	7.96E-02
TPY		7.03E-02	6.55E-02	6.33E-02	5.97E-02
Cobalt (lb/hr) = Basis (pg/J) x 2.324 x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, pg/J (1)		3.9	3.9	3.9	3.9
HIR (MMBtu/hr)		1,972	1,838	1,778	1,675
lb/hr		1.79E-02	1.67E-02	1.61E-02	1.52E-02
TPY		1.34E-02	1.25E-02	1.21E-02	1.14E-02
Copper (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (1)		1300	1300	1300	1300
HIR (MMBtu/hr)		1,972	1,838	1,778	1,675
lb/hr		2.56E+00	2.39E+00	2.31E+00	2.18E+00
TPY		1.92E+00	1.79E+00	1.73E+00	1.63E+00
Formaldehyde (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (2)		405	405	405	405
HIR (MMBtu/hr)		1,972	1,838	1,778	1,675
lb/hr		7.99E-01	7.44E-01	7.20E-01	6.78E-01
TPY		5.99E-01	5.58E-01	5.40E-01	5.09E-01
Manganese (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (1)		340	340	340	340
HIR (MMBtu/hr)		1,972	1,838	1,778	1,675
lb/hr		6.70E-01	6.25E-01	6.05E-01	5.70E-01
TPY		5.03E-01	4.68E-01	4.53E-01	4.27E-01
Nickel (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (1)		1200	1200	1200	1200
HIR (MMBtu/hr)		1,972	1,838	1,778	1,675
lb/hr		2.37E+00	2.21E+00	2.13E+00	2.01E+00
TPY		1.77E+00	1.65E+00	1.60E+00	1.51E+00
Polycyclic Organic Matter (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (2)		0.278	0.278	0.278	0.278
HIR (MMBtu/hr)		1,972	1,838	1,778	1,675
lb/hr		5.48E-04	5.11E-04	4.94E-04	4.68E-04
TPY		4.11E-04	3.83E-04	3.71E-04	3.49E-04
Selenium (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (2)		23.42	23.42	23.42	23.42
HIR (MMBtu/hr)		1,972	1,838	1,778	1,675
lb/hr		4.62E-02	4.30E-02	4.16E-02	3.92E-02
TPY		3.46E-02	3.23E-02	3.12E-02	2.94E-02
Vanadium (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (2)		69.5	69.5	69.5	69.5
HIR (MMBtu/hr)		1,972	1,838	1,778	1,675
lb/hr		1.37E-01	1.28E-01	1.24E-01	1.16E-01
TPY		1.03E-01	9.56E-02	9.27E-02	8.73E-02
Zinc (lb/hr) = Basis (pg/J) x 2.324 x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, pg/J (1)		294	294	294	294
HIR (MMBtu/hr)		1,972	1,838	1,778	1,675
lb/hr		1.35E+00	1.26E+00	1.21E+00	1.14E+00
TPY		1.01E+00	9.42E-01	9.11E-01	8.58E-01

Note: Multiply by 2.324 to convert picogram/Joule (pg/J) to lb/10E+12 Btu.

Source: (1) EPA, 1993; (2) EPA, 1990

Table A5-1. Design Information and Stack Parameters for Hardee Power Station Unit 3, Simple and Combined Cycle—
Westinghouse 501F, Dry Low NOx Combustor, Distillate Oil (Water Injection), 75 Percent Load

Data	Gas Turbine Fuel Oil 32 °F	Gas Turbine Fuel Oil 59 °F	Gas Turbine Fuel Oil 72 °F	Gas Turbine Fuel Oil 95 °F
General				
Power (MW)	137.7	124.8	118.6	108.1
Heat Input (MMBtu/hr, HHV)	1,588	1,485	1,438	1,357
Heat Input (MMBtu/hr, LHV)	1,491	1,394	1,350	1,274
Estimated Heat Rate (Btu/kwh, LHV)	10,828	11,173	11,385	11,787
Relative Humidity (Percent)	30	60	80	80
CT Exhaust Flow				
Mass Flow (lb/hr)	3,067,000	2,949,730	2,888,580	2,780,380
Mass Flow (lb/hr) ^ a	3,220,350	3,097,217	3,033,009	2,919,399
Temperature (oF)	1,130	1,130	1,130	1,130
Moisture (% Vol.)	9.57	10.07	10.96	12.91
Oxygen (% Vol.)	11.73	11.85	11.77	11.54
Molecular Weight	28.48	28.41	28.30	28.07
Water Injection (lb/hr)	88,750	83,020	80,390	75,850
Fuel Oil Consumption (lb/hr)= Heat Input (MMBtu/hr) x 1,000,000 Btu/MMBtu + Fuel Heat Content, LHV (Btu/lb)				
Heat Input (MMBtu/hr, HHV)	1,588	1,485	1,438	1,357
Heat Content (Btu/lb, HHV)	19,680	19,680	19,680	19,680
Fuel Oil (lb/hr)	80,691	75,457	73,069	68,953
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)	3,220,350	3,097,217	3,033,009	2,919,399
Temperature (°F)	1,130	1,130	1,130	1,130
Molecular Weight	28.48	28.41	28.30	28.07
Volume Flow (acfm)	2,187,002	2,108,829	2,072,653	2,011,367
Volume Flow (dscfm)= [(Mass Flow (lb/hr) x 1,545 x (68°F + 460°F)] + [Molecular weight x 2116.8] + 60 min/hr x [(1 - Moisture(%)/100)]				
Mass Flow (lb/hr)	3,220,350	3,097,217	3,033,009	2,919,399
Temperature (°F)	68	68	68	68
Molecular Weight	28.48	28.41	28.30	28.07
Moisture (% Vol.)	9.57	10.07	10.96	12.91
Volume Flow (dscfm)	656,748	629,771	612,842	581,696
Bypass Stack Data				
Stack Height (ft)	75	75	75	75
Diameter (ft)	23.0	23.0	23.0	23.0
Velocity (ft/sec)= Volume flow (acfm) from CT + [((diameter) ² + 4) x 3.14159] + 60 sec/min				
Volume Flow (acfm) from CT	2,187,002	2,108,829	2,072,653	2,011,367
Diameter (ft)	23.0	23.0	23.0	23.0
Velocity (ft/sec)	87.7	84.6	83.1	80.7
HRSG Stack Data				
Stack Height (ft)	90	90	90	90
Diameter (ft)	19.0	19.0	19.0	19.0
Volume Flow (acfm) from HRSG= [Volume flow (acfm) x (HRSG temp.(°F) + 460°F)] + [CT temp.(°F) + 460°F]				
Volume Flow (acfm) from CT	2,187,002	2,108,829	2,072,653	2,011,367
CT Temperature (°F)	1,130	1,130	1,130	1,130
HRSG Temperature (°F)	285	285	285	285
Volume Flow (acfm) from HRSG	1,024,727	988,099	971,149	942,433
Velocity (ft/sec)= Volume flow (acfm) from HRSG + [((diameter) ² + 4) x 3.14159] + 60 sec/min				
Volume Flow (acfm) from HRSG	1,024,727	988,099	971,149	942,433
Diameter (ft)	19.0	19.0	19.0	19.0
Velocity (ft/sec)	60.2	58.1	57.1	55.4

Note: Universal gas constant= 1,545 ft-lb(force)/°R; atmospheric pressure= 2,116.8 lb(force)/ft²

^ a A 5 percent margin has been added to maximize emissions since operating history has been limited.

Source: Westinghouse, 1993.

Table A5-2. Maximum Emissions for Criteria Pollutants for Hardee Power Station Unit 3, Simple and Combined Cycle--
Westinghouse 501F, Dry Low NOx Combustor, Distillate Oil (Water Injection), 75 Percent Load

Pollutant	Gas Turbine Fuel Oil 32 °F	Gas Turbine Fuel Oil 59 °F	Gas Turbine Fuel Oil 72 °F	Gas Turbine Fuel Oil 95 °F
Hours of Operation	1500	1500	1500	1500
Particulate (lb/hr) = Emission rate (lb/hr) from manufacturer				
Basis (including H2SO4), lb/hr	53.9	50.8	49.2	47.3
lb/hr	53.9	50.8	49.2	47.3
TPY	40.4	38.1	36.9	35.5
Sulfur Dioxide (lb/hr) = Fuel oil (lb/hr) x sulfur content(fraction) x (lb SO2/lb S)				
Fuel Oil (lb/hr)	80,691	75,457	73,069	68,953
Sulfur content (%)	0.05	0.05	0.05	0.05
lb SO2/lb S (64/32)	2.0	2.00	2.00	2.00
lb/hr	80.69	75.46	73.07	68.95
TPY	60.5	56.6	54.8	51.7
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% O2, ISO	42	42	42	42
Basis, ppmvd @15% O2	42.4	42.0	36.9	29.3
Moisture (%)	9.57	10.07	10.96	12.91
Oxygen (%)	11.73	11.85	11.77	11.54
Volume Flow (acfm)	2,187,002	2,108,829	2,072,653	2,011,367
Temperature (°F)	1,130	1,130	1,130	1,130
lb/hr	268.0	248.0	210.9	158.3
TPY	201.0	186.0	158.1	118.7
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 (%)	9.57	10.07	10.96	12.91
Volume Flow (acfm)	2,187,002	2,108,829	2,072,653	2,011,367
Temperature (°F)	1,130	1,130	1,130	1,130
lb/hr	85.9	82.4	80.1	76.1
TPY	64.4	61.8	60.1	57.1
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	10.0	10.0	10.0	10.0
Moisture (%)	9.57	10.07	10.96	12.91
Volume Flow (acfm)	2,187,002	2,108,829	2,072,653	2,011,367
Temperature (°F)	1,130	1,130	1,130	1,130
lb/hr	16.4	15.7	15.3	14.5
TPY	12.3	11.8	11.4	10.9
Lead (lb/hr) = Lead (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Emission Rate Basis, lb/10E+12 Btu	58	58	58	58
HIR (MMBtu/hr)	1,588	1,485	1,438	1,357
lb/hr	9.21E-02	8.61E-02	8.34E-02	7.87E-02
TPY	6.91E-02	6.46E-02	6.26E-02	5.90E-02

Note: ppmvd = parts per million, volume dry; O2 = oxygen; ISO = ISO conditions

Source: Westinghouse, 1993; EPA, 1993

Table A5-3. Maximum Emissions of Other Regulated Pollutants for Hardee Power Station Unit No. 3, Simple and Combined Cycle-
Westinghouse 501F, Dry Low NOx Combustor, Distillate Oil (Water Injection), 75 Percent Load

Pollutant	Units	Gas Turbine Fuel Oil 32 °F	Gas Turbine Fuel Oil 59 °F	Gas Turbine Fuel Oil 72 °F	Gas Turbine Fuel Oil 95 °F
Hours of Operation		1500	1500	1500	1500
Arsenic (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (1)		4.9	4.9	4.9	4.9
HIR (MMBtu/hr)		1,588	1,485	1,438	1,357
lb/hr		7.78E-03	7.28E-03	7.05E-03	6.65E-03
TPY		5.84E-03	5.46E-03	5.28E-03	4.99E-03
Beryllium (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (5)		2.5	2.5	2.5	2.5
HIR (MMBtu/hr)		1,588	1,485	1,438	1,357
lb/hr		3.97E-03	3.71E-03	3.60E-03	3.39E-03
TPY		2.98E-03	2.78E-03	2.70E-03	2.54E-03
Fluoride (lb/hr) = Basis (pg/J) x 2.324 x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, pg/J (2)		14	14	14	14
HIR (MMBtu/hr)		1,588	1,485	1,438	1,357
lb/hr		5.17E-02	4.83E-02	4.68E-02	4.42E-02
TPY		3.88E-02	3.62E-02	3.51E-02	3.31E-02
Mercury (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (3)		8.8	8.8	8.8	8.8
HIR (MMBtu/hr)		1,588	1,485	1,438	1,357
lb/hr		1.40E-02	1.31E-02	1.27E-02	1.19E-02
TPY		1.05E-02	9.80E-03	9.49E-03	8.96E-03
Sulfuric Acid Mist (lb/hr) = From CT Exhaust [Fuel consumption (lb/hr) x sulfur content (fraction) x (Conversion (fraction) of S to H2SO4) x lb H2SO4/lb S] + HRSG Effect [Fuel consumption (lb/hr) x sulfur content (fraction) x Fraction Fuel S to SO2 x (Conversion (fraction) of SO2 to H2SO4) x lb H2SO4/lb S]					
Fuel consumption (lb/hr)		80,691	75,457	73,069	68,953
Sulfur Content (%)		0.05	0.05	0.05	0.05
lb H2SO4/lb S (98/32)		3.06	3.06	3.06	3.06
CT Exhaust- % S Conversion to H2SO4 (4)		10	10	10	10
lb/hr		12.36	11.55	11.19	10.56
TPY		9.27	8.67	8.39	7.92
HRSG Effect- Fuel Sulfur (%) to SO2 (4)		90	90	90	90
% SO2 Conversion to H2SO4		5	5	5	5
lb/hr		5.56	5.20	5.03	4.75
TPY		4.17	3.90	3.78	3.56
Total lb/hr		17.92	16.75	16.22	15.31
Total TPY		13.44	12.57	12.17	11.48

Note: Multiply by 2.324 to convert picogram/Joule (pg/J) to lb/10E+12 Btu.

Sources: (1) EPA, 1993; (2) EPA, 1981; (3) FDEP, 1992; (4) Westinghouse, 1993; (5) EPA, 1990

Table A5-4. Maximum Emissions of Non-Regulated Pollutant for Hardee Power Station Unit 3, Simple and Combined Cycle--Westinghouse 501F, Dry Low NOx Combustor, Disulfate Oil (Water Injection), 75 Percent Load

Pollutant	Gas Turbine Fuel Oil 32 °F	Gas Turbine Fuel Oil 59 °F	Gas Turbine Fuel Oil 72 °F	Gas Turbine Fuel Oil 95 °F
Hours of Operation	1500	1500	1500	1500
Antimony (lb/hr) = Basis (pg/J) x 2.324 x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, pg/J (1)	8.4	9.4	9.4	8.4
HIR (MMBtu/hr)	1,588	1,485	1,438	1,357
lb/hr	3.47E-02	3.24E-02	3.14E-02	2.98E-02
TPY	2.60E-02	2.43E-02	2.36E-02	2.22E-02
Barium (lb/hr) = Basis (pg/J) x 2.324 x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, pg/J (1)	8.4	8.4	8.4	8.4
HIR (MMBtu/hr)	1,588	1,485	1,438	1,357
lb/hr	3.10E-02	2.90E-02	2.81E-02	2.65E-02
TPY	2.33E-02	2.17E-02	2.11E-02	1.99E-02
Cadmium (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, lb/10E+12 Btu (2)	10.5	10.5	10.5	10.5
HIR (MMBtu/hr)	1,588	1,485	1,438	1,357
lb/hr	1.67E-02	1.56E-02	1.51E-02	1.42E-02
TPY	1.25E-02	1.17E-02	1.13E-02	1.07E-02
Chlorine (lb/hr) = Basis (ppm) x Fuel oil (lb/hr) + 1,000,000 (adj. for ppm)				
Basis, ppm	0.5	0.5	0.5	0.5
Fuel Oil (lb/hr)	80,691.1	75,457.3	73,069.1	68,953.3
lb/hr	4.03E-02	3.77E-02	3.65E-02	3.45E-02
TPY	3.03E-02	2.83E-02	2.74E-02	2.59E-02
Chromium (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, lb/10E+12 Btu (2)	47.5	47.5	47.5	47.5
HIR (MMBtu/hr)	1,588	1,485	1,438	1,357
lb/hr	7.54E-02	7.05E-02	6.83E-02	6.45E-02
TPY	5.66E-02	5.29E-02	5.12E-02	4.83E-02
Cobalt (lb/hr) = Basis (pg/J) x 2.324 x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, pg/J (1)	3.9	3.9	3.9	3.9
HIR (MMBtu/hr)	1,588	1,485	1,438	1,357
lb/hr	1.44E-02	1.35E-02	1.30E-02	1.23E-02
TPY	1.08E-02	1.01E-02	9.78E-03	9.22E-03
Copper (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, lb/10E+12 Btu (1)	1300	1300	1300	1300
HIR (MMBtu/hr)	1,588	1,485	1,438	1,357
lb/hr	2.06E+00	1.93E+00	1.87E+00	1.76E+00
TPY	1.55E+00	1.45E+00	1.40E+00	1.32E+00
Formaldehyde (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, lb/10E+12 Btu (2)	405	405	405	405
HIR (MMBtu/hr)	1,588	1,485	1,438	1,357
lb/hr	6.43E-01	6.01E-01	5.82E-01	5.50E-01
TPY	4.82E-01	4.51E-01	4.37E-01	4.12E-01
Manganese (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, lb/10E+12 Btu (1)	340	340	340	340
HIR (MMBtu/hr)	1,588	1,485	1,438	1,357
lb/hr	5.40E-01	5.05E-01	4.89E-01	4.61E-01
TPY	4.05E-01	3.79E-01	3.67E-01	3.46E-01
Nickel (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, lb/10E+12 Btu (1)	1200	1200	1200	1200
HIR (MMBtu/hr)	1,588	1,485	1,438	1,357
lb/hr	1.91E+00	1.78E+00	1.73E+00	1.63E+00
TPY	1.43E+00	1.34E+00	1.29E+00	1.22E+00
Polycyclic Organic Matter (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, lb/10E+12 Btu (2)	0.278	0.278	0.278	0.278
HIR (MMBtu/hr)	1,588	1,485	1,438	1,357
lb/hr	4.41E-04	4.13E-04	4.00E-04	3.77E-04
TPY	3.31E-04	3.10E-04	3.00E-04	2.83E-04
Selenium (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, lb/10E+12 Btu (2)	23.42	23.42	23.42	23.42
HIR (MMBtu/hr)	1,588	1,485	1,438	1,357
lb/hr	3.72E-02	3.48E-02	3.37E-02	3.18E-02
TPY	2.79E-02	2.61E-02	2.53E-02	2.38E-02
Vanadium (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, lb/10E+12 Btu (2)	69.5	69.5	69.5	69.5
HIR (MMBtu/hr)	1,588	1,485	1,438	1,357
lb/hr	1.10E-01	1.03E-01	9.99E-02	9.43E-02
TPY	8.28E-02	7.74E-02	7.50E-02	7.07E-02
Zinc (lb/hr) = Basis (pg/J) x 2.324 x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, pg/J (1)	294	294	294	294
HIR (MMBtu/hr)	1,588	1,485	1,438	1,357
lb/hr	1.09E+00	1.01E+00	9.83E-01	9.27E-01
TPY	8.14E-01	7.61E-01	7.37E-01	6.95E-01

Note: Multiply by 2.324 to convert picogram/Joule (pg/J) to lb/10E+12 Btu.

Source: (1) EPA, 1993; (2) EPA, 1990

Table A6-1. Design Information and Stack Parameters for Hardee Power Station Unit 3, Simple and Combined Cycle-
Westinghouse 501F, Dry Low NOx Combustor, Distillate Oil (Water Injection), 50 Percent Load

Data	Gas Turbine Fuel Oil 32 °F	Gas Turbine Fuel Oil 59 °F	Gas Turbine Fuel Oil 72 °F	Gas Turbine Fuel Oil 95 °F
General				
Power (MW)	91.4	82.7	78.6	71.6
Heat Input (MMBtu/hr, HHV)	1,146	1,082	1,051	1,000
Heat Input (MMBtu/hr, LHV)	1,076	1,016	987	939
Estimated Heat Rate (Btu/kwh, LHV)	11,773	12,285	12,555	13,114
Relative Humidity (Percent)	30	60	80	80
CT Exhaust Flow				
Mass Flow (lb/hr)	2,722,390	2,613,340	2,555,800	2,452,050
Mass Flow (lb/hr) ^ a	2,858,510	2,744,007	2,683,590	2,574,653
Temperature (oF)	1,035	1,048	1,054	1,065
Moisture (% Vol.)	6.63	7.31	8.31	10.43
Oxygen (% Vol.)	13.58	13.56	13.41	13.06
Molecular Weight	28.71	28.62	28.51	28.27
Water Injection (lb/hr)	40,780	38,480	37,400	35,580
Fuel Oil Consumption (lb/hr)= Heat Input (MMBtu/hr) x 1,000,000 Btu/MMBtu + Fuel Heat Content, LHV (Btu/lb)				
Heat Input (MMBtu/hr, HHV)	1,146	1,082	1,051	1,000
Heat Content (Btu/lb, HHV)	19,680	19,680	19,680	19,680
Fuel Oil (lb/hr)	58,232	54,980	53,404	50,813
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)	2,858,510	2,744,007	2,683,590	2,574,653
Temperature (°F)	1,035	1,048	1,054	1,065
Molecular Weight	28.71	28.62	28.51	28.27
Volume Flow (acfm)	1,810,907	1,758,653	1,733,676	1,689,577
Volume Flow (dscfm)= [(Mass Flow (lb/hr) x 1,545 x (68°F + 460°F)] + [Molecular weight x 2116.8] + 60 min/hr x [(1 - Moisture(%)/100)]				
Mass Flow (lb/hr)	2,858,510	2,744,007	2,683,590	2,574,653
Temperature (°F)	68	68	68	68
Molecular Weight	28.71	28.62	28.51	28.27
Moisture (% Vol.)	6.63	7.31	8.31	10.43
Volume Flow (dscfm)	597,168	570,750	554,368	523,968
Bypass Stack Data				
Stack Height (ft)	75	75	75	75
Diameter (ft)	23.0	23	23	23
Velocity (ft/sec)= Volume flow (acfm) from CT + [((diameter)²+ 4) x 3.14159] + 60 sec/min				
Volume Flow (acfm) from CT	1,810,907	1,758,653	1,733,676	1,689,577
Diameter (ft)	23.0	23.0	23.0	23.0
Velocity (ft/sec)	72.6	70.5	69.5	67.8
HRSG Stack Data				
Stack Height (ft)	90	90	90	90
Diameter (ft)	19.0	19.0	19.0	19.0
Volume Flow (acfm) from HRSG= [Volume flow (acfm) x (HRSG temp.(°F) + 460°F)] + [CT temp.(°F) + 460°F]				
Volume Flow (acfm) from CT	1,810,907	1,758,653	1,733,676	1,689,577
CT Temperature (°F)	1,035	1,048	1,054	1,065
HRSG Temperature (°F)	285	285	285	285
Volume Flow (acfm) from HRSG	902,425	868,830	853,097	825,400
Velocity (ft/sec)= Volume flow (acfm) from HRSG + [((diameter)²+ 4) x 3.14159] + 60 sec/min				
Volume Flow (acfm) from HRSG	902,425	868,830	853,097	825,400
Diameter (ft)	19.0	19.0	19.0	19.0
Velocity (ft/sec)	53.0	51.1	50.1	48.5

Note: Universal gas constant= 1,545 ft-lb(force)/°R; atmospheric pressure= 2,116.8 lb(force)/ft²

^ a A 5 percent margin has been added to maximize emissions since operating history has been limited.

Source: Westinghouse, 1993.

Table A6-2. Maximum Emissions for Criteria Pollutants for Hardee Power Station Unit 3, Simple and Combined Cycle--
Westinghouse 501F, Dry Low NOx Combustor, Distillate Oil (Water Injection), 50 Percent Load

Pollutant	Gas Turbine Fuel Oil 32 °F	Gas Turbine Fuel Oil 59 °F	Gas Turbine Fuel Oil 72 °F	Gas Turbine Fuel Oil 95 °F
Hours of Operation	1500	1500	1500	1500
Particulate (lb/hr)= Emission rate (lb/hr) from manufacturer				
Basis (including H ₂ SO ₄), lb/hr	44.9	43.2	41.9	39.3
lb/hr	44.9	43.2	41.9	39.3
TPY	33.7	32.4	31.4	29.5
Sulfur Dioxide (lb/hr)= Fuel oil (lb/hr) x sulfur content(fraction) x (lb SO ₂ /lb S)				
Fuel Oil (lb/hr)	58,232	54,980	53,404	50,813
Sulfur content (%)	0.05	0.05	0.05	0.05
lb SO ₂ /lb S (64/32)	2.0	2.00	2.00	2.00
lb/hr	58.23	54.98	53.40	50.81
TPY	43.7	41.2	40.1	38.1
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 , ISO	42	42	42	42
Basis, ppmvd @15% O ₂	43.2	42.0	37.6	29.9
Moisture (%)	6.63	7.31	8.31	10.43
Oxygen (%)	13.58	13.56	13.41	13.06
Volume Flow (acfm)	1,810,907	1,758,653	1,733,676	1,689,577
Temperature (°F)	1,035	1,048	1,054	1,065
lb/hr	199.0	182.5	158.8	120.2
TPY	149.3	136.8	119.1	90.1
Carbon Monoxide (lb/hr)= CO(ppm) x [1 - Moisture%]/100 x 2116.8 lb/ft ² 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	45	45	45	45
Moisture (%)	6.63	7.31	8.31	10.43
Volume Flow (acfm)	1,810,907	1,758,653	1,733,676	1,689,577
Temperature (°F)	1,035	1,048	1,054	1,065
lb/hr	117.1	112.0	108.8	102.8
TPY	87.9	84.0	81.6	77.1
VOCs (lb/hr)= VOC(ppm) x [1 - Moisture%]/100 x 2116.8 lb/ft ² 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	10.0	10.0	10.0	10.0
Moisture (%)	6.63	7.31	8.31	10.43
Volume Flow (acfm)	1,810,907	1,758,653	1,733,676	1,689,577
Temperature (°F)	1,035	1,048	1,054	1,065
lb/hr	14.9	14.2	13.8	13.1
TPY	11.2	10.7	10.4	9.8
Lead (lb/hr)= Lead (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Emission Rate Basis, lb/10E+12 Btu	58	58	58	58
HIR (MMBtu/hr)	1,146	1,062	1,051	1,000
lb/hr	6.65E-02	6.28E-02	6.10E-02	5.80E-02
TPY	4.99E-02	4.71E-02	4.57E-02	4.35E-02

Note: ppmvd= parts per million, volume dry; O₂= oxygen; ISO= ISO conditions

Source: Westinghouse, 1993; EPA, 1993

Table A6-3. Maximum Emissions of Other Regulated Pollutants for Hardee Power Station Unit No. 3, Simple and Combined Cycle - Westinghouse 501F, Dry Low NOx Combustor, Distillate Oil (Water Injection), 50 Percent Load

Pollutant	Units	Gas Turbine Fuel Oil 32 °F	Gas Turbine Fuel Oil 59 °F	Gas Turbine Fuel Oil 72 °F	Gas Turbine Fuel Oil 95 °F
Hours of Operation		1500	1500	1500	1500
Arsenic (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (1)		4.9	4.9	4.9	4.9
HIR (MMBtu/hr)		1,146	1,082	1,051	1,000
lb/hr		5.62E-03	5.30E-03	5.15E-03	4.90E-03
TPY		4.21E-03	3.98E-03	3.86E-03	3.68E-03
Beryllium (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (5)		2.5	2.5	2.5	2.5
HIR (MMBtu/hr)		1,146	1,082	1,051	1,000
lb/hr		2.87E-03	2.71E-03	2.63E-03	2.50E-03
TPY		2.15E-03	2.03E-03	1.97E-03	1.88E-03
Fluoride (lb/hr) = Basis (pg/J) x 2.324 x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, pg/J (2)		14	14	14	14
HIR (MMBtu/hr)		1,146	1,082	1,051	1,000
lb/hr		3.73E-02	3.52E-02	3.42E-02	3.25E-02
TPY		2.80E-02	2.64E-02	2.56E-02	2.44E-02
Mercury (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu					
Basis, lb/10E+12 Btu (3)		8.8	8.8	8.8	8.8
HIR (MMBtu/hr)		1,146	1,082	1,051	1,000
lb/hr		1.01E-02	9.52E-03	9.25E-03	8.80E-03
TPY		7.56E-03	7.14E-03	6.94E-03	6.60E-03
Sulfuric Acid Mist (lb/hr) = From CT Exhaust [Fuel consumption (lb/hr) x sulfur content (fraction) x (Conversion (fraction) of S to H2SO4) x lb H2SO4/lb S] + HRSG Effect [Fuel consumption (lb/hr) x sulfur content (fraction) x Fraction Fuel S to SO2 x (Conversion (fraction) of SO2 to H2SO4) x lb H2SO4/lb S]					
Fuel consumption (lb/hr)		58,232	54,980	53,404	50,813
Sulfur Content (%)		0.05	0.05	0.05	0.05
lb H2SO4/lb S (98/32)		3.06	3.06	3.06	3.06
CT Exhaust - % S Conversion to H2SO4 (4)		10	10	10	10
lb/hr		8.92	8.42	8.18	7.78
TPY		6.69	6.31	6.13	5.84
HRSG Effect - Fuel Sulfur (%) to SO2 (4)		90	90	90	90
% SO2 Conversion to H2SO4		5	5	5	5
lb/hr		4.01	3.79	3.68	3.50
TPY		3.01	2.84	2.76	2.63
Total lb/hr		12.93	12.21	11.86	11.28
Total TPY		9.70	9.16	8.89	8.46

Note: Multiply by 2.324 to convert picogram/Joule (pg/J) to lb/10E+12 Btu.

Sources: (1) EPA, 1993; (2) EPA, 1981; (3) FDEP, 1992; (4) Westinghouse, 1993; (5) EPA, 1990

Table A6-4. Maximum Emissions of Non-Regulated Pollutant for Hardee Power Station Unit 3, Simple and Combined Cycle - Westinghouse 501F, Dry Low NOx Combustor, Distillate Oil (Water Injection), 50 Percent Load

Pollutant	Gas Turbine Fuel Oil 32 °F	Gas Turbine Fuel Oil 59 °F	Gas Turbine Fuel Oil 72 °F	Gas Turbine Fuel Oil 95 °F
Hours of Operation	1500	1500	1500	1500
Antimony (lb/hr) = Basis (pg/J) x 2.324 x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, pg/J (1)	9.4	9.4	9.4	9.4
HIR (MMBtu/hr)	1,148	1,082	1,051	1,000
lb/hr	2.50E-02	2.38E-02	2.30E-02	2.18E-02
TPY	1.88E-02	1.77E-02	1.72E-02	1.64E-02
Barium (lb/hr) = Basis (pg/J) x 2.324 x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, pg/J (1)	8.4	8.4	8.4	8.4
HIR (MMBtu/hr)	1,148	1,082	1,051	1,000
lb/hr	2.24E-02	2.11E-02	2.05E-02	1.95E-02
TPY	1.68E-02	1.58E-02	1.54E-02	1.46E-02
Cadmium (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, lb/10E+12 Btu (2)	10.5	10.5	10.5	10.5
HIR (MMBtu/hr)	1,148	1,082	1,051	1,000
lb/hr	1.20E-02	1.14E-02	1.10E-02	1.05E-02
TPY	9.02E-03	8.52E-03	8.28E-03	7.88E-03
Chlorine (lb/hr) = Basis (ppm) x Fuel oil (lb/hr) + 1,000,000 (adj. for ppm)				
Basis, ppm	0.5	0.5	0.5	0.5
Fuel Oil (lb/hr)	58,231.7	54,979.7	53,404.5	50,813.0
lb/hr	2.91E-02	2.75E-02	2.67E-02	2.54E-02
TPY	2.18E-02	2.06E-02	2.00E-02	1.91E-02
Chromium (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, lb/10E+12 Btu (2)	47.5	47.5	47.5	47.5
HIR (MMBtu/hr)	1,148	1,082	1,051	1,000
lb/hr	5.44E-02	5.14E-02	4.99E-02	4.75E-02
TPY	4.08E-02	3.85E-02	3.74E-02	3.56E-02
Cobalt (lb/hr) = Basis (pg/J) x 2.324 x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, pg/J (1)	3.9	3.9	3.9	3.9
HIR (MMBtu/hr)	1,148	1,082	1,051	1,000
lb/hr	1.04E-02	9.81E-03	9.53E-03	9.06E-03
TPY	7.78E-03	7.36E-03	7.14E-03	6.80E-03
Copper (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, lb/10E+12 Btu (1)	1300	1300	1300	1300
HIR (MMBtu/hr)	1,148	1,082	1,051	1,000
lb/hr	1.49E+00	1.41E+00	1.37E+00	1.30E+00
TPY	1.12E+00	1.05E+00	1.02E+00	9.75E-01
Formaldehyde (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, lb/10E+12 Btu (2)	405	405	405	405
HIR (MMBtu/hr)	1,148	1,082	1,051	1,000
lb/hr	4.64E-01	4.38E-01	4.26E-01	4.05E-01
TPY	3.48E-01	3.29E-01	3.19E-01	3.04E-01
Manganese (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, lb/10E+12 Btu (1)	340	340	340	340
HIR (MMBtu/hr)	1,148	1,082	1,051	1,000
lb/hr	3.90E-01	3.68E-01	3.57E-01	3.40E-01
TPY	2.92E-01	2.78E-01	2.68E-01	2.55E-01
Nickel (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, lb/10E+12 Btu (1)	1200	1200	1200	1200
HIR (MMBtu/hr)	1,148	1,082	1,051	1,000
lb/hr	1.38E+00	1.30E+00	1.26E+00	1.20E+00
TPY	1.03E+00	9.74E-01	9.46E-01	9.00E-01
Polycyclic Organic Matter (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, lb/10E+12 Btu (2)	0.278	0.278	0.278	0.278
HIR (MMBtu/hr)	1,148	1,082	1,051	1,000
lb/hr	3.19E-04	3.01E-04	2.92E-04	2.78E-04
TPY	2.39E-04	2.26E-04	2.19E-04	2.09E-04
Selenium (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, lb/10E+12 Btu (2)	23.42	23.42	23.42	23.42
HIR (MMBtu/hr)	1,148	1,082	1,051	1,000
lb/hr	2.68E-02	2.53E-02	2.46E-02	2.34E-02
TPY	2.01E-02	1.90E-02	1.85E-02	1.76E-02
Vanadium (lb/hr) = Basis (lb/10E+12 Btu) x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, lb/10E+12 Btu (2)	69.5	69.5	69.5	69.5
HIR (MMBtu/hr)	1,148	1,082	1,051	1,000
lb/hr	7.96E-02	7.52E-02	7.30E-02	6.95E-02
TPY	5.97E-02	5.64E-02	5.48E-02	5.21E-02
Zinc (lb/hr) = Basis (pg/J) x 2.324 x Heat Input Rate (MMBtu/hr) + 1,000,000 MMBtu/10E+12 Btu				
Basis, pg/J (1)	294	294	294	294
HIR (MMBtu/hr)	1,148	1,082	1,051	1,000
lb/hr	7.83E-01	7.39E-01	7.18E-01	6.83E-01
TPY	5.87E-01	5.54E-01	5.39E-01	5.12E-01

Note: Multiply by 2.324 to convert picogram/Joule (pg/J) to lb/10E+12 Btu.

Source: (1) EPA, 1993; (2) EPA, 1990

Table A7 - 1. Summary of Maximum Emissions for Criteria Pollutants for Hardee Power Station Unit 3, Simple and Combined Cycle - Westinghouse 501F, Dry Low NOx Combustor, Natural Gas and Distillate Fuel Oil, Base Load

Pollutant	Units	Gas Turbine - Distillate Oil			Gas Turbine - Natural Gas			Gas Turbine - Natural Gas (PA) ^a		Maximum Emissions ^b		
		32 °F	59 °F	95 °F	32 °F	59 °F	95 °F	80 °F	95 °F	32 °F	59 °F	95 °F
Hours of Operation/Unit		1,500	1,500	1,500	5,260	5,260	5,260	2,000	2,000	8,760	8,760	8,760
Particulate	lb/hr	134.10	125.47	112.99	14.83	13.89	12.72	14.44	14.23	134.10	125.47	112.99
	TPY	100.57	94.10	84.75	38.99	36.53	33.48	14.44	14.23	154.00	145.07	132.43
Sulfur Dioxide	lb/hr	200.41	186.79	170.22	10.28	9.58	8.73	9.32	9.28	200.41	186.79	170.22
	TPY	150.30	140.09	127.67	27.04	25.20	22.96	9.32	9.28	186.66	174.61	159.91
Nitrogen Oxides	lb/hr	699.19	621.60	399.10	208.16	185.45	121.81	251.50	212.01	699.19	621.60	399.10
	TPY	524.40	466.20	299.33	547.45	487.72	320.35	251.50	212.01	1323.35	1205.42	831.70
Carbon Monoxide	lb/hr	181.55	170.59	151.58	142.49	133.91	119.04	313.39	299.63	181.55	313.39	299.63
	TPY	136.16	127.94	113.68	374.74	352.18	313.08	313.39	299.63	824.30	793.52	726.40
VOC	lb/hr	41.50	38.99	34.65	20.36	19.13	17.01	17.91	17.98	41.50	38.99	34.65
	TPY	31.12	29.24	25.98	53.53	50.31	44.73	17.91	17.98	102.57	97.46	88.69
Lead	lb/hr	2.29E-01	2.13E-01	1.94E-01	NA	NA	NA	NA	NA	2.29E-01	2.13E-01	1.94E-01
	TPY	1.72E-01	1.60E-01	1.46E-01	NA	NA	NA	NA	NA	1.72E-01	1.60E-01	1.46E-01

^ a Power augmentation assumed when ambient temperature is 80 °F or more.

^ b Maximum annual emission for 32°F and 59°F cases include emissions for power augmentation at 80°F.

Table A7-2. Summary of Maximum Emissions of Other Regulated Pollutants for Hardee Power Station Unit No. 3, Simple and Combined Cycle - Westinghouse 501F, Dry Low NOx Combustor, Natural Gas and Distillate Fuel Oil, Base Load

Pollutant	Units	Gas Turbine - Distillate Oil			Gas Turbine - Natural Gas			Gas Turbine - Natural Gas (PA) ^a		Maximum Emissions ^b		
		32 °F	59 °F	95 °F	32 °F	59 °F	95 °F	80 °F	95 °F	32 °F	59 °F	95 °F
Arsenic	lb/hr	1.93E-02	1.80E-02	1.64E-02	NA	NA	NA	NA	NA	1.93E-02	1.80E-02	1.64E-02
	TPY	1.45E-02	1.35E-02	1.23E-02	NA	NA	NA	NA	NA	1.45E-02	1.35E-02	1.23E-02
Beryllium	lb/hr	9.86E-03	9.19E-03	8.38E-03	NA	NA	NA	NA	NA	9.86E-03	9.19E-03	8.38E-03
	TPY	7.40E-03	6.89E-03	6.28E-03	NA	NA	NA	NA	NA	7.40E-03	6.89E-03	6.28E-03
Fluoride	lb/hr	1.28E-01	1.20E-01	1.09E-01	NA	NA	NA	NA	NA	1.28E-01	1.20E-01	1.09E-01
	TPY	9.62E-02	8.97E-02	8.17E-02	NA	NA	NA	NA	NA	9.62E-02	8.97E-02	8.17E-02
Mercury	lb/hr	3.47E-02	3.23E-02	2.95E-02	9.71E-05	9.06E-05	8.25E-05	8.81E-05	8.77E-05	3.47E-02	3.23E-02	2.95E-02
	TPY	2.60E-02	2.43E-02	2.21E-02	2.55E-04	2.38E-04	2.17E-04	8.81E-05	8.77E-05	2.64E-02	2.46E-02	2.24E-02
Sulfuric Acid Mist	lb/hr	4.45E+01	4.15E+01	3.78E+01	2.03E+00	1.89E+00	1.72E+00	1.84E+00	1.83E+00	4.45E+01	4.15E+01	3.78E+01
	TPY	3.34E+01	3.11E+01	2.83E+01	5.33E+00	4.97E+00	4.53E+00	1.84E+00	1.83E+00	4.05E+01	3.79E+01	3.47E+01

^ a Power augmentation assumed when ambient temperature is 80 °F or more.

^ b Maximum annual emission for 32°F and 59°F cases include emissions for power augmentation at 80°F.

Table A7-3. Summary of Maximum Emissions of Non-Regulated Pollutants for Hardee Power station Unit 3, Simple and Combined Cycle-
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas and Distillate Fuel Oil, Base Load

Pollutant	Units	Gas Turbine- Distillate Oil			Gas Turbine- Natural Gas			Gas Turbine- Natural Gas (PA) ^a		Maximum Emissions ^b		
		32 °F	59 °F	95 °F	32 °F	59 °F	95 °F	80 °F	95 °F	32 °F	59 °F	95 °F
Antimony	lb/hr	8.62E-02	8.03E-02	7.32E-02	NA	NA	NA	NA	NA	8.62E-02	8.03E-02	7.32E-02
	TPY	6.46E-02	6.02E-02	5.49E-02	NA	NA	NA	NA	NA	6.46E-02	6.02E-02	5.49E-02
Barium	lb/hr	7.70E-02	7.18E-02	6.54E-02	NA	NA	NA	NA	NA	7.70E-02	7.18E-02	6.54E-02
	TPY	5.77E-02	5.38E-02	4.90E-02	NA	NA	NA	NA	NA	5.77E-02	5.38E-02	4.90E-02
Cadmium	lb/hr	4.14E-02	3.86E-02	3.52E-02	NA	NA	NA	NA	NA	4.14E-02	3.86E-02	3.52E-02
	TPY	3.11E-02	2.89E-02	2.64E-02	NA	NA	NA	NA	NA	3.11E-02	2.89E-02	2.64E-02
Chlorine	lb/hr	1.00E-01	9.34E-02	8.51E-02	NA	NA	NA	NA	NA	1.00E-01	9.34E-02	8.51E-02
	TPY	7.52E-02	7.00E-02	6.38E-02	NA	NA	NA	NA	NA	7.52E-02	7.00E-02	6.38E-02
Chromium	lb/hr	1.87E-01	1.75E-01	1.59E-01	NA	NA	NA	NA	NA	1.87E-01	1.75E-01	1.59E-01
	TPY	1.41E-01	1.31E-01	1.19E-01	NA	NA	NA	NA	NA	1.41E-01	1.31E-01	1.19E-01
Cobalt	lb/hr	3.57E-02	3.33E-02	3.04E-02	NA	NA	NA	NA	NA	3.57E-02	3.33E-02	3.04E-02
	TPY	2.68E-02	2.50E-02	2.28E-02	NA	NA	NA	NA	NA	2.68E-02	2.50E-02	2.28E-02
Copper	lb/hr	5.13E+00	4.78E+00	4.36E+00	NA	NA	NA	NA	NA	5.13E+00	4.78E+00	4.36E+00
	TPY	3.85E+00	3.58E+00	3.27E+00	NA	NA	NA	NA	NA	3.85E+00	3.58E+00	3.27E+00
Formaldehyde	lb/hr	1.60E+00	1.49E+00	1.36E+00	3.17E-01	2.96E-01	2.69E-01	2.87E-01	2.86E-01	1.60E+00	1.49E+00	1.36E+00
	TPY	1.20E+00	1.12E+00	1.02E+00	8.34E-01	7.77E-01	7.08E-01	2.87E-01	2.86E-01	2.32E+00	2.18E+00	2.01E+00
Manganese	lb/hr	1.34E+00	1.25E+00	1.14E+00	NA	NA	NA	NA	NA	1.34E+00	1.25E+00	1.14E+00
	TPY	1.01E+00	9.37E-01	8.54E-01	NA	NA	NA	NA	NA	1.01E+00	9.37E-01	8.54E-01
Nickel	lb/hr	4.73E+00	4.41E+00	4.02E+00	NA	NA	NA	NA	NA	4.73E+00	4.41E+00	4.02E+00
	TPY	3.55E+00	3.31E+00	3.02E+00	NA	NA	NA	NA	NA	3.55E+00	3.31E+00	3.02E+00
Polycyclic Organic Matter	lb/hr	1.10E-03	1.02E-03	9.31E-04	4.00E-03	3.73E-03	3.40E-03	3.63E-03	3.62E-03	4.00E-03	3.73E-03	3.62E-03
	TPY	8.22E-04	7.66E-04	6.98E-04	1.05E-02	9.82E-03	8.95E-03	3.63E-03	3.62E-03	1.50E-02	1.42E-02	1.33E-02
Selenium	lb/hr	9.24E-02	8.61E-02	7.85E-02	NA	NA	NA	NA	NA	9.24E-02	8.61E-02	7.85E-02
	TPY	6.93E-02	6.46E-02	5.88E-02	NA	NA	NA	NA	NA	6.93E-02	6.46E-02	5.88E-02
Vanadium	lb/hr	2.74E-01	2.55E-01	2.33E-01	NA	NA	NA	NA	NA	2.74E-01	2.55E-01	2.33E-01
	TPY	2.06E-01	1.92E-01	1.75E-01	NA	NA	NA	NA	NA	2.06E-01	1.92E-01	1.75E-01
Zinc	lb/hr	2.89E+00	2.51E+00	2.29E+00	NA	NA	NA	NA	NA	2.89E+00	2.51E+00	2.29E+00
	TPY	2.02E+00	1.88E+00	1.72E+00	NA	NA	NA	NA	NA	2.02E+00	1.88E+00	1.72E+00

^a Power augmentation assumed when ambient temperature is 80 °F or more.

^b Maximum annual emission for 32°F and 59°F cases include emissions for power augmentation at 80°F.

Table A7-1A. Summary of Maximum Emissions for Criteria Pollutants for Hardee Power Station Unit 3, Simple and Combined Cycle-
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas (Without Power Augmentation) and Distillate Fuel Oil, Base Load

Pollutant	Units	Gas Turbine- Distillate Oil			Gas Turbine- Natural Gas			Maximum Emissions		
		32 °F	59 °F	95 °F	32 °F	59 °F	95 °F	32 °F	59 °F	95 °F
Hours of Operation/Unit		1500	1500	1500	7260	7260	7260	8,760	8,760	8,760
Particulate	lb/hr	134.10	125.47	112.99	14.83	13.89	12.72	134.10	125.47	112.99
	TPY	100.57	94.10	84.75	53.82	50.42	46.18	154.39	144.52	130.93
Sulfur Dioxide	lb/hr	200.41	186.79	170.22	10.28	9.58	8.73	200.41	186.79	170.22
	TPY	150.30	140.09	127.67	37.32	34.79	31.70	187.62	174.88	159.36
Nitrogen Oxides	lb/hr	699.19	621.60	399.10	208.16	185.45	121.81	699.19	621.60	399.10
	TPY	524.40	466.20	299.33	755.61	673.17	442.16	1,280.00	1,139.36	741.49
Carbon Monoxide	lb/hr	181.55	170.59	151.58	142.49	133.91	119.04	181.55	170.59	151.58
	TPY	136.16	127.94	113.68	517.23	486.09	432.12	653.39	614.03	545.81
VOC	lb/hr	41.50	38.99	34.65	20.36	19.13	17.01	41.50	38.99	34.65
	TPY	31.12	29.24	25.98	73.89	69.44	61.73	105.01	98.69	87.72
Lead	lb/hr	2.29E-01	2.13E-01	1.94E-01	NA	NA	NA	2.29E-01	2.13E-01	1.94E-01
	TPY	1.72E-01	1.60E-01	1.46E-01	NA	NA	NA	1.72E-01	1.60E-01	1.46E-01

Table A7-2A. Summary of Maximum Emissions of Other Regulated Pollutants for Hardee Power Station Unit No. 3, Simple and Combined Cycle-
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas (Without Power Augmentation) and Distillate Fuel Oil, Base Load

Pollutant	Units	Gas Turbine- Distillate Oil			Gas Turbine- Natural Gas			Maximum Emissions		
		32 °F	59 °F	95 °F	32 °F	59 °F	95 °F	32 °F	59 °F	95 °F
Arsenic	lb/hr	1.93E-02	1.80E-02	1.64E-02	NA	NA	NA	1.93E-02	1.80E-02	1.64E-02
	TPY	1.45E-02	1.35E-02	1.23E-02	NA	NA	NA	1.45E-02	1.35E-02	1.23E-02
Beryllium	lb/hr	9.86E-03	9.19E-03	8.38E-03	NA	NA	NA	9.86E-03	9.19E-03	8.38E-03
	TPY	7.40E-03	6.89E-03	6.28E-03	NA	NA	NA	7.40E-03	6.89E-03	6.28E-03
Fluoride	lb/hr	1.28E-01	1.20E-01	1.09E-01	NA	NA	NA	1.28E-01	1.20E-01	1.09E-01
	TPY	9.62E-02	8.97E-02	8.17E-02	NA	NA	NA	9.62E-02	8.97E-02	8.17E-02
Mercury	lb/hr	3.47E-02	3.23E-02	2.95E-02	9.71E-05	9.06E-05	8.25E-05	3.47E-02	3.23E-02	2.95E-02
	TPY	2.60E-02	2.43E-02	2.21E-02	3.53E-04	3.29E-04	3.00E-04	2.64E-02	2.46E-02	2.24E-02
Sulfuric Acid	lb/hr	4.45E+01	4.15E+01	3.78E+01	2.03E+00	1.89E+00	1.72E+00	4.45E+01	4.15E+01	3.78E+01
	TPY	3.34E+01	3.11E+01	2.83E+01	7.36E+00	6.86E+00	6.25E+00	4.07E+01	3.80E+01	3.46E+01

Table A7-3A. Summary of Maximum Emissions of Non-Regulated Pollutants for Hardee Power station Unit 3, Simple and Combined Cycle-
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas (Without Power Augmentation) and Distillate Fuel Oil, Base Load

Pollutant	Units	Gas Turbine- Distillate Oil			Gas Turbine- Natural Gas			Maximum Emissions		
		32 °F	59 °F	95 °F	32 °F	59 °F	95 °F	32 °F	59 °F	95 °F
Antimony	lb/hr	8.62E-02	8.03E-02	7.32E-02	NA	NA	NA	8.62E-02	8.03E-02	7.32E-02
	TPY	6.46E-02	6.02E-02	5.49E-02	NA	NA	NA	6.46E-02	6.02E-02	5.49E-02
Barium	lb/hr	7.70E-02	7.18E-02	6.54E-02	NA	NA	NA	7.70E-02	7.18E-02	6.54E-02
	TPY	5.77E-02	5.38E-02	4.90E-02	NA	NA	NA	5.77E-02	5.38E-02	4.90E-02
Cadmium	lb/hr	4.14E-02	3.86E-02	3.52E-02	NA	NA	NA	4.14E-02	3.86E-02	3.52E-02
	TPY	3.11E-02	2.89E-02	2.64E-02	NA	NA	NA	3.11E-02	2.89E-02	2.64E-02
Chlorine	lb/hr	1.00E-01	9.34E-02	8.51E-02	NA	NA	NA	1.00E-01	9.34E-02	8.51E-02
	TPY	7.52E-02	7.00E-02	6.38E-02	NA	NA	NA	7.52E-02	7.00E-02	6.38E-02
Chromium	lb/hr	1.87E-01	1.75E-01	1.59E-01	NA	NA	NA	1.87E-01	1.75E-01	1.59E-01
	TPY	1.41E-01	1.31E-01	1.19E-01	NA	NA	NA	1.41E-01	1.31E-01	1.19E-01
Cobalt	lb/hr	3.57E-02	3.33E-02	3.04E-02	NA	NA	NA	3.57E-02	3.33E-02	3.04E-02
	TPY	2.68E-02	2.50E-02	2.28E-02	NA	NA	NA	2.68E-02	2.50E-02	2.28E-02
Copper	lb/hr	5.13E+00	4.78E+00	4.36E+00	NA	NA	NA	5.13E+00	4.78E+00	4.36E+00
	TPY	3.85E+00	3.58E+00	3.27E+00	NA	NA	NA	3.85E+00	3.58E+00	3.27E+00
Formaldehyde	lb/hr	1.60E+00	1.49E+00	1.36E+00	3.17E-01	2.96E-01	2.69E-01	1.60E+00	1.49E+00	1.36E+00
	TPY	1.20E+00	1.12E+00	1.02E+00	1.15E+00	1.07E+00	9.78E-01	2.35E+00	2.19E+00	2.00E+00
Manganese	lb/hr	1.34E+00	1.25E+00	1.14E+00	NA	NA	NA	1.34E+00	1.25E+00	1.14E+00
	TPY	1.01E+00	9.37E-01	8.54E-01	NA	NA	NA	1.01E+00	9.37E-01	8.54E-01
Nickel	lb/hr	4.73E+00	4.41E+00	4.02E+00	NA	NA	NA	4.73E+00	4.41E+00	4.02E+00
	TPY	3.55E+00	3.31E+00	3.02E+00	NA	NA	NA	3.55E+00	3.31E+00	3.02E+00
Polycyclic Organic Matter	lb/hr	1.10E-03	1.02E-03	9.31E-04	4.00E-03	3.73E-03	3.40E-03	4.00E-03	3.73E-03	3.40E-03
	TPY	8.22E-04	7.66E-04	6.98E-04	1.45E-02	1.36E-02	1.23E-02	1.54E-02	1.43E-02	1.30E-02
Selenium	lb/hr	9.24E-02	8.61E-02	7.85E-02	NA	NA	NA	9.24E-02	8.61E-02	7.85E-02
	TPY	6.93E-02	6.46E-02	5.88E-02	NA	NA	NA	6.93E-02	6.46E-02	5.88E-02
Vanadium	lb/hr	2.74E-01	2.55E-01	2.33E-01	NA	NA	NA	2.74E-01	2.55E-01	2.33E-01
	TPY	2.06E-01	1.92E-01	1.75E-01	NA	NA	NA	2.06E-01	1.92E-01	1.75E-01
Zinc	lb/hr	2.69E+00	2.51E+00	2.29E+00	NA	NA	NA	2.69E+00	2.51E+00	2.29E+00
	TPY	2.02E+00	1.88E+00	1.72E+00	NA	NA	NA	2.02E+00	1.88E+00	1.72E+00

Table A8-1. Summary of Maximum Emissions for Criteria Pollutants for Hardee Power Station Unit 3, Simple and Combined Cycle-
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas and Distillate Fuel Oil, 75 Percent Load

Pollutant	Units	Gas Turbine- Distillate Oil			Gas Turbine- Natural Gas			Maximum Emissions		
		32 °F	59 °F	95 °F	32 °F	59 °F	95 °F	32 °F	59 °F	95 °F
Particulate	lb/hr	107.83	101.51	94.62	11.65	11.34	10.60	107.83	101.51	94.62
Sulfur Dioxide	lb/hr	161.38	150.91	137.91	8.35	7.80	7.12	161.38	150.91	137.91
Nitrogen Oxides	lb/hr	536.00	495.94	316.51	166.82	149.90	98.79	536.00	495.94	316.51
Carbon Monoxide	lb/hr	171.78	164.73	152.15	112.94	108.36	100.07	171.78	164.73	152.15
VOC	lb/hr	32.72	31.38	28.98	16.13	15.48	14.30	32.72	31.38	28.98
Lead	lb/hr	1.84E-01	1.72E-01	1.57E-01	NA	NA	NA	1.84E-01	1.72E-01	1.57E-01

Table A8-2. Summary of Maximum Emissions of Other Regulated Pollutants for Hardee Power Station Unit No. 3, Simple and Combined Cycle--
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas and Distillate Fuel Oil, 75 Percent Load

Pollutant	Units	Gas Turbine-- Distillate Oil			Gas Turbine-- Natural Gas			Maximum Emissions		
		32 °F	59 °F	95 °F	32 °F	59 °F	95 °F	32 °F	59 °F	95 °F
Arsenic	lb/hr	1.56E-02	1.46E-02	1.33E-02	NA	NA	NA	1.56E-02	1.46E-02	1.33E-02
Beryllium	lb/hr	7.94E-03	7.43E-03	6.79E-03	NA	NA	NA	7.94E-03	7.43E-03	6.79E-03
Fluoride	lb/hr	1.03E-01	9.66E-02	8.83E-02	NA	NA	NA	1.03E-01	9.66E-02	8.83E-02
Mercury	lb/hr	2.79E-02	2.61E-02	2.39E-02	7.89E-05	7.37E-05	6.73E-05	2.79E-02	2.61E-02	2.39E-02
Sulfuric Acid Mist	lb/hr	3.58E+01	3.35E+01	3.06E+01	1.65E+00	1.54E+00	1.40E+00	3.58E+01	3.35E+01	3.06E+01

Table A8-3. Summary of Maximum Emissions of Non-Regulated Pollutants for Hardee Power station Unit 3, Simple and Combined Cycle--
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas and Distillate Fuel Oil, 75 Percent Load

Pollutant	Units	Gas Turbine - Distillate Oil			Gas Turbine - Natural Gas			Maximum Emissions		
		32 °F	59 °F	95 °F	32 °F	59 °F	95 °F	32 °F	59 °F	95 °F
Antimony	lb/hr	6.94E-02	6.49E-02	5.93E-02	NA	NA	NA	6.94E-02	6.49E-02	5.93E-02
Barium	lb/hr	6.20E-02	5.80E-02	5.30E-02	NA	NA	NA	6.20E-02	5.80E-02	5.30E-02
Cadmium	lb/hr	3.33E-02	3.12E-02	2.85E-02	NA	NA	NA	3.33E-02	3.12E-02	2.85E-02
Chlorine	lb/hr	8.07E-02	7.55E-02	6.90E-02	NA	NA	NA	8.07E-02	7.55E-02	6.90E-02
Chromium	lb/hr	1.51E-01	1.41E-01	1.29E-01	NA	NA	NA	1.51E-01	1.41E-01	1.29E-01
Cobalt	lb/hr	2.88E-02	2.69E-02	2.46E-02	NA	NA	NA	2.88E-02	2.69E-02	2.46E-02
Copper	lb/hr	4.13E+00	3.86E+00	3.53E+00	NA	NA	NA	4.13E+00	3.86E+00	3.53E+00
Formaldehyde	lb/hr	1.29E+00	1.20E+00	1.10E+00	2.58E-01	2.41E-01	2.20E-01	1.29E+00	1.20E+00	1.10E+00
Manganese	lb/hr	1.08E+00	1.01E+00	9.23E-01	NA	NA	NA	1.08E+00	1.01E+00	9.23E-01
Nickel	lb/hr	3.81E+00	3.56E+00	3.26E+00	NA	NA	NA	3.81E+00	3.56E+00	3.26E+00
Polycyclic Organic Matter	lb/hr	8.83E-04	8.26E-04	7.54E-04	3.25E-03	3.04E-03	2.77E-03	3.25E-03	3.04E-03	2.77E-03
Selenium	lb/hr	7.44E-02	6.96E-02	6.36E-02	NA	NA	NA	7.44E-02	6.96E-02	6.36E-02
Vanadium	lb/hr	2.21E-01	2.06E-01	1.89E-01	NA	NA	NA	2.21E-01	2.06E-01	1.89E-01
Zinc	lb/hr	2.17E+00	2.03E+00	1.85E+00	NA	NA	NA	2.17E+00	2.03E+00	1.85E+00

Table A9-1. Summary of Maximum Emissions for Criteria Pollutants for Hardee Power Station Unit 3, Simple and Combined Cycle--
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas and Distillate Fuel Oil, 50 Percent Load

Pollutant	Units	Gas Turbine-- Distillate Oil			Gas Turbine-- Natural Gas			Maximum Emissions		
		32 °F	59 °F	95 °F	32 °F	59 °F	95 °F	32 °F	59 °F	95 °F
Particulate	lb/hr	89.86	86.41	78.56	10.22	9.75	9.26	89.86	86.41	78.56
Sulfur Dioxide	lb/hr	116.46	109.96	101.63	6.19	5.83	5.39	116.46	109.96	101.63
Nitrogen Oxides	lb/hr	398.06	364.93	240.35	124.23	114.04	73.59	398.06	364.93	240.35
Carbon Monoxide	lb/hr	234.30	223.93	205.58	153.33	146.58	134.58	234.30	223.93	205.58
VOC	lb/hr	29.75	28.44	26.10	29.21	27.92	25.63	29.75	28.44	26.10
Lead	lb/hr	1.33E-01	1.26E-01	1.16E-01	NA	NA	NA	1.33E-01	1.26E-01	1.16E-01

Table A9-2. Summary of Maximum Emissions of Other Regulated Pollutants for Hardee Power Station Unit No. 3, Simple and Combined Cycle—Westinghouse 501F, Dry Low NOx Combustor, Natural Gas and Distillate Fuel Oil, 50 Percent Load

Pollutant	Units	Gas Turbine— Distillate Oil			Gas Turbine— Natural Gas			Maximum Emissions		
		32 °F	59 °F	95 °F	32 °F	59 °F	95 °F	32 °F	59 °F	95 °F
Arsenic	lb/hr	1.12E-02	1.06E-02	9.80E-03	NA	NA	NA	1.12E-02	1.06E-02	9.80E-03
Beryllium	lb/hr	5.73E-03	5.41E-03	5.00E-03	NA	NA	NA	5.73E-03	5.41E-03	5.00E-03
Fluoride	lb/hr	7.46E-02	7.04E-02	6.51E-02	NA	NA	NA	7.46E-02	7.04E-02	6.51E-02
Mercury	lb/hr	2.02E-02	1.90E-02	1.76E-02	5.85E-05	5.51E-05	5.09E-05	2.02E-02	1.90E-02	1.76E-02
Sulfuric Acid Mist	lb/hr	2.59E+01	2.44E+01	2.26E+01	1.22E+00	1.15E+00	1.06E+00	2.59E+01	2.44E+01	2.26E+01

Table A9-3. Summary of Maximum Emissions of Non-Regulated Pollutants for Hardee Power station Unit 3, Simple and Combined Cycle--
Westinghouse 501F, Dry Low NOx Combustor, Natural Gas and Distillate Fuel Oil, 50 Percent Load

Pollutant	Units	Gas Turbine-- Distillate Oil			Gas Turbine-- Natural Gas			Maximum Emissions		
		32 °F	59 °F	95 °F	32 °F	59 °F	95 °F	32 °F	59 °F	95 °F
Antimony	lb/hr	5.01E-02	4.73E-02	4.37E-02	NA	NA	NA	5.01E-02	4.73E-02	4.37E-02
Barium	lb/hr	4.47E-02	4.22E-02	3.90E-02	NA	NA	NA	4.47E-02	4.22E-02	3.90E-02
Cadmium	lb/hr	2.41E-02	2.27E-02	2.10E-02	NA	NA	NA	2.41E-02	2.27E-02	2.10E-02
Chlorine	lb/hr	5.82E-02	5.50E-02	5.08E-02	NA	NA	NA	5.82E-02	5.50E-02	5.08E-02
Chromium	lb/hr	1.09E-01	1.03E-01	9.50E-02	NA	NA	NA	1.09E-01	1.03E-01	9.50E-02
Cobalt	lb/hr	2.08E-02	1.96E-02	1.81E-02	NA	NA	NA	2.08E-02	1.96E-02	1.81E-02
Copper	lb/hr	2.98E+00	2.81E+00	2.60E+00	NA	NA	NA	2.98E+00	2.81E+00	2.60E+00
Formaldehyde	lb/hr	9.28E-01	8.76E-01	8.10E-01	1.91E-01	1.80E-01	1.66E-01	9.28E-01	8.76E-01	8.10E-01
Manganese	lb/hr	7.79E-01	7.36E-01	6.80E-01	NA	NA	NA	7.79E-01	7.36E-01	6.80E-01
Nickel	lb/hr	2.75E+00	2.60E+00	2.40E+00	NA	NA	NA	2.75E+00	2.60E+00	2.40E+00
Polycyclic Organic Matter	lb/hr	6.37E-04	6.02E-04	5.56E-04	2.41E-03	2.27E-03	2.10E-03	2.41E-03	2.27E-03	2.10E-03
Selenium	lb/hr	5.37E-02	5.07E-02	4.68E-02	NA	NA	NA	5.37E-02	5.07E-02	4.68E-02
Vanadium	lb/hr	1.59E-01	1.50E-01	1.39E-01	NA	NA	NA	1.59E-01	1.50E-01	1.39E-01
Zinc	lb/hr	1.57E+00	1.48E+00	1.37E+00	NA	NA	NA	1.57E+00	1.48E+00	1.37E+00

United States
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Air



SUPPLEMENT F

TO

**COMPILATION
OF
AIR POLLUTANT
EMISSION FACTORS**

VOLUME I:

**STATIONARY POINT
AND AREA SOURCES**



3.1 STATIONARY GAS TURBINES FOR ELECTRICITY GENERATION

3.1.1 General

Stationary gas turbines are applied in electric power generators, in gas pipeline pump and compressor drives, and in various process industries. Gas turbines (greater than 3 MW(e)) are used in electrical generation for continuous, peaking, or standby power. The primary fuels used are natural gas and distillate (No. 2) fuel oil, although residual fuel oil is used in a few applications.

3.1.2 Emissions

Emission control technologies for gas turbines have advanced to a point where all new and most existing units are complying with various levels of specified emission limits. For these sources, the emission factors become an operational specification rather than a parameter to be quantified by testing. This section treats uncontrolled (i.e., baseline) emissions and controlled emissions with specific control technologies.

The emission factors presented are for simple cycle gas turbines. These factors also apply to cogeneration/combined cycle gas turbines. In general, if the heat recovery steam generator (HRSG) is not supplementary fired, the simple cycle input specific emission factors (lb/MMBtu) will apply to cogeneration/combined cycle systems. The output specific emissions (g/hp-hr) will decrease according to the ratio of simple cycle to combined cycle power output. If the HRSG is supplementary fired, the emissions and fuel usage must be considered to estimate stack emissions. Nitrogen Oxide (NO_x) emissions from regenerative cycle turbines (which account for only a small percentage of turbines in use) are greater than emissions from simple cycle turbines because of the increased combustion air temperature entering the turbine. The carbon monoxide (CO) and hydrocarbon (HC) emissions may be lower with the regenerative system for a comparable design. More power is produced from the same energy input, so the input specific emissions factor will be affected by changes in emissions, while output specific emissions will reflect the increased power output.

Water/steam injection is the most prevalent NO_x control for cogeneration/combined cycle gas turbines. The water or steam is injected with the air and fuel into the turbine combustion can in order to lower the peak temperatures which, in turn, decreases the thermal NO_x produced. The lower average temperature within the combustor can may produce higher levels of CO and HC as a result of incomplete combustion.

Selective catalytic reduction (SCR) is a post-combustion control which selectively reduces NO_x by reaction of ammonia and NO on a catalytic surface to form N_2 and H_2O . Although SCR systems can be used alone, all existing applications of SCR have been used in conjunction with water/steam injection controls. For optimum SCR operation, the flue gas must be within a temperature range of 600-800°F with the precise limits dependent on the catalyst. Some SCR systems also utilize a CO catalyst to give simultaneous catalytic CO/ NO_x control.

Advanced combustor can designs are currently being phased into production turbines. These dry techniques decrease turbine emissions by modifying the combustion mixing, air staging, and flame stabilization to allow operation at a much leaner air/fuel ratio relative to normal operation. Operating at leaner conditions will lower peak temperatures within the primary flame zone of the combustor. The lower temperatures may also increase CO and HC emissions.

TABLE 3.1-7. TRACE ELEMENT EMISSION FACTORS FOR DISTILLATE OIL-FIRED GAS TURBINES^a
(Source Classification Code: 20100101)

EMISSION FACTOR RATING: E^b

Trace Element	pg/J	lb/MMBtu
Aluminum	64	1.5 E-04
Antimony	9.4	2.2 E-05
Arsenic	2.1	4.9 E-06
Barium	8.4	2.0 E-05
Beryllium	.14	3.3 E-07
Boron	28	6.5 E-05
Bromine	1.8	4.2 E-06
Cadmium	1.8	4.2 E-06
Calcium	330	7.7 E-04
Chromium	20	4.7 E-05
Cobalt	3.9	9.1 E-06
Copper	578	1.3 E-03
Iron	256	6.0 E-04
Lead	25	5.8 E-05
Magnesium	100	2.3 E-04
Manganese	145	3.4 E-04
Mercury	.39	9.1 E-07
Molybdenum	3.6	8.4 E-06
Nickel	526	1.2 E-03
Phosphorus	127	3.0 E-04
Potassium	185	4.3 E-04
Selenium	2.3	5.3 E-06
Silicon	575	1.3 E-03
Sodium	590	1.4 E-03
Tin	35	8.1 E-05
Vanadium	1.9	4.4 E-06
Zinc	294	6.8 E-04

^aReference 1.

^bEmission factor rating of "E" indicates that the data are from a limited data set and may not be representative of a specific source or population of sources.

PB91-126003

United States
Environmental Protection
Agency

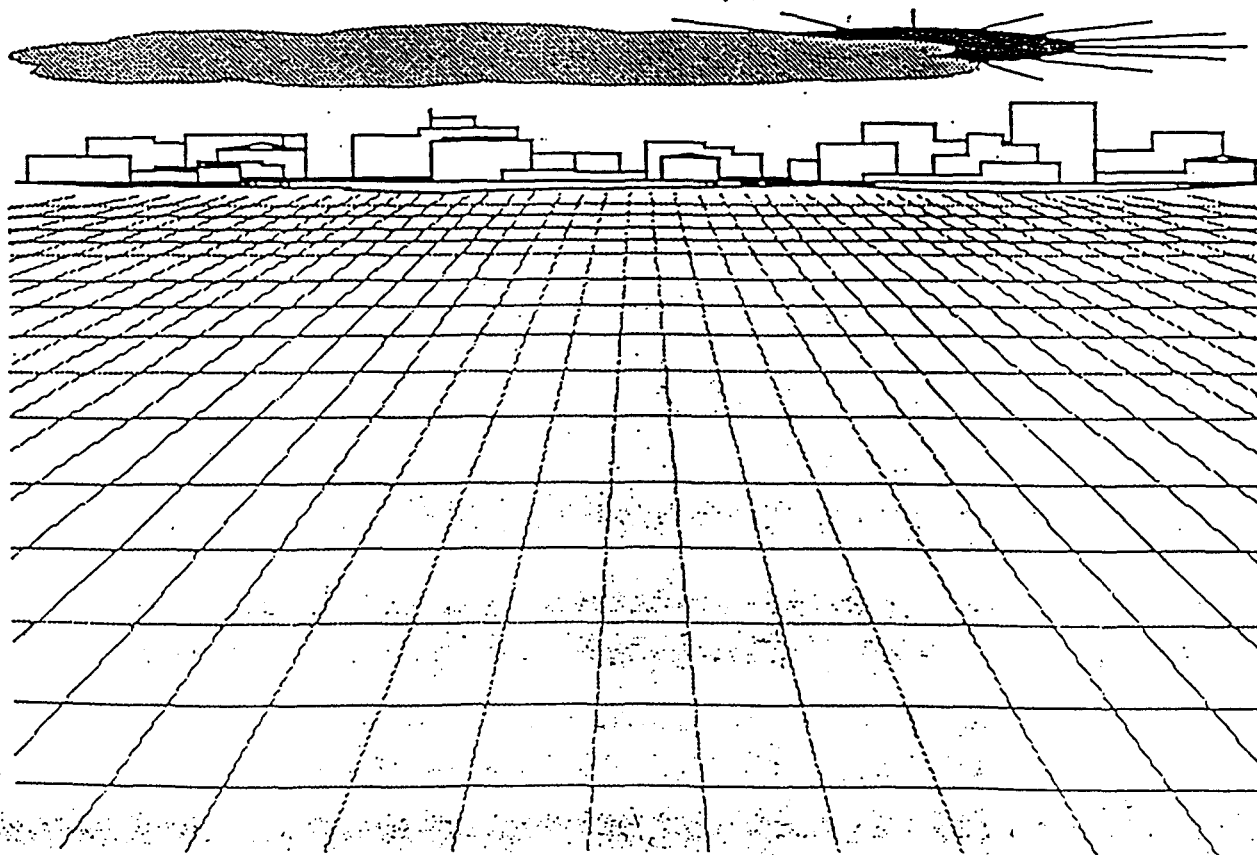
Office of Air Quality
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AIR



TOXIC AIR POLLUTANT EMISSION FACTORS - A COMPILATION FOR SELECTED AIR TOXIC COMPOUNDS AND SOURCES, SECOND EDITION



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INDUSTRIAL PROCESS	SIC CODE	EMISSION SOURCE	SIC CODE	POLLUTANT	CAS NUMBER	EMISSION FACTOR	NOTES	REFERENCE
Reinforcing metals production	3341	Pelt furnace at permanent magnet alloy facility	304	Nickel	7440020	2 lb/ton of nickel charged	Controlled by fabric filter, based on engineering judgement	110
Reinforcing metals production	3341	Pelt furnace at superalloy facility	304	Nickel	7440020	2 lb/ton of nickel charged	Controlled by fabric filter, based on engineering judgement	110
Benzophenone production	2849	Fugitive emissions	301	Phenol	100952	0.28 lb/ton used	From engineering estimates	13
Benzophenone production	2849	General emissions	301	Phenol	100952	1.6 lb/ton used	From engineering estimates	13
Benzophenone production	2849	Storage	407044	Phenol	100952	0.02 lb/ton used	From engineering estimates	13
Oil and coal combustion	49	Stack - particulate	102	Polychlorinated dibenzo-p-dioxins, total		1.34 x 10E-4 lb/ton	No para homologue included, one location, TCDD detection = 4 x 10E-5 lb/ton	119
Oil and coal combustion	49	Stack - particulate	102	2,3,7,8-Tetrachlorodibenz o-p-dioxin	1746016	Not detectable	One location, detection limit = 2 x 10E-5 lb/ton	119
Oil combustion		Fuel oil		Ammonia	7444417	0.8 lb/1000 gallons fuel oil burned	Sources emitting > 100 tons MCH/year	179
Oil combustion		Distillate oil-fired boiler, utility/commerce/industry/residential	1	Arsenic	7440382	4.2 lb/10E12 Btu	Uncontrolled, calculated based on engineering judgement	34
Oil combustion		Distillate oil-fired boiler, utility/commerce/industry/residential	1	Arsenic	7440382	2.04 lb/10E12 Btu	Controlled with multiclone, calculated based on engineering judgement	34
Oil combustion		Distillate oil-fired boiler, utility/commerce/industry/residential	1	Arsenic	7440382	0.90 lb/10E12 Btu	Controlled with ESP, calculated based on engineering judgement	34
Oil combustion		Distillate oil-fired boiler, utility/commerce/industry/residential	1	Arsenic	7440382	0.42 lb/10E12 Btu	Controlled with scrubber, calculated based on engineering judgement	34
Oil combustion		Residual oil-fired boiler, utility/commerce/industry/residential	1	Arsenic	7440382	19 lb/10E12 Btu	Uncontrolled, calculated based on engineering judgement	34
Oil combustion		Residual oil-fired boiler, utility/commerce/industry/residential	1	Arsenic	7440382	9.31 lb/10E12 Btu	Controlled with multiclone, calculated based on engineering judgement	34

INDUSTRIAL PROCESS	SIC CODE	EMISSION SOURCE	SOC CODE	POLLUTANT	CAS NUMBER	EMISSION FACTOR	NOTES	REFERENCE
Oil combustion		Residual oil-fired boiler, util/commerc/industr/residential	1	Arsenic	7440382	2.28 lb/10E12 Btu	Controlled with ESP, calculated based on engineering judgement	34
Oil combustion		Residual oil-fired boiler, util/commerc/industr/residential	1	Arsenic	7440382	1.90 lb/10E12 Btu	Controlled with scrubber, calculated based on engineering judgement	34
Oil combustion		Distillate oil-fired boiler, util/commerc/industr/residential	1	Beryllium	7440417	2.5 lb/10E12 Btu	Uncontrolled, calculated based on engineering judgement	34
Oil combustion		Distillate oil-fired boiler, util/commerc/industr/residential	1	Beryllium	7440417	1.38 lb/10E12 Btu	Controlled with multiclones, calculated based on engineering judgement	34
Oil combustion		Distillate oil-fired boiler, util/commerc/industr/residential	1	Beryllium	7440417	0.38 lb/10E12 Btu	Controlled with ESP, calculated based on engineering judgement	34
Oil combustion		Distillate oil-fired boiler, util/commerc/industr/residential	1	Beryllium	7440417	0.18 lb/10E12 Btu	Controlled with scrubber, calculated based on engineering judgement	34
Oil combustion		Residual oil-fired boiler, util/commerc/industr/residential	1	Beryllium	7440417	4.2 lb/10E12 Btu	Uncontrolled, calculated based on engineering judgement	34
Oil combustion		Residual oil-fired boiler, util/commerc/industr/residential	1	Beryllium	7440417	2.48 lb/10E12 Btu	Controlled with multiclones, calculated based on engineering judgement	34
Oil combustion		Residual oil-fired boiler, util/commerc/industr/residential	1	Beryllium	7440417	0.59 lb/10E12 Btu	Controlled with ESP, calculated based on engineering judgement	34
Oil combustion		Residual oil-fired boiler, util/commerc/industr/residential	1	Beryllium	7440417	0.25 lb/10E12 Btu	Controlled with scrubber, calculated based on engineering judgement	34
Oil combustion		Distillate oil-fired boiler, util/commerc/industr/residential	1	Cadmium	7440439	10.8 lb/10E12 Btu	Uncontrolled, calculated based on engineering judgement	34

		CODE	POLLUTANT	NUMBER	EMISSION FACTOR		
Oil combustion	Distillate oil-fired boiler, util/commerc/industr/residential	1	Cadmium	7440429	7.45 lb/10C12 Btu	Controlled with multiclones, calculated based on engineering judgement	34
Oil combustion	Distillate oil-fired boiler, util/commerc/industr/residential	1	Cadmium	7440429	1.84 lb/10C12 Btu	Controlled with ESP, calculated based on engineering judgement	34
Oil combustion	Distillate oil-fired boiler, util/commerc/industr/residential	1	Cadmium	7440429	0.43 lb/10C12 Btu	Controlled with scrubber, calculated based on engineering judgement	34
Oil combustion	Residual oil-fired boiler, util/commerc/industr/residential	1	Cadmium	7440429	15.7 lb/10C12 Btu	Uncontrolled, calculated based on engineering judgement	34
Oil combustion	Residual oil-fired boiler, util/commerc/industr/residential	1	Cadmium	7440429	44.84 lb/10C12 Btu	Controlled with multiclones, calculated based on engineering judgement	34
Oil combustion	Residual oil-fired boiler, util/commerc/industr/residential	1	Cadmium	7440429	9.90 lb/10C12 Btu	Controlled with ESP, calculated based on engineering judgement	34
Oil combustion	Residual oil-fired boiler, util/commerc/industr/residential	1	Cadmium	7440429	3.94 lb/10C12 Btu	Controlled with scrubber, calculated based on engineering judgement	34
Oil combustion	Distillate oil-fired boiler, util/commerc/industr/residential	1	Chromium	7440473	47.8 lb/10C12 Btu	Uncontrolled, calculated based on engineering judgement	34
Oil combustion	Distillate oil-fired boiler, util/commerc/industr/residential	1	Chromium	7440473	27.8 lb/10C12 Btu	Controlled with multiclones, calculated based on engineering judgement	34
Oil combustion	Distillate oil-fired boiler, util/commerc/industr/residential	1	Chromium	7440473	12.92 lb/10C12 Btu	Controlled with ESP, calculated based on engineering judgement	34
Oil combustion	Distillate oil-fired boiler, util/commerc/industr/residential	1	Chromium	7440473	3.84 lb/10C12 Btu	Controlled with scrubber, calculated based on engineering judgement	34

INDUSTRIAL PROCESS	SIC CODE	EMISSION SOURCE	SIC CODE	POLLUTANT	CAS NUMBER	EMISSION FACTOR	NOTES	REFERENCE
Oil combustion		Residual oil-fired boiler, utility/commercial/industrial/residential	1	Chlorine	7440473	21 lb/10E12 Btu	Uncontrolled, calculated based on engineering judgement	34
Oil combustion		Residual oil-fired boiler, utility/commercial/industrial/residential	1	Chlorine	7440473	12.18 lb/10E12 Btu	Controlled with multiclones, calculated based on engineering judgement	34
Oil combustion		Residual oil-fired boiler, utility/commercial/industrial/residential	1	Chlorine	7440473	6.09 lb/10E12 Btu	Controlled with ESP, calculated based on engineering judgement	34
Oil combustion		Residual oil-fired boiler, utility/commercial/industrial/residential	1	Chlorine	7440473	1.68 lb/10E12 Btu	Controlled with scrubber, calculated based on engineering judgement	34
Oil combustion		Distillate oil-fired boiler, utility/commercial/industrial/residential	1	Copper	7440508	290 lb/10E12 Btu	Uncontrolled, calculated based on engineering judgement	34
Oil combustion		Distillate oil-fired boiler, utility/commercial/industrial/residential	1	Copper	7440508	145.2 lb/10E12 Btu	Controlled with multiclones, calculated based on engineering judgement	34
Oil combustion		Distillate oil-fired boiler, utility/commercial/industrial/residential	1	Copper	7440508	42 lb/10E12 Btu	Controlled with ESP, calculated based on engineering judgement	34
Oil combustion		Distillate oil-fired boiler, utility/commercial/industrial/residential	1	Copper	7440508	25.2 lb/10E12 Btu	Controlled with scrubber, calculated based on engineering judgement	34
Oil combustion		Residual oil-fired boiler, utility/commercial/industrial/residential	1	Copper	7440508	278 lb/10E12 Btu	Uncontrolled, calculated based on engineering judgement	34
Oil combustion		Residual oil-fired boiler, utility/commercial/industrial/residential	1	Copper	7440508	145.2 lb/10E12 Btu	Controlled with multiclones, calculated based on engineering judgement	34

INDUSTRIAL PROCESS	CODE	EMISSION SOURCE	SIC CODE	POLLUTANT	NUMBER	EMISSION FACTOR	NOTES	REFERENCE
Oil combustion		Residual oil-fired boiler, utility/commercial/industrial/residential	1	Copper	7440508	23.2 lb/10C12 Btu	Controlled with scrubber, calculated based on engineering judgement	34
Oil combustion		Oil-fired boiler or furnace, utility/commercial/industrial/residential	1	Formaldehyde	80000	405 lb/10C12 Btu	Uncontrolled, based on emissions testing	34
Oil combustion		Industrial, commercial, and residential boilers	1	Lead	7439921	8.9 lb/10C12 Btu	Uncontrolled, calculated based on engineering judgement, assumed use distillate oil	34
Oil combustion		Utility boiler	101004	Lead	7439921	28 lb/10C12 Btu	Uncontrolled, calculated based on engineering judgement, assumed use residual oil	34
Oil combustion		Distillate oil-fired boiler, utility/commercial/industrial/residential	1	Manganese	7439945	14 lb/10C12 Btu	Controlled with scrubber, calculated based on engineering judgement	34
Oil combustion		Distillate oil-fired boiler, utility/commercial/industrial/residential	1	Manganese	7439945	6.44 lb/10C12 Btu	Controlled with multiclones, calculated based on engineering judgement	34
Oil combustion		Distillate oil-fired boiler, utility/commercial/industrial/residential	1	Manganese	7439945	2.08 lb/10C12 Btu	Controlled with ESP, calculated based on engineering judgement	34
Oil combustion		Distillate oil-fired boiler, utility/commercial/industrial/residential	1	Manganese	7439945	1.54 lb/10C12 Btu	Controlled with scrubber, calculated based on engineering judgement	34
Oil combustion		Residual oil-fired boiler, utility/commercial/industrial/residential	1	Manganese	7439945	26 lb/10C12 Btu	Uncontrolled, calculated based on engineering judgement	34
Oil combustion		Residual oil-fired boiler, utility/commercial/industrial/residential	1	Manganese	7439945	11.96 lb/10C12 Btu	Controlled with multiclones, calculated based on engineering judgement	34
Oil combustion		Residual oil-fired boiler, utility/commercial/industrial/residential	1	Manganese	7439945	8.22 lb/10C12 Btu	Controlled with ESP, calculated based on engineering judgement	34

INDUSTRIAL PROCESS	SIC CODE	EMISSION SOURCE	SIC CODE	POLLUTANT	CAS NUMBER	EMISSION FACTOR	NOTES	REFERENCE
Oil combustion		Residual oil-fired boiler, util/commerc/industr/residential	1	Benzenes	7139948	2.84 lb/10012 Btu	Controlled with scrubber, calculated based on engineering judgement	34
Oil combustion		Distillate oil-fired boiler, util/commerc/industr/residential	1	Mercury	7439974	3.0 lb/10012 Btu	Uncontrolled, based on engineering judgement	34
Oil combustion		Distillate oil-fired boiler, util/commerc/industr/residential	1	Mercury	7439974	3.0 lb/10012 Btu	Controlled by multiclone, based on engineering judgement	34
Oil combustion		Distillate oil-fired boiler, util/commerc/industr/residential	1	Mercury	7439974	2.25 lb/10012 Btu	Controlled by ESP, based on engineering judgement	34
Oil combustion		Distillate oil-fired boiler, util/commerc/industr/residential	1	Mercury	7439974	0.78 lb/10012 Btu	Controlled by scrubber, based on engineering judgement	34
Oil combustion		Residual oil-fired boiler, util/commerc/industr/residential	1	Mercury	7439974	3.2 lb/10012 Btu	Uncontrolled, based on engineering judgement	34
Oil combustion		Residual oil-fired boiler, util/commerc/industr/residential	1	Mercury	7439974	3.2 lb/10012 Btu	Controlled by multiclone, based on engineering judgement	34
Oil combustion		Residual oil-fired boiler, util/commerc/industr/residential	1	Mercury	7439974	2.4 lb/10012 Btu	Controlled by ESP, based on engineering judgement	34
Oil combustion		Residual oil-fired boiler, util/commerc/industr/residential	1	Mercury	7439974	0.82 lb/10012 Btu	Controlled by scrubber, based on engineering judgement	34
Oil combustion		Distillate oil-fired boiler, util/commerc/industr/residential	1	Nickel	7440020	170 lb/10012 Btu	Uncontrolled, based on engineering judgement	34
		Distillate oil-fired	1	Nickel	7440020	17 lb/10012 Btu	Controlled by multiclone, based on engineering judgement	34

INDUSTRIAL PROCESS	EMISSION SOURCE	SC CODE	POLLUTANT	METHOD	EMISSION FACTOR	NOTES	REFERENCE
Oil combustion	Distillate oil-fired boiler, util/commerc/industr/residential	1	Nickel	7440020	47.6 lb/10E12 Btu	Controlled by ESP, based on engineering judgment	34
Oil combustion	Distillate oil-fired boiler, util/commerc/industr/residential	1	Nickel	7440020	6.8 lb/10E12 Btu	Controlled by scrubber, based on engineering judgment	34
Oil combustion	Residual oil-fired boiler, util/commerc/industr/residential	1	Nickel	7440020	1240 lb/10E12 Btu	Uncontrolled, based on engineering judgment	34
Oil combustion	Residual oil-fired boiler, util/commerc/industr/residential	1	Nickel	7440020	442.6 lb/10E12 Btu	Controlled by multiclone, based on engineering judgment	34
Oil combustion	Residual oil-fired boiler, util/commerc/industr/residential	1	Nickel	7440020	352.8 lb/10E12 Btu	Controlled by ESP, based on engineering judgment	34
Oil combustion	Residual oil-fired boiler, util/commerc/industr/residential	1	Nickel	7440020	50.4 lb/10E12 Btu	Controlled by scrubber, based on engineering judgment	34
Oil combustion	Cast iron sectional boilers, distillate oil	10300501	Polycyclic organic matter		34.8 lb/10E12 Btu	Uncontrolled, home heating application	114
Oil combustion	Distillate watertube boilers	10300501	Polycyclic organic matter		0.278 lb/10E12 Btu heat input	Uncontrolled	114
Oil combustion	Hot air furnaces, distillate oil	10300501	Polycyclic organic matter		0.324 lb/10E12 Btu	Uncontrolled, same reference also lists 115.4 for same boiler/fuel type	114
Oil combustion	Scotch marine boilers, distillate oil	10300501	Polycyclic organic matter		41.04 lb/10E12 Btu	Uncontrolled	114
Oil combustion	Flue gas	1	2,3,7,8-Tetrachlorodibenzofuran		Not detectable	Low ash, 2% sulfur oil, sampled after heat exch., before ESP, 2378-TCDD detec. limit <0.67-1.3 ng/m3	119
Oil combustion	Boiler flue gas	1	2,3,7,8-Tetrachlorodibenzodioxin	1744014	Not detectable	Low ash, 2% sulfur oil, sampled after heat exch., before ESP, 2378-TCDD detec. limit <4.2-7.9 ng/m3	119
Oil combustion, commercial	Scotch marine boilers, residual oil	10300401	Polycyclic organic matter		2,203 lb/10E12 Btu heat input	Uncontrolled, represents benz(a)pyrene only	114

INDUSTRIAL PROCESS	SIC CODE	EMISSION SOURCE	SCC CODE	POLLUTANT	CAS NUMBER	EMISSION FACTOR	NOTES	REFERENCE
Oil combustion, commercial		Tangential furnace, distillate oil	103005	Selenium	7782492	23.42 lb/10E12 Btu	Uncontrolled, based on reported emissions data and engineering judgement	54
Oil combustion, commercial		Tangential furnace, residual oil	103004	Selenium	7782492	23.42 lb/10E12 Btu	Uncontrolled, based on reported emissions data and engineering judgement	54
Oil combustion, commercial		Wall furnace, distillate oil	103005	Selenium	7782492	23.42 lb/10E12 Btu	Uncontrolled, based on reported emissions data and engineering judgement	54
Oil combustion, commercial		Wall furnace, residual oil	103004	Selenium	7782492	23.42 lb/10E12 Btu	Uncontrolled, based on reported emissions data and engineering judgement	54
Oil combustion, commercial		Distillate oil-fired tangential furnaces	103005	Vanadium	7440422	49.8 lb/10E12 Btu	Uncontrolled, based on reported emissions data and engineering judgement	54
Oil combustion, commercial		Distillate oil-fired wall furnaces	103005	Vanadium	7440422	49.8 lb/10E12 Btu	Uncontrolled, based on reported emissions data and engineering judgement	54
Oil combustion, commercial		Residual oil-fired tangential furnaces	103004	Vanadium	7440422	8487 lb/10E12 Btu	Uncontrolled, based on reported emissions and engineering judgement	54
Oil combustion, commercial		Residual oil-fired wall furnaces	103004	Vanadium	7440422	8487 lb/10E12 Btu	Uncontrolled, based on reported emissions and engineering judgement	54
Oil combustion, industrial		Oil-fired boiler	102005	Lead	7439921	0.00018 lbs/10E6 BTU heat input	Uncontrolled emissions, based on 1 test	129
Oil combustion, industrial		Steam atomized watertube, residual oil	10200401	Polycyclic organic matter		8.33 lb/10E12 Btu heat input	Uncontrolled, represents mostly particulate POM	114
Oil combustion, industrial		Watertube, residual oil	10200401	Polycyclic organic matter		1.46 lb/10E12 Btu heat input	Uncontrolled, represents both gaseous and particulate POM	114
Oil combustion, industrial		Tangential furnace	102	Selenium	7782492	4.63 lb/10E12 Btu	Controlled by scrubber, based on reported emissions data and engineering judgement	54
Oil combustion, industrial		Tangential furnace	102	Selenium	7782492	23.42 lb/10E12 Btu	Uncontrolled, based on reported emissions data and engineering judgement	54
Oil combustion, industrial		Wall furnace	102	Selenium	7782492	4.63 lb/10E12 Btu	Controlled by scrubber, based on reported emissions data and engineering judgement	54
Oil combustion, industrial		Wall furnace	102	Selenium	7782492	23.42 lb/10E12 Btu	Uncontrolled, based on reported emissions data and engineering judgement	54
Oil combustion, industrial		Tangential furnace	102	Vanadium	7440422	402.9 lb/10E12 Btu	Controlled by scrubber, based on reported emissions and engineering judgement	54

INDUSTRIAL PROCESS	SIC CODE	EMISSION SOURCE	SIC CODE	POLLUTANT	CAS NUMBER	EMISSION FACTOR	NOTES	REFERENCE
Municipal waste combustion	4953	Mass burn waterwall combustor, small size new model to any age medium	501001	Tetrachlorodibenzo-p-diox ins, total		3.2×10^{-8} lb/ton feed	Capacity < 600 tons/day, ESP control only, overall average of several source averages, range is 1.26×10^{-8} - 5.2×10^{-8} lb/ton	180
Municipal waste combustion	4953	Mass burn waterwall combustor, small size new model to any age medium	501001	Tetrachlorodibenzo-p-diox ins, total		0.74 ug/Hg feed	Capacity < 600 tons/day, spray drying after acid gas and PM control, one data point only	180
Municipal waste combustion	4953	Mass burn waterwall combustor, small size new model to any age medium	501001	Tetrachlorodibenzo-p-diox ins, total		2.0×10^{-8} lb/ton feed	Capacity < 600 tons/day, dry sorbent injection after acid gas and PM control, range is 1.08×10^{-8} - 2.4×10^{-8} lb/ton	180
Municipal waste combustion	4953	Mass burn waterwall combustor, built before 1980	501001	Tetrachlorodibenzo-p-diox ins, total		2.8×10^{-6} lb/ton feed	ESP control only, overall average of several source averages, range is 6.4×10^{-8} - 4.0×10^{-6} lb/ton	180
Municipal waste combustion	4953	Mass burn, refractory facility	501001	Tetrachlorodibenzo-p-diox ins, total		3.4×10^{-6} lb/ton feed	ESP control only, overall average of several source averages, range is 3.0×10^{-6} - 3.6×10^{-6} lb/ton	180
Municipal waste combustion	4953	Inclinator stack	501001	Zinc	7440444	1.0 lb/ton munic. solid waste-dry wt.	Controlled by spray-baffle scrubber, based on material balance for model inclinator	78
Naphthalene production		Process emissions		Naphthalene	91203	0.478 lb/ton naphthalene produced	Based on POM emissions and 873 naphthalene	79
Naphthalene production		Storage		Naphthalene	91203	0.0454 lb/ton produced	Based on data from State files and engineering judgement	79
Natural gas combustion		Commercial boilers	10300401	Ammonia	7664417	0.49 lb/10E6 cubic feet gas burned	Sources emitting > 100 tons MGD/year	179
Natural gas combustion		Industrial boilers	10200401	Ammonia	7664417	3.2 lbs/10E6 cubic feet gas burned	Sources emitting > 100 tons MGD/year	179
Natural gas combustion		Boilers, exhaust system	102004	Benzene	71432	1.185 lb by vol (or 48 by wt) of total VOC	South Coast study, California, engineering judgement	132
Natural gas combustion		Commercial/institutional	103004	Formaldehyde	50000	220.3 lb/10E12 Btu heat input	Control status unspecified, based on source tests	104
Natural gas combustion		Domestic		Formaldehyde	50000	997 lb/10E12 Btu heat input	Control status unspecified, based on source tests	104
Natural gas combustion		Industrial	102004	Formaldehyde	50000	88.12 lb/10E12 Btu heat input	Control status unspecified, based on source tests	104
Natural gas combustion		Double shell boilers, heat heating		Polycyclic organic matter		1.113 lb/10E12 Btu heat input	Represents primarily particulate POM, uncontrolled	114
Natural gas combustion		Firerube boiler, process heater	10200401	Polycyclic organic matter		0.449 lb/10E12 Btu heat input	Represents primarily particulate POM, uncontrolled	114

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United States
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Office of Air Quality
Planning And Standards
Research Triangle Park, NC 27711

EPA-450/2-89-001
April 1989

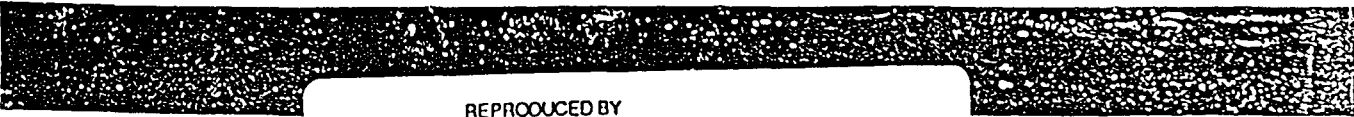
AIR



ESTIMATING AIR TOXICS EMISSIONS FROM COAL AND OIL COMBUSTION SOURCES







REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL
INFORMATION SERVICE
SPRINGFIELD, VA 22161

TABLE 4-1. SUMMARY OF TOXIC POLLUTANT EMISSION
FACTORS FOR OIL COMBUSTION^a

Pollutant	Emission Factor (lb/10 ¹² Btu)	
	Residual Oil	Distillate Oil
Arsenic	19	4.2 ✓
Beryllium	4.2	2.5 ✓
Cadmium	15.7	10.5 ✓
Chromium	21	48 47.5
Copper	280	280 ✓
Lead	28 ^c	8.9 ^d ✓
Mercury	3.2	3.0 ✓
Manganese	26	14 ✓
Nickel	1260	170 ✓
POM	8.4 ^b	22.5 RANGE .275
Formaldehyde	405 ^e	405 ^e ✓

^aAll emission factors are uncontrolled, and are applicable to oil-fired boilers and furnaces in all combustion sectors unless otherwise noted.

^bThis value was calculated using all available residual oil data given in Table 4-35. If the upper end of the range of available data is excluded when calculating an average value (which could be used in this table), the average factor for POM from residual oil combustion becomes 4.1 lb/10¹² BTU.

^cApplicable to utility boilers only.

^dApplicable to industrial, commercial, and residential boilers.

^eThe formaldehyde factors are based on very limited and relatively old data. Consult Table 4-37 and accompanying discussion for more detailed information.

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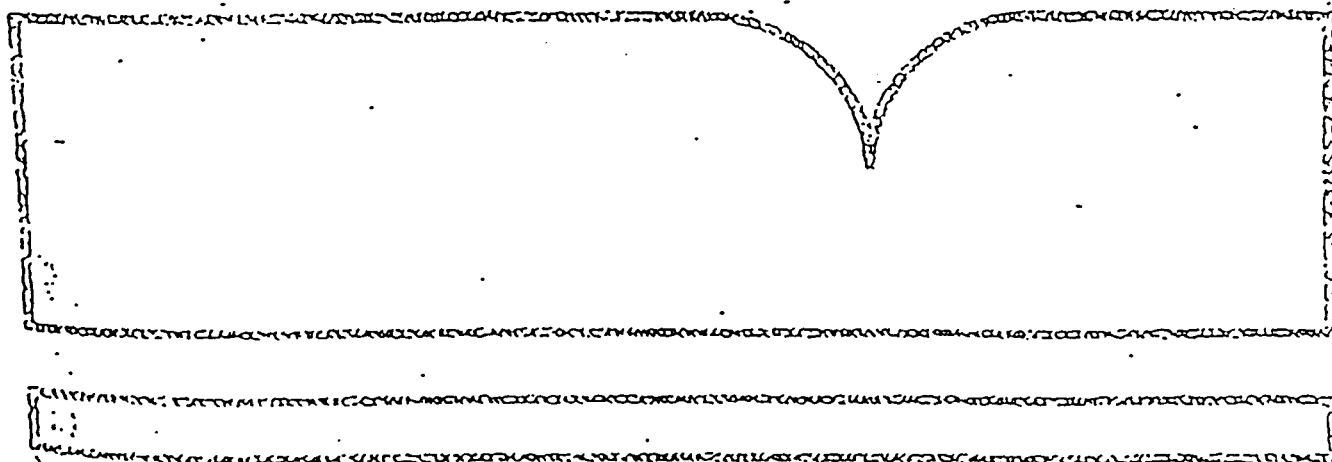
Emissions Assessment of Conventional Stationary
Combustion Systems: Volume V: Industrial
Combustion Sources

TRW, Inc.
Redondo Beach, CA

Prepared for

Industrial Environmental Research Lab.
Research Triangle Park, NC

1981



U.S. Department of Commerce
National Technical Information Service
Springfield, VA

TABLE G1. COMPARISON OF EXISTING TRACE ELEMENT EMISSION FACTOR DATA WITH RESULTS OF CURRENT STUDY OF OIL-FIRED INDUSTRIAL COMBUSTION SOURCES. (pg. 7)

Element	Distillate oil-fired boilers			Residual oil-fired boilers		
	Existing data			Existing data		
	Current study	Ref. 42	Ref. 43	Current study	Ref. 42	Ref. 21 Ref. 28
Aluminum (Al)	178	15	250	177	156	87 132
Arsenic (As)	3.5	1.3	1.5	1.2	9.1	18 12
Barium (Ba)	1.2	8.4	16	3.3	9.5	29 31
Calcium (Ca)	75	845	450	229	780	320 1428
Cadmium (Cd)	1.3	2.5	11	0.66	0.2	52 6.9
Cobalt (Co)	3.6	2.3	1.0	11	23	50 10
Chromium (Cr)	24	36	29	29	50	30 21
Copper (Cu)	37	205	160	10	93	64 350
Fluorine (F)	—	14	—	—	1.0	2.7 149
Iron (Fe)	363	545	140	83	379	411 453
Mercury (Hg)	—	1.7	1.2	—	1.9	0.9 1.5
Potassium (K)	85	60	230	261	213	777 392
Lithium (Li)	0.5	1.5	1.2	1.1	1.0	1.4 1.7
Magnesium (Mg)	42	40	210	24	111	297 2384
Nickel (Ni)	255	112	230	720	804	964 433
Lead (Pb)	24	48	42	2	7	80 34
Antimony (Sb)	—	1.7	5.7	—	21	10 25
Silicon (Si)	735	173	—	8655	1610	400 595
Vanadium (V)	195	30	2.9	366	250	3656 714
Zinc (Zn)	42	40	110	33	46	29 66

pg. 509

**MERCURY EMISSIONS TO THE
ATMOSPHERE IN FLORIDA**

FINAL REPORT

Prepared For:

**Florida Department of Environmental Regulation
2600 Blair Stone Road
Tallahassee, Florida 32399**

Prepared By:

**KBN Engineering and Applied Sciences, Inc.
1034 NW 57th Street
Gainesville, Florida 32605**

**August 1992
91166C1**

Table 2.2-2. Mercury Emission Factors Used for Florida Electric Utility Sources

Fuel	Removal	Units	Emission Factor		
			Low	Average	High
Coal-Uncontrolled	NA	lb/10 ¹² Btu ^a	10	16	21
		lb/Mton	0.25	0.42	0.546
w/ESP	25%	lb/10 ¹² Btu	7.2	12.0	15.6
		lb/Mton	0.19	0.32	0.41
w/Scrubber	70%	lb/10 ¹² Btu	2.9	4.8	6.3
		lb/Mton	0.08	0.13	0.16
Residual Oil	NA	lb/10 ¹² Btu	0.4	3.6	9.3
		lb/10 ³ gal ^b	5.79E-05	5.46E-04	1.41E-03
Distillate Oil	NA	lb/10 ¹² Btu	0.4	3.4	8.8
		lb/10 ³ gal ^c	4.99E-05	4.71E-04	1.21E-03
Natural Gas	NA	lb/10 ¹² Btu ^d	0.001	0.014	0.027
		lb/MMcf	1.25E-06	1.44E-05	2.75E-05

Note: NA = not applicable.

Units: M = 1,000

^a Calculated based on 13,100 Btu/lb coal.^b Calculated based on 18,500 Btu/lb and 8.2 lb/gal.^c Calculated based on 19,500 Btu/lb and 7.1 lb/gal.^d Calculated based on 1,024 Btu/scf.

Source: KBN, 1992.

ATTACHMENT B

**BEST AVAILABLE CONTROL TECHNOLOGY EVALUATION FOR THE
PROPOSED HARDEE UNIT 3**

B.1 NEW SOURCE PERFORMANCE STANDARDS

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 proposed Hardee Unit 3 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).

B.2 BEST AVAILABLE CONTROL TECHNOLOGY

B.2.1 NITROGEN OXIDES

Advanced dry low- NO_x combustion alone has increasingly been approved by regulatory agencies as BACT and is technically feasible for the proposed project. Available information suggests that SCR with dry low- NO_x combustor technology or with wet injection is also technically feasible. For the Hardee Unit 3 Project, advanced dry low- NO_x combustor technology is equivalent to the SCR technology and has several important advantages.

B.2.1.1 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. 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, (e.g., the California Air Control Board, the South Coast Air Quality Management District, the New Jersey Department of Environmental Protection, and the Rhode Island Department of Environmental Management).

Historically, the most stringent NO_x controls for CTs established as LAER/BACT by state agencies were selective catalytic reduction (SCR) with wet injection and wet injection alone. When SCR has been employed, wet injection is used initially to reduce NO_x emissions. However, advanced dry low-NO_x technology has only recently been developed and made available for gas turbines. SCR is a post-combustion control, while advanced dry low-NO_x combustors minimize the formation of NO_x in the combustion process.

SCR has been installed or permitted in about 130 projects. The majority of these projects (more than 90 percent) are cogeneration facilities with capacities of 50 MW or less. About 83 percent (i.e., 109) of the projects have been in California. Of these 109 projects that have either installed SCR or have been permitted with SCR, 43 percent have been in the Southern California NO₂ nonattainment area where SCR was required not as BACT but as LAER, a more stringent requirement. 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).

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.

All the projects in California have natural gas as the primary fuel, and only 15 of the SCR applications in California have distillate fuel as backup.

The remaining projects with SCR (i.e., 23 projects) are located in the eastern United States. These projects are located in Vermont, Massachusetts, Connecticut, New Jersey, New York, Rhode Island, and Virginia. A majority of these projects are cogenerators or independent power producers. The size of these projects ranges from 22 MW to 450 MW, with 87 percent less than 100 MW in size. While almost all 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 80 percent of NO_x in the exhaust gas stream. The most stringent emission limiting standards associated with SCR are approximately 9 ppm for natural gas firing. However, two facilities have reported emission limits of about 4.5 ppm. These emission limits were clearly determined to be LAER on CTs using water injection with uncontrolled NO_x levels below 42 ppm. SCR has not been installed or permitted on simple cycle CTs.

Wet injection historically has been the primary method of reducing NO_x emissions from CTs. 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 O₂ and heat rate). Development of improved wet injection combustors reduced NO_x concentrations to 25 ppmvd (corrected to

15 percent O₂) when burning natural gas. More recently, however, CT manufacturers have developed dry low-NO_x combustors that can reduce NO_x concentrations to less than 25 ppmvd (corrected to 15 percent O₂) when firing natural gas.

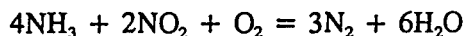
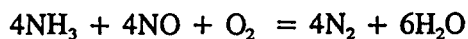
In Florida, all of the most recent PSD permits and BACT determinations for gas turbines have required either wet injection or dry low-NO_x technology for NO_x control. The emission limits included in these permits and BACT determinations are primarily in the range of 15 ppmvd to 25 ppmvd (corrected to 15 percent O₂, dry conditions) for future operations on natural-gas firing. No permits have been issued for units using SCR in Florida.

B.2.1.2 Technology Description 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 will occur (i.e., CO and VOC emissions).

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 GE, Kraftwork Union, and ABB, can achieve NO_x concentrations of 25 ppmvd or less when firing natural gas. GE and Westinghouse 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 15 ppmvd (corrected to 15 percent O₂), a level which is guaranteed by the selected vendor (Westinghouse) for the project.

Selective Catalytic Reduction (SCR)--SCR uses ammonia (NH₃) to react with NO_x in the gas stream in the presence of a catalyst. NH₃, 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:



SCR operating experience, as applied to gas turbines, consists primarily of baseload natural-gas-fired installations either of cogeneration or combined cycle configuration; no simple cycle facilities have SCR. Exhaust gas temperatures of simple cycle CTs generally are in the range of 1,000°F, which exceeds the optimum range for SCR. 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.

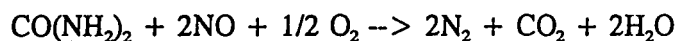
The use of SCR has been limited to facilities that burn natural gas or small amounts of fuel oil since SCR catalysts are contaminated by sulfur-containing fuels (i.e., fuel oil). For most fuel-oil-burning facilities, catalyst operation is discontinued, or the exhaust bypasses the SCR system. While the operating experience with SCR has not been extensive, certain cost, technical, and environmental considerations have surfaced for units firing both natural gas and oil while using SCR. These considerations are summarized in Table B-3.

As presented in Table B-3, ammonium salts (ammonium sulfate and bisulfate) are formed by 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.

Zeolite catalysts, which are reported to be capable of operating in temperature ranges from 600°F to 950°F, have become available commercially only recently. Their application with SCR primarily has been limited to internal combustion engines. Optimum performance of an SCR system using a zeolite catalyst is reported to range from about 800°F to 900°F. At temperatures of 1,000°F and above, the zeolite catalyst will be irreparably damaged. Application of an SCR system using a zeolite catalyst would be feasible for the project; however, use on simple cycle operation is technically infeasible without exhaust gas cooling. Moreover, since zeolite catalysts

have not been operated continuously in combustion exhausts greater than 900°F, the cooling system would have to reduce turbine exhaust temperatures about 200°F (i.e., to around 800°F).

NO_xOUT Process--The NO_xOUT 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_xOUT 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:



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 (SO₃), 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 to three reported cases:

1. Trial demonstration on a 62.5-ton-per-hour (TPH) stoker-fired wood waste boiler with 60 to 65 percent NO_x reduction,
2. A 600 x 10⁶ Btu CO boiler with 60 to 70 percent NO_x reduction, and
3. A 75-MW pulverized coal-fired unit with 65 percent NO_x reduction.

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 Hardee Unit 3 CT is about 1,000°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 a combustion turbine is typically about 1,000°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 Determination--A technical evaluation of available post-combustion gas controls (i.e., NO_xOUT, Thermal DeNO_x, and NSCR) indicates that these processes have not been applied to CT/HRSR and are technically infeasible for the project because of process constraints (e.g., temperature).

For the BACT analysis, dry low-NO_x combustion technology and SCR in combination with combustion controls are feasible alternatives that can achieve a maximum degree of emission reduction. The advanced dry low-NO_x combustor alone can achieve 15 ppm (corrected) and the SCR with dry low-NO_x combustor is capable of achieving a NO_x emission level of 9 ppm when firing natural gas (corrected to 15 percent O₂ dry conditions). When firing oil, the emissions with SCR and wet injection would be about 15 ppm (corrected), whereas emissions with wet injection alone would be 42 ppm (corrected). However, the SCR has an associated ammonia slip (i.e., up to 10 ppm).

B.2.1.3 SCR Cost Estimates

Tables B-4 and B-5 present the total capital and annualized cost for SCR, respectively.

B.2.2 CARBON MONOXIDE

B.2.2.1 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-6 presents a listing of LAER/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. For the CTs being evaluated, CO emissions will not exceed 15 ppmvd, corrected to dry conditions when firing natural gas under full load conditions and 25 ppmvd when firing distillate oil. During power augmentation mode, CO emissions will be less than 50 ppmvd.

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 wet injection. These installations have been required to use LAER technology and typically have CO limits in the 10 ppm range (corrected to dry conditions).

B.2.2.2 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 efficiencies above 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. The existing oxidation catalyst applications primarily have been limited to smaller cogeneration facilities burning natural gas. Oxidation catalysts have not been used on fuel-oil-fired CTs or combined cycle facilities. The use of sulfur-containing fuels in an oxidation catalyst system would result in an increase of SO₃ emissions and concomitant corrosive effects to the stack. In addition, trace metals in the fuel could result in catalyst poisoning during prolonged periods of operation.

Since the units likely will require numerous startups, variations in exhaust conditions will influence catalyst life and performance. Very little technical data exist to demonstrate the effect of such cycling.

The lack of demonstrated operation with oil firing suggests rejection of catalytic oxidation as a technically feasible alternative. However, the advent of a second generation catalyst suggests that an oxidation catalyst could be used although none have been placed in actual operation.

B.2.2.3 Oxidation Catalyst Costs

Table B-7 presents the capital and annualized cost for an oxidation catalyst.

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 x 10⁶ 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.

Table B-2. Summary of BACT Determinations for NOx Emissions from Gas-fired Turbines (Page 1 of 4)

Facility Name	State	Permit Issue Date	Unit/Process Description	Capacity (Size)	NOx Emission Limit				Control Method	Efficiency (%)
					(lb/MMBtu)	(lb/hr)	(TPY)	(ppmv basis)		
Florida Power Corp.	FL	Nov-93	Combustion Turbines (2)	2346 MMBtu/hr (oil)	--	73/305	639/153	12/15 (gas) (with/without ISO corrections) / 42 (oil) @ 15% O2	Dry low NOx burners	--
Tampa Electric Co.	FL	Nov-93	Combustion Turbine (1)	1907 MMBtu/hr (oil)	--	111.25/188	522/164.7	12.5 (syngas) / 42 (oil)	Dry low NOx burners	--
Tiger Bay Cogen	FL	May-93	GE FA	206 MW	--	97.2	425.7	15 @ 15% O2	Dry low NOx burners	--
Grays Ferry Co. Cogen Partn.	PA	Nov-92	Oil and Gas Turbine	1150 MMBtu	--	--	--	9	Dry Low NOx Burner	--
Central Florida Cogen	FL	Nov-92	GE EA	125 MW	--	87.8	384.5	25 @ 15% O2	Low NOx burners/water inj.	--
Gordonsville Energy L.P.	VA	Sep-92	Gas Turbine	1331.1 X10(7) SCF/Y	--	--	245	--	Water Injection with SCR	80.00
Gordonsville Energy L.P.	VA	Sep-92	Gas Turbines with SF (2)	1.51 X10(9) Btu/h	--	--	--	9 @ 15% O2	Water Injection with SCR	80.00
University of Florida Cogen	FL	Aug-92	GE LM6000	43 MW	--	35	142.7	25 @ 15% O2	--	--
Bermuda Hundred NRG Ld. Partn.	VA	Mar-92	Gas Turbine	1175 MMBtu/hr	--	--	--	9 ppm @ 15% O2	SCR/Steam Injection	91.00
Bermuda Hundred NRG Ld. Partn.	VA	Mar-92	Gas Turbine	1117 MMBtu/hr	--	--	--	15 ppm @ 15% O2	SCR/Steam Injection	--
Kalamazoo Power Limited	MI	Dec-91	Gas Turbines (2)	1805.9 MMBtu/hr	--	--	--	15 ppmv	Dry Low NOx Burners	--
Lake Cogen Limited	FL	Nov-91	Combined Cycle	42 MW	--	--	--	25 ppm @ 15% O2	Combustion Control	--
Lake Cogen	FL	Nov-91	Combined Cycle	120 MW	--	--	--	25 @ 15% O2	Steam Injection	--
Pasco Cogen	FL	Nov-91	Combined Cycle	120 MW	--	--	--	25 @ 15% O2	Steam Injection	--
Southern California Gas	CA	Oct-91	GT Solar Model H	5500 HP	--	--	--	8 ppm @ 15% O2	High Temp SCR	--
Southern California Gas	CA	Oct-91	GT Solar Model H	47.64 MMBtu/hr	--	1.92	--	--	SCR	--
El Paso Natural Gas	AZ	Oct-91	GT Solar Centaur H	5500 HP	--	--	--	42 ppm @ 15% O2	Dry Low NOx Combustor	--
El Paso Natural Gas	AZ	Oct-91	GT Solar Centaur H	5500 HP	--	--	--	85.1 ppm @ 15% O2	Lean Fuel Mix	--
El Paso Natural Gas	AZ	Oct-91	GT Solar Centaur H	5500 HP	--	--	--	84.9 ppm @ 15% O2	Lean Burn	--
El Paso Natural Gas	AZ	Oct-91	GE Gas Turbine	12000 HP	--	--	--	42 ppm @ 15% O2	Steam Injection	--
El Paso Natural Gas	AZ	Oct-91	GE Gas Turbine	12000 HP	--	--	--	225 ppm @ 15% O2	Steam Injection	--
Florida Power Corporation	FL	Sep-91	Simple Cycle	552 MW	--	--	--	42 @ 15% O2	Dry Low NOx Combustor	--
Enron Louisiana Energy Co.	LA	Aug-91	Gas Turbines (2)	78.2 MMBtu/hr	--	6.3	--	40 ppmv @ 15% O2	Water Inject 0.67 lb/lb	71.00
City of Lakeland	FL	Jul-91	Combined Cycle	120 MW	--	--	--	25 @ 15% O2	Dry Low NOx Combustor	--
Sumas Energy, Inc.	WA	Jun-91	Gas Turbine	80 MW	--	--	--	6 @ 15% O2	SCR	90.00
Florida P&L Co. (Martin)	FL	Jun-91	Combined Cycle	860 MW	--	--	--	25 @ 15% O2	Dry Low NOx Combustor	--
Northern Consolidated Power	PA	May-91	Gas Turbines (2)	34.6 KW	--	--	--	25 ppm @ 15% O2	Steam Injection, SCR in 1997	85.00
Commonwealth Atlantic LTD Partn.	VA	Mar-91	Gas Turbine	1533 MMBtu/hr	--	139	--	25	H2O Injection I Low NOx Comb.	--
Commonwealth Atlantic LTD Partn.	VA	Mar-91	Gas Turbine	1400 MMBtu/hr	--	--	1032	42	Water Injection	--
Florida P&L Co. (Ft. Lauderdale)	FL	Mar-91	Combined Cycle	860 MW	--	--	--	42 @ 15% O2	Steam Injection	--

Table B-2. Summary of BACT Determinations for NOx Emissions from Gas-fired Turbines (Page 2 of 4)

Facility Name	State	Permit Issue Date	Unit/Process Description	Capacity (Size)	NOx Emission Limit				Control Method	Efficiency (%)
					(lb/MMBtu)	(lb/hr)	(TPY)	(ppmv basis)		
Hardee Power Station	FL	Dec-90	Combined Cycle	660 MW	--	--	--	42 @ 15% O2	Wet Injection	--
Newark Bay Cogeneration Partn.	NJ	Nov-90	Gas Turbine	50 MW	--	--	--	8.3 (gas) / 16 (kerosene) @ 15% O2	Steam Injection with 80% SCR	94.00
Salinas River Cogen	CA	Nov-90	Gas Turbine	43.2 MW	--	10	--	6 @ 15% O2	Dry Low NOx Comb. & SCR	--
Sargent Canyon Cogen Co.	CA	Nov-90	Gas Turbine	42.5 MW	--	10	--	6 @ 15% O2	Dry Low NOx Comb. & SCR	--
March Point Cogen	WA	Oct-90	Turbine	80 MW	--	--	--	25 @ 15% O2	Massive Steam Injection	80.00
Las Vegas Cogen	NV	Oct-90	Turbine, Peaking	397 MMBtu/hr	--	--	--	10 ppm	Water Injection & SCR	--
Delmarva Power Corporation	DE	Sep-90	Combined Cycle	450 MW	0.1	--	--	25 @ 15% O2	Dry Low NOx Combustor	--
Doswell Limited Partnership	VA	May-90	Combustion	1261 MMBtu/hr	--	--	--	9 ppm @ 15% O2	Dry Combustion with SCR	--
Oneida Cogeneration Facility	NY	Feb-90	GE Frame 6	417 MMBtu/hr	--	--	--	32 ppm	Combustion Control	--
Fulton Cogeneration Associates	NY	Jan-90	GE LM5000	500 MMBtu/hr	--	--	--	36 ppm	Water Injection	--
Amoco Research Center	IL	Jan-90	Gas Turbine	96 MMBtu/hr	--	--	--	49 ppm @ 15% O2	Water Injection with SCR	--
O'Brian California Cogen II	CA	Jan-90	Gas Turbine	49.5 MW	--	114.6	--	--		
Richmond Power Enterprise Partn.	VA	Dec-89	Gas Turbines (2)	1163.5 MMBtu/hr	--	--	--	8.2 ppm @ 15% O2	Steam Injection with SCR	--
Arrowhead Cogeneration	VT	Dec-89	Gas Turbine	282 MMBtu/hr	--	--	--	9 @ 15% O2, 1H Avg.	Water Injection & SCR	80.00
JMC Selkirk, Inc.	NY	Nov-89	GE Frame 7	80 MW	--	--	--	25 ppm	Steam Injection	--
Shell Offshore, Inc.	AL	Oct-89	Gas Turbine	5000 HP	--	--	--	42 ppm	Water Injection	85.00
Badger Creek Limited	CA	Oct-89	GT-Cogen.	457.8 MMBtu/hr	0.0135	--	--	--	Steam Injection & SCR	--
Capitol District NRG Ctr	CT	Oct-89	Gas Turbine	738.8 MMBtu/hr	--	--	--	42 @ 15% O2	Steam Injection	--
Panda-Rosemary Corp.	NC	Sep-89	GE Frame 6	499 MMBtu/hr	0.17	83	--	--	Water Injection	--
Panda-Rosemary Corp.	NC	Sep-89	GE Frame 7	1047 MMBtu/hr	--	173	--	--	Water Injection	--
Mobil E & P U.S., INC.	CA	Sep-89	Gas Turbines (3)	3.2 MW	--	2.1	--	--	SCR	--
Kamine Syracuse Cogeneration Co.	NY	Sep-89	Gas Turbine	79 MW	--	--	--	36 ppm	Water Injection	--
Syracuse University	NY	Sep-89	Gas Turbine	79 MW	--	--	--	25 ppm	Steam Injection	--
City of Anaheim GT Proj.	CA	Sep-89	Gas Turbine	442 MMBtu/hr	--	3.75	--	--	Steam Injection & SCR	69.60
Cimarron Chemical Co.	CO	Aug-89	Turbines (2)	271 MMBtu/hr	--	--	--	65 ppmv @ 15% O2	Steam Injection	--
Sayreville Cogeneration	NJ	May-89	Gas Turbine	100 MW	--	--	--	25 @ 15% O2	Steam Injection	--
Tropicana Products, Inc.	FL	May-89	Gas Turbine	45.4 MW	--	--	--	42 ppm @ 15% O2	Steam Injection	--
Empire Energy - Niagara Cogen	NY	May-89	GR Frame 6 (3)	1248 MMBtu/hr	--	--	--	42 ppm	Steam Injection	--
Megan-Racine Assoc.	NY	Mar-89	GE LM5000	430 MMBtu/hr	--	--	--	42 ppm	Water Injection	--
Potomac Electric Power Company	MD	Mar-89	Combined Cycle	860 MW	--	--	--	42 @ 15% O2	Steam Injection	--
Bellingham Cogeneration	MA	Feb-89	Combustion Turbine	100 MW	--	--	--	25 (gas) / 42 (oil) @ 15% O2	Steam Injection	--

Table B-2. Summary of BACT Determinations for NOx Emissions from Gas-fired Turbines (Page 3 of 4)

Facility Name	State	Permit Issue Date	Unit/Process Description	Capacity (Size)	NOx Emission Limit				Control Method	Efficiency (%)
					(lb/MMBtu)	(lb/hr)	(TPY)	(ppmv basis)		
Indec/Oswego Hill Cogen	NY	Feb-89	GE Frame 6	40 MW	--	--	--	42 @ 15% O2	Water Injection	--
Pawtucket Power	RI	Jan-89	Turbine	58 MW	--	--	--	9 @ 15% O2	SCR	--
L&J Energy System Cogen	NY	Jan-89	GE LM 5000	40 MW	--	--	--	42 ppm	Steam Injection	--
Mojave Cogen	CA	Jan-89	Turbine	490 MMBtu/hr	0.031	--	--	--	--	--
Ocean State Power	RI	Jan-89	Combined Cycle	500 MW	--	--	--	9 @ 15% O2	Steam Injection & SCR	--
Mojave Cogen	CA	Jan-89	Turbine	45 MW	--	--	--	10 ppm	Steam Injection & SCR	--
Champion International	AL	Nov-88	Gas Turbine	35 MW	--	--	--	42 @ 15% O2	Steam Injection	70.00
Indeck-Yerks Energy Services	NY	Nov-88	GE Frame 6	40 MW	--	--	--	42 @ 15% O2	Steam Injection	--
Long Island Lighting Co.	NY	Nov-88	Peaking Units (3)	75 MW	--	--	--	55 ppm	Water Injection	--
Amtrak	PA	Oct-88	Turbine (2)	20 MW	--	--	--	42 @ 15% O2	Water Injection	--
Mobile Oil	CA	Sep-88	Turbine (2)	81.4 MMBtu/hr	0.047	3.78	--	--	Water Injection & SCR	--
Kamine South Glens Falls	NY	Sep-88	GE Frame 6	40 MW	--	--	--	42 ppm	Steam Injection	--
Orlando Utilities	FL	Sep-88	Gas Turbines (2)	35 MW	--	--	--	42 @ 15% O2	Steam Injection	--
Delmarva Power Corporation	DE	Aug-88	Turbines (2)	200 MW	--	--	--	42 ppm	Low NOx Burners and Water Inj.	--
O'Brien Cogen	CT	Aug-88	Gas Turbines (2)	499.9 MMBtu/hr	--	--	--	39 @ 15% O2	Water Injection	--
Kamine Carthage	NY	Jul-88	GE Frame 6	40 MW	--	--	--	42 ppm	Steam Injection	--
ADA Cogeneration	MI	Jun-88	Turbine	245 MMBtu/hr	--	--	--	42 @ 15% O2, 1H Avg.	Water Injection	59.00
CCF-1 Jefferson Station	CT	May-88	Gas Turbines (2)	110 MMBtu/hr	--	--	--	36 @ 15% O2	Water Injection	--
Merck Sharp & Pohme	PA	May-88	Turbine	310 MMBtu/hr	--	--	--	42 @ 15% O2	Steam Injection	--
Virginia Power	VA	Apr-88	GE Turbine	1875 MMBtu/hr	--	490	--	42 @ 15% O2	Steam Injection	--
TBG/Grumman	NY	Mar-88	Gas Turbine	16 MW	0.2	--	--	75 ppm	Water Inj./Combustion Control	--
Combined Energy Resources	CA	Feb-88	Gas Turbine	25.94 MW	--	199	--	--	Water Injection & SCR	81.00
Texas Gas Transmission Corp.	KY	Feb-88	Gas Turbine	14300 HP	--	--	--	--	NOx 0.015 % by Volume	--
Midland Cogeneration Venture	MI	Feb-88	Turbines (12)	984.2 MMBtu/hr	--	--	--	42 @ 15% O2	Steam Injection	--
Midway-Sunset Cogen	CA	Jan-88	GE Frame 7 (3)	75 MW	--	85	--	--	Water Injection & Quiet Combust.	--
Downtown Cogeneration Assoc.	LA	Aug-87	Gas Turbine	71.9 MMBtu/hr	--	--	--	42 @ 15% O2	Water Injection	--
BAF Energy	CA	Jul-87	Turbine, Generator	887.2 MMBtu/hr	--	30.1	--	9 @ 15% O2	Steam Injection & SCR	80.00
AES Placerita, Inc.	CA	Jul-87	Turbine	530 MMBtu/hr	--	14.2	--	9 @ 15% O2	St./F Ratio 2.2:1 & SCR	--
AES Placerita, Inc.	CA	Jul-87	Gas Turbine	530 MMBtu/hr	--	12	--	9 @ 15% O2	St./F Ratio 2.2:1 & SCR	--
Simpson Paper Co.	CA	Jun-87	Gas Turbine	49.5 MW	--	9.71	--	6 @ 15% O2	Steam Injection & SCR	--
Power Development Co.	CA	Jun-87	Gas Turbine	49 MMBtu/hr	--	1.5	--	9 @ 15% O2	Water Injection & SCR	--
San Joaquin Cogen Limited	CA	Jun-87	Gas Turbine	48.6 MW	--	10.4	--	6 @ 15% O2	Water Injection & SCR	76.00
Cogen Technologies	NJ	Jun-87	GE Frame 6 (3)	40 MW	--	--	--	9.6 @ 15% O2	Water Injection & SCR	95.00

Table B-2. Summary of BACT Determinations for NOx Emissions from Gas-fired Turbines (Page 4 of 4)

Facility Name	State	Permit	Unit/Process Description	Capacity (Size)	NOx Emission Limit				Control Method	Efficiency (%)
		Issue Date			(lb/MMBtu)	(lb/hr)	(TPY)	(ppmv basis)		
Trunkline LNG	LA	May-87	Gas Turbine	147102 SCF/hr	--	59	--	--	--	--
Pacific Gas Transmission	OR	May-87	Gas Turbine	14000 HP	--	50.3	--	154 ppm	Combustion Control	--
Anheuser-Busch	FL	Apr-87	Gas Turbine	95.7 MMBtu/hr	0.1	--	--	--	--	--
Alaska Elect. Gen. & Trans.	AK	Mar-87	Gas Turbine	80 MW	--	--	--	75 @ 15% O2	Water Injection	--
Sycamore Cogen	CA	Mar-87	Gas Turbine	75 MW	--	--	--	--	--	--
U.S. Borax & Chemical Corp.	CA	Feb-87	Gas Turbine	45 MW	--	40	--	25 ppm @ 15% O2	Proper Combust. Techniques	--
Sierra LTD.	CA	Feb-87	GE Gas Turbine	11.34 MMBtu/hr	0.016	4.04	--	--	Steam Injection & SCR	95.86
Midway-Sunset Project	CA	Jan-87	Gas Turbines (3)	973 MMBtu/hr	--	113.4	--	16.31 ppmv	Water Injection	73.00
City of Santa Clara	CA	Jan-87	Gas Turbine	--	--	--	--	42 @ 15% O2	Water Injection	--
O'Brien NRG Systems/Merchants Ref	CA	Dec-86	Gas Turbine	359.5 MMBtu/hr	--	30.3	--	15 @ 15% O2	Water Injection & SCR	--
California Dept. of Corr.	CA	Dec-86	Gas Turbine	5.1 MW	--	--	--	38 @ 15% O2	1:1 Water Injection	--
Double 'C' Limited	CA	Nov-86	Gas Turbine	25 MW	--	8.08	--	--	H2O Inj. & Selected Catalytic	--
Kern Front Limited	CA	Nov-86	Gas Turbines (2)	50 MW	--	8.08	--	4.5 @ 15% O2	Water Injection & SCR	95.80
PG&E, Station T	CA	Aug-86	GE LM5000	396 MMBtu/hr	--	63	--	25 ppm @ 15% O2	Steam Injection @ St/F Ratio	75.00
Wichita Falls E. I., I.	TX	Jun-86	Gas Turbine	20 MW	--	684	--	--	Steam Injection	--
Formosa Plastic Corp.	TX	May-86	GE MS 6001	38.4 MW	--	--	640	--	Steam Injection	--
Kern Energy Corp.	CA	Apr-86	Gas Turbine	8.8 MMBtu/hr	0.023	8.29	--	--	Steam Inj., Low NOx Config.	87.00
Monarch Cogen	CA	Apr-86	Combined Cycle	92.2 MMBtu/hr	--	8.02	--	22 @ 15% O2	SCR	--
Moran Power, Inc.	CA	Apr-86	Gas Turbine	8 MMBtu/hr	0.02	8.29	--	--	Steam Inj., Low NOx Config.	87.00
Southeast Energy, Inc.	CA	Apr-86	Gas Turbine	8 MMBtu/hr	0.023	8.29	--	--	Steam Inj., Low NOx Config.	87.00
Western Power Systems, Inc.	CA	Mar-86	GE Gas Turbine	26.5 MW	--	--	--	9 @ 15% O2	Water Injection & SCR	80.00
AES Placerita, Inc.	CA	Mar-86	Turbine	519 MMBtu/hr	--	26.2	--	7 @ 15% O2	Water Injection & SCR	--
OLS Energy	CA	Jan-86	GE Gas Turbine	256 MMBtu/hr	--	--	--	9 @ 15% O2	Water Injection & Scrubber	80.00
Union Generation	CA	Jan-86	Gas Turbine	16 MW	--	--	--	25 @ 15% O2	Water Injection & Scrubber	--

Table B-3. Cost, Technical, and Environmental Considerations of SCR Used on Combustion Turbines (Page 1 of 2)

Consideration	Description
COST:	
Catalyst Replacement	Catalyst life varies depending on the application. Cost ranges from 20 to 40 percent of total capital cost and is the dominant annual cost factor.
Ammonia	Ratio of at least 1:1 NH_3 to NO_x generally needed to obtain high removal efficiencies. Special storage and handling equipment required.
Space Requirements	For new installations, space in the catalyst is needed for replacement layers. Additional space is also required for catalyst maintenance and replacement.
Backup Equipment	Reliability requirements necessitate redundant systems, such as ammonia control and vaporization equipment.
Catalyst Back Pressure Heat Rate Reduction	Addition of catalyst creates backpressure on the turbine, which reduces overall heat rate.
Electrical	Additional usage of energy to operate ammonia pumps and dilution fans.
TECHNICAL:	
Ammonia Flow Distribution	NH_3 must be uniformly distributed in the exhaust stream to assure optimum mixing with NO_x before reaching the catalyst.
Temperature	The narrow temperature range that SCR systems operate within (i.e., about 100°F) must be maintained even during load changes. Operational problems could occur if this range is not maintained.
Ammonia Control	Quantity of NH_3 introduced must be carefully controlled. With too little NH_3 , the desired control efficiency is not reached; with too much NH_3 , NH_3 emissions (referred to as slip) occur.
Flow Control	The velocity through the catalyst must be within a range to assure satisfactory residence time.

Table B-3. Cost, Technical, and Environmental Considerations of SCR Used on Combustion Turbines (Page 2 of 2)

Consideration	Description
ENVIRONMENTAL:	
Ammonia Slip	NH ₃ slip (NH ₃ that passes unreacted through the catalyst and into the atmosphere) can occur if 1) too much ammonia is added, 2) the flow distribution is not uniform, 3) the velocity is not within the optimum range, or 4) the proper temperature is not maintained.
Ammonium Salts	Ammonium salts (ammonium sulfate and bisulfate) can lead to increased corrosion. These salts can occur when firing natural gas. These compounds are emitted as particulates.
Ammonia Transportation and Storage	Storage and handling of anhydrous ammonia produces additional environmental risks. Appropriate controls and contingency plans in the event of a release are required.

Table B-4. Direct and Indirect Capital Cost for Selective Catalytic Reduction (SCR) (Page 1 of 3)

Cost Component	Estimated Cost (\$)	Basis for Cost Estimate
<u>Direct Capital Costs</u>		
SCR Associated Equipment	1,461,700	Developed from manufacturer budget quotations ^a
Ammonia Storage Tank	257,900	Developed from manufacturer budget quotations ^b
HRSB Modification	884,100	Developed from manufacturer budget quotations ^c
<u>Indirect Capital Costs</u>		
Installation and Foundation (Includes Contractor Fee)	734,400	20% of SCR associated equipment and catalyst ^d
<u>Engineering Costs</u>		
Engineering, Erection Supervision, Startup, and O&M Training	554,800	10% of SCR equipment and catalyst with contingency; ammonia storage tank; HRSB direct capital costs; and installation labor. ^e
Project Support	305,200	5% of SCR equipment and catalyst with contingency; ammonia storage tank; HRSB direct capital and engineering costs; and installation labor. ^f
Ammonia Emergency Preparedness Program	100,000	Engineering estimate
Liability Insurance	30,500	0.5% of SCR equipment and catalyst with contingency; ammonia storage tank; HRSB engineering costs; and installation labor.
Interest During Construction	980,800	15% of all direct and indirect capital costs, including catalyst cost ^g
Contingency	796,400	15% of all capital costs ^h
<u>Total Capital Costs</u>	6,105,700	Sum of all capital costs
<u>Annualized Capital Costs</u>	717,200	Capital recovery of 10% over 20 years, 11.74% per year ⁱ
<u>Recurring Capital Costs</u>		
SCR Catalyst (Materials and Labor)	2,210,000	Developed from manufacturer budget quotations ^j
Contingency	331,500	15% of recurring capital costs ^k
<u>Total Recurring Capital Costs</u>	2,541,700	Sum of recurring capital costs

Table B-4. Direct and Indirect Capital Cost for Selective Catalytic Reduction (SCR) (Page 2 of 3)

Cost Component	Estimated Cost (\$)	Basis for Cost Estimate
<u>Annualized Recurring Capital Costs</u>	1,022,000	Capital recovery of 10% over 3 years, 40.21% per year ¹

Note: HRSG = heat recovery steam generators.
SCR = selective catalytic reduction.

Footnotes for Table B-4

Note: All calculations rounded to nearest 100.

- a. Developed from various vendor data as an algorithm to account for mass flow (lb/hr) through HRSG.

The SCR associated cost is made up of 2 factors:

1. Catalyst Housing, vaporizer, and HRSG wash system is \$100 per 1,000 lb/hr mass flow at ISO operating conditions (i.e., 3,683,600 lb/hr).

$$\$100/1,000 \text{ mass flow} \times 3,683.6 \times 10^3 \text{ lb/hr} \times 2 \text{ CTs} = \$736,720$$

2. Control system costs = $\$362,500 \times 2 = \$725,000$

Total is \$1,461,700

- b. Ammonia tank size is based on SCR size as follows:

$$\$35/1,000 \text{ lb mass flow} \times 3,683.6 \times 10^3 \text{ lb/hr} = \$257,900$$

- c. HRSG modifications based on mass flow at \$120 per 1,000 lb mass flow.

$$\$120/1,000 \text{ lb mass flow} \times 3,683.6 \times 10^3 \text{ lb/hr} = \$884,100$$

- d. From EPA OAQPS cost control manual

$$(\$1,461,700 + \$2,210,200) \times 0.20 = \$734,400$$

- e. From EPA OAQPS cost control manual

$$(\$1,461,700 + \$257,900 + \$2,210,200 + \$884,600 + \$734,400) \times 0.10 \\ = \$554,800$$

- f. Engineering estimate; same as engineering costs except add engineering costs and multiply by 0.05.

Table B-4. Direct and Indirect Capital Cost for Selective Catalytic Reduction (SCR) (Page 3 of 3)

Cost Component	Estimated Cost (\$)	Basis for Cost Estimate
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Footnotes for Table B-4 (continued)

- g. From OAQPS cost control manual and engineering estimate.
 $0.15 \times (\$1,461,700 + \$257,900 + \$884,100 + \$734,400 + \$554,800 + \$305,200 + \$100,000 + \$30,500 + \$2,210,200) = \$980,800$
- h. From EPA OAQPS cost control manual and engineering estimate
 $0.15 \times (\$1,461,700 + \$257,900 + \$884,100 + \$734,400 + \$554,800 + \$305,200 + \$100,000 + \$30,500 + \$980,800) = \$796,400$
- i. OAQPS cost control manual; standard statistical tables for 10% interest over 20 years
 $\$6,105,700 \times 0.1174 = \$717,200$
- j. Developed from manufacturer data at \$0.3/lb mass flow:
 $\$0.3 \times 3,683,600 \times 2 = \$2,210,200$
- k. Same rationale as h:
 $0.15 \times \$2,210,200 = \$331,500$
- l. Manufacturer guarantees of 3 years life of catalyst. Used OAQPS cost control manual interest of 10 percent over 3 years (40.21 percent per year):
 $0.4021 \times \$2,541,700 = \$1,022,000$

Table B-5. Annualized Cost for Selective Catalytic Reduction (SCR) (Page 1 of 3)

Cost Component	Estimated Cost (\$)	Basis for Cost Estimate
<u>Direct Annual Costs</u>		
Operating Personnel	31,200	24 hours/week @ \$25/hour ^a
Ammonia	88,000	\$300/ton; NH ₃ :NO _x = 1:1:1 volume ^b
Accident/Emergency Response Plan	8,100	Consultant estimate, 80 hours/year @ \$75/hour plus expenses @ 35% labor ^c
Inventory Cost	86,500	Capital recovery (11.74%/year) for 1/3 of catalyst cost ^d
Catalyst Disposal Cost	68,800	Engineering estimate ^e
Contingency	54,200	15% of indirect costs ^f
<u>Energy Costs</u>		
Electrical	70,100	80 kWh/CT; \$0.05/kWh ^g
Heat Rate Penalty	684,600	4" back pressure, heat rate reduction of 0.5%, energy loss at \$0.05/kWh ^h
MW Loss Penalty	803,000	391 MW lost for 3 of SCR maintenance; lost capacity @ \$0.05/kW; cost of natural gas @ \$3/MMBtu subtracted ⁱ
Fuel Escalation Costs	343,000	Real cost increase of fuel ^j
Contingency	237,700	15% of energy costs; excludes fuel escalation ^k
<u>Total Direct Annual Costs</u>	2,471,100	Sum of all direct annual costs
<u>Indirect Annual Costs</u>		
Overhead	79,000	60% of ammonia and 115% of O&M labor, and 15% of O&M labor (OAQPS Cost Control Manual) ^l
Property Taxes and Insurance	172,900	2% of total capital costs ^m
Annualized Capital Costs	717,200	Capital recovery of 10% over 20 years, 11.74% per year (from Table B-4)

Table B-5. Annualized Cost for Selective Catalytic Reduction (SCR) (Page 2 of 3)

Cost Component	Estimated Cost (\$)	Basis for Cost Estimate
Recurring Capital Costs	1,022,000	Capital recovery of 10% over 3 years, 40.21% per year (from Table B-4)
<u>Total Indirect Annual Costs</u>	1,991,100	Sum of all indirect annual costs
<u>Total Annual Costs</u>	4,462,200	Total annualized cost ^a
<u>Cost Effectiveness (\$/ton NO_x)</u>	6,802	Total annual costs divided by tons NO _x removed ^a

Note: All calculations rounded to the nearest \$100.

kW = kilowatt.
 kWh = kilowatt-hour.
 kWh/hr = kilowatt-hour per hour.
 MM/Btu = million British thermal units.
 NH₃ = ammonia.
 NO_x = nitrogen oxides.
 O&M = operation and maintenance.

Footnotes for Table B-5

Note: all calculations rounded to nearest 100

a. Engineering Estimate:

$$24 \text{ hours/week} \times 52 \text{ weeks/year} \times \$25/\text{hour} = \$31,200$$

b. Delivered cost of ammonia at \$330/ton

$$656 \text{ TPY removed} \times \$330 \times 17/46 \text{ (molecular weight of ammonia to NO}_x\text{)} \times 1.1 = 88,000$$

c. $80 \text{ hours/yr} \times \$75 \times 1.35 = \$8,100$

d. Required to purchase and store 1/3 of a catalyst for replacement or required.

$$\$2,210,200 \times 0.1174 \text{ (20 years @ 10 percent)} \div 3 = \$86,500$$

e. Estimated as \$28/1,000 lb mass flow; based on catalyst volume.

$$\$28/1,000 \text{ lb mass flow} \times 3,683.6 \times 10^3 \text{ lb/hr} \times 2 \text{ CTs} \div 3 = \$68,800$$

Table B-5. Annualized Cost for Selective Catalytic Reduction (SCR) (Page 3 of 3)

Footnotes for Table B-5

- f. OAQPS cost control manual background documents
 $0.15 \times (\$31,200 + \$88,000 + \$8,100 + \$86,500 + \$78,400 + 68,800) = \$54,200$
- g. 80 kWh/hr/CT from SCR manufacturer; \$0.05/kWh is cost of estimated energy:
 $80 \text{ kWh/hr/CT} \times \$8,760 \text{ hr/yr} \times \$0.08/\text{kWh} \times 2 \text{ CTs} = \$70,100$
- h. 4" back pressure from SCR manufacturer; 0.5 percent energy losses from general CT performance; 156.3 MW power rating at ISO (59°F) conditions.
 $156.3 \text{ MW} \times 0.005 \times 8,760 \text{ hrs/yr} \times 1,000 \text{ kW/mw} \times \$0.05/\text{kWh} \times 2 \text{ CTs} = \$684,600$
- i. 3 days required to change catalyst or maintenance; saving in gas usage subtracted
 $391 \text{ MW} \times 3 \text{ days} \times 24 \text{ hours} \times \$0.05/\text{kWh} \times 1,000 \text{ mwh} - (1,677 \times 10^6 \text{ Btu/hr} \times 3 \text{ days} \times 24 \text{ hours} \times \$3/10^6 \text{ Btu}) = \$803,000$
- j. Escalation of fuel costs over inflation; 3 percent over 20 years; factor calculated as 0.454565; applies to electrical and heat rate costs only:
 $0.454565 \times (\$70,100 + \$684,600) = \$343,000$
- k. OAQPS cost control manual background documents
 $0.15 \times (\$70,100 + \$684,600 + \$803,000) = \$233,700$
- l. $0.6 (\$88,000 + 1.15 \times \$31,200) + 0.15 \times \$31,200 = \$79,000$
- m. From OAQPS cost control manual
 $0.02 \times (\$6,105,700 + \$2,541,700) = \$172,900$
- n. Total direct annual costs plus total indirect annual costs:
 $\$2,471,100 + \$1,991,100 = \$4,462,200$
- o. Cost effectiveness is total annual costs divided by the tons removed
 $\$4,462,200 \div 656 = \$6,802/\text{ton of NO}_x \text{ removed}$

Tons removed: Gas = 195 TPY at 5,260 hours/year operation
15 ppm to 9 ppm

Oil = 300 TPY at 1,500 hours/year operation
42 ppm to 15 ppm

Gas with Power
Augmentation = 161 TPY at 2,000 hours/year operation
25 ppm to 9 ppm

Table B-5. Summary of BACT Determinations for CO Emissions from Gas-fired Turbines (Page 1 of 3)

Facility Name	State	Permit Issue Date	Unit/Process Description	Capacity (Size)	CO Emission Limit				Control Method	Efficiency (%)
					(lb/MMBtu)	(lb/hr)	(TPY)	(ppmvd basis)		
Florida Power Corp.	FL	Nov-93	Combustion turbines (2)	2346 MMBtu/hr (oil)	--	77/93	675/47	25 (gas) / 30 (oil)	Proper Combustion	--
Tampa Electric Co.	FL	Nov-93	Combustion turbine (1)	1907 MMBtu/hr (oil)	--	99/99	434/86.7	25 (gas) / 30 (oil)	Proper Combustion	--
Tiger Bay Cogen	FL	May-93	GE FA	206 MW	--	48.8	213.7	15 @ 15% O ₂	Proper Combustion	--
Central Florida Cogen	FL	Nov-92	GE EA	126 MW	--	42.9	187.8	20 @ 15% O ₂	Efficient Combustion	--
Gordonsville Energy L.P.	VA	Sep-92	Gas Turbines (2)	1.51 X10(9) Btu/hr	--	57	--	--	Combustion	--
Gordonsville Energy L.P.	VA	Sep-92	Gas Turbine	1331.13 X10(7) SCF/Y	--	--	249.9	--	Combustion	--
University of Florida Cogen	FL	Aug-92	GE LM6000	43 MW	--	38.8	158	42 @ 15% O ₂	--	--
Bermuda Hundred NRG L.P.	VA	Mar-92	Combustion	1175 MMBtu/hr	--	62	--	--	Furnace Design	91.00
Bermuda Hundred Energy	VA	Mar-92	Gas Turbine	1175 MMBtu/hr	62	--	--	--	Furnace Design	--
Bermuda Hundred Energy	VA	Mar-92	Gas Turbine	1117 MMBtu/hr	62	--	--	--	Furnace Design	--
Lake Cogen Limited	FL	Nov-91	Gas Turbines (2)	42 MW	--	--	--	42 ppm @ 15% O ₂	Combustion	--
Lake Cogen	FL	Nov-91	Combined Cycle	120 MW	--	--	--	42	78 ppmvd for oil firing	--
Pasco Cogen	FL	Nov-91	Combined Cycle	120 MW	--	--	--	42	78 ppmvd for oil firing	--
Southern California Gas	CA	Oct-91	GT Solar Model H	47.64 MMBtu/hr	--	--	--	7.74 ppm @ 15% O ₂	High Temp Oxidation Catalyst	--
El Paso Natural Gas	AZ	Oct-91	GT Solar Centaur H	5500 HP	--	--	--	10.5 ppm @ 15% O ₂	Lean Fuel Mix	--
El Paso Natural Gas	AZ	Oct-91	GE Gas Turbine	12000 HP	--	--	--	60	Lean Burn	--
Florida Power Corporation	FL	Sep-91	Simple Cycle	552 MW	--	--	--	--	25 ppmvd for oil firing	--
Enron Louisiana Energy Co.	LA	Aug-91	Gas Turbines (2)	78.2 MMBtu/hr	--	5.8	--	60 @ 15% O ₂	Base Case, No additional Control--	--
Sumas Energy, Inc.	WA	Jun-91	Gas Turbine	80 MW	--	--	--	6 @ 15% O ₂	CO Catalyst	80.00
Florida P&L Co. (Martin)	FL	Jun-91	Combined Cycle	860 MW	--	--	--	30	33 ppmvd for oil firing	--
Northern Consolidated Power	PA	May-91	Gas Turbines (2)	34.6 KW each	--	--	110	--	Catalytic Oxidation	90.00
Hardee Power Station	FL	Dec-90	Combined Cycle	660 MW	--	--	--	10	26 ppmvd for oil firing	--
Newark Bay Cogeneration Partn.	NJ	Nov-90	Gas Turbine	50 MW	--	--	--	1.8 (gas) / 2.6 (kerosene) @ 15% O ₂	Catalytic Oxidation	--
March Point Cogen	WA	Oct-90	Turbine	80 MW	--	--	--	37 @ 15% O ₂	Combustion Control	--
Delmarva Power Corporation	DE	Sep-90	Combined Cycle	450 MW	--	--	--	15 ppm	Good Combustion	--
Doswell Limited Partnership	VA	May-90	Combustion	1261 MMBtu/hr	--	25	--	--	Combustion Design & Operation	--
Oneida Cogeneration Facility	NY	Feb-90	GE Frame 6	417 MMBtu/hr	--	--	--	40 ppm	Combustion	--
Fulton Cogeneration Associates	NY	Jan-90	GE LM5000	500 MMBtu/hr	0.02	--	--	--	Combustion	--
Arrowhead Cogeneration	VT	Dec-89	Gas Turbine	282 MMBtu/hr	--	--	--	50 @ ISO Cond & 12% O ₂	Design & Good Combustion Techniques--	--
JMC Selkirk, Inc.	NY	Nov-89	GE Frame 7	80 MW	--	--	--	25 ppm	Combustion Control	--

Table B-6. Summary of BACT Determinations for CO Emissions from Gas-fired Turbines (Page 2 of 3)

Facility Name	State	Permit Issue Date	Unit/Process Description	Capacity (Size)	CO Emission Limit				Control Method	Efficiency (%)
					(lb/MMBtu)	(lb/hr)	(TPY)	(ppmvd basis)		
Capitol District NRG Ctr	CT	Oct-89	Gas Turbine	738.8 MMBtu/hr	0.112	--	--	--	--	--
Panda-Rosemary Corp.	NC	Sep-89	GE Frame 7	1047 MMBtu/hr	--	23.1	--	--	Combustion	--
Panda-Rosemary Corp.	NC	Sep-89	GE Frame 6	499 MMBtu/hr	0.022	10.8	--	--	Combustion Control	--
Kamine Syracuse Cogeneration Co.	NY	Sep-89	Gas Turbine	79 MW	0.028	--	--	--	Combustion	--
Syracuse University	NY	Sep-89	Gas Turbine	79 MW	0.17	--	--	--	Catalytic Oxidation	--
Kamine Syracuse Cogeneration Co.	NY	Sep-89	Gas Turbine	79 MW	0.028	--	--	--	Combustion Control	--
Sayreville Cogeneration	NJ	May-89	Gas Turbine	100 MW	--	--	--	25 @ 15% O ₂	Combustion Control	--
Tropicana Products, Inc.	FL	May-89	Gas Turbine	45.4 MW	--	--	--	10 @ 15% O ₂	--	--
Empire Energy - Niagara Cogen	NY	May-89	GR Frame 6 (3)	1248 MMBtu/hr	0.024	--	--	--	Combustion Control	--
Megan-Racine Associates, Inc.	NY	Mar-89	GE LM5000	430 MMBtu/hr	0.026	--	--	--	Combustion	--
Megan-Racine Assoc.	NY	Mar-89	GE LM5000	430 MMBtu/hr	0.026	--	--	--	Combustion Control	--
Indec/Oswego Hill Cogen	NY	Feb-89	GE Frame 6	40 MW	0.022	--	--	--	--	--
Bellingham Cogeneration	MA	Feb-89	Combustion Turbine	100 MW	--	--	--	25 (gas) / 150 (oil) @ 15% O ₂	Combustion Control	--
Pawtucket Power	RI	Jan-89	Turbine	58 MW	--	--	--	23 @ 15% O ₂	--	--
Ocean State Power	RI	Jan-89	Combined Cycle	500 MW	--	--	--	25 @ 15% O ₂	--	--
Champion International	AL	Nov-88	Gas Turbine	35 MW	--	9	--	--	--	--
Long Island Lighting Co.	NY	Nov-88	Peaking Units (3)	75 MW	--	--	--	10 ppm	Combustion Control	--
Amtrak	PA	Oct-88	Turbine (2)	20 MW	--	30.76	--	--	--	--
Kamine South Glens Falls	NY	Sep-88	GE Frame 6	40 MW	0.021	--	--	--	Combustion Control	--
Orlando Utilities	FL	Sep-88	Gas Turbines (2)	35 MW	--	--	--	10 @ 15% O ₂	Combustion Control	--
Delmarva Power Corporation	DE	Aug-88	Turbines (2)	200 MW	--	--	--	15 ppm	Good Combustion	--
Kamine Carthage	NY	Jul-88	GE Frame 6	40 MW	0.022	--	--	--	Combustion Control	--
ADA Cogeneration	MI	Jun-88	Turbine	245 MMBtu/hr	0.1	--	--	--	Water Injection	--
CCF-1 Jefferson Station	CT	May-88	Gas Turbines (2)	110 MMBtu/hr	0.605	--	--	--	--	--
TBG/Grumman	NY	Mar-88	Gas Turbine	16 MW	0.181	--	--	--	CO Catalyst	--
Midland Cogeneration Venture	MI	Feb-88	Turbines (12)	984.2 MMBtu/hr	--	26	--	--	Turbine Design	--
Midway-Sunset Cogen	CA	Jan-88	GE Frame 7 (3)	75 MW	--	94	--	--	Proper Combustion	--
Downtown Cogeneration Assoc.	LA	Aug-87	Gas Turbine	71.9 MMBtu/hr	0.048	--	--	--	--	--
San Joaquin Cogen Limited	CA	Jun-87	Gas Turbine	48.6 MW	--	55.25	--	55 @ 15% O ₂	Combustion Control	--
Cogen Technologies	NJ	Jun-87	GE Frame 6 (3)	40 MW	--	--	--	50 @ 15% O ₂	--	--
Pacific Gas Transmission	OR	May-87	Gas Turbine	14000 HP	--	6	25	--	--	--
Alaska Elect. Gen. & Trans.	AK	Mar-87	Gas Turbine	80 MW	--	--	--	109 lb/scf fuel	Water Injection	--

Table B-6. Summary of BACT Determinations for CO Emissions from Gas-fired Turbines (Page 3 of 3)

Facility Name	State	Permit	Unit/Process Description	Capacity (Size)	CO Emission Limit				Control Method	Efficiency (%)
		Issue Date			(lb/MMBtu)	(lb/hr)	(TPY)	(ppmvd basis)		
Sycamore Cogen	CA	Mar-87	Gas Turbine	75 MW	--	--	--	10 @ 15% O ₂	CO Catalyst & Comb. Control	--
PG&E, Station T	CA	Aug-86	GE LMS000	396 MMBtu/hr	--	--	--	--	CO Catalyst (No limit indicated)	--
Formosa Plastic Corp.	TX	May-86	GE MS 6001	38.4 MW	--	--	32.4	--	--	--

Table B-7. Capital and Annualized Cost for Oxidation Catalyst

Cost Component	Cost (\$)	Basis
I. CAPITAL COSTS		
A. DIRECT:		
1. Associated Equipment for Catalyst	287,330	Manufacture Estimate - \$260 per lb/hr mass flow; 15% for equipment Engineering Estimate 25% of Equipment Costs (I.A.1. & 2., and II.A.)
2. Exhaust Modification	150,000	
3. Installation	516,380	
B. INDIRECT:		
1. Engineering & Supervision	154,910	7.5% of Equipment Costs (I.A.1. & 2., and II.A.)
2. Construction and Field Expense	206,550	10% of Equipment Costs (I.A.1. & 2., and II.A.)
3. Construction Contractor Fee	103,280	5% of Equipment Costs (I.A.1. & 2., and II.A.)
4. Startup & Testing	41,310	2% of Equipment Costs (I.A.1. & 2., and II.A.)
5. Contingency	218,960	15% of Direct and Indirect Capital Costs (I.A. and I.B.1-4)
6. Interest During Construction	496,040	15% of Direct and Indirect Capital Costs, and Recurring Capital Costs (I.A., I.B.1.-4 and II.A.)
TOTAL CAPITAL COSTS	2,174,770	Sum of Direct and Indirect Capital Costs
ANNUALIZED CAPITAL COSTS	255,450	Capital Recovery of 10% over 20 years
II. RECURRING CAPITAL COSTS		
A. Catalyst	1,628,200	Manufacture's Estimate - \$260 per lb/hr mass flow; 85% of catalyst 15% of Recurring Capital Costs (II.A.)
B. Contingency	244,230	
TOTAL RECURRING CAPITAL COSTS	1,872,430	Sum of Recurring Capital Costs
ANNUALIZED RECURRING CAPITAL COSTS	752,930	Capital Recovery of 10% over 20 years
III. ANNUALIZED COST		
A. DIRECT:		
1. Labor - Operator & Supervisor	11,960	4 hours/week, 52 weeks/year, \$25/hour and 15% supervisor cost 0.5% of Total and Recurring Capital Costs Capital Carrying cost (10% over 20 years) for catalyst for 1 CT
2. Maintenance	20,240	
3. Inventory Cost	63,750	
B. ENERGY COSTS		
1. Heat Rate Penalty	273,840	0.2% heat rate penalty. \$50/MW energy loss Loss of 391 MW for one day; cost of natural gas at \$3/10 ⁶ Btu deducted from cost Fuel escalation of 3% over inflation; annualized over 20 years 25% of energy costs
2. MW Loss Penalty (catalyst changeout)	227,410	
3. Fuel Escalation Costs	124,490	
4. Contingency	93,860	
C. INDIRECT:		
1. Overhead	19,320	60% of Labor and Maintenance Costs (III.A.1. and 2.)
2. Property Taxes	40,470	1% of Total and Recurring Capital Cost
3. Insurance	40,470	1% of Total and Recurring Capital Cost
4. Administration	80,940	2% of Total and Recurring Capital Cost
Annualized Capital Costs	255,450	
Annualized Recurring Capital Costs	752,930	
TOTAL ANNUALIZED COSTS	2,005,120	Sum of Operating and Maintenance and Annualized Capital Costs
Cost Effectiveness (\$/ton CO removed)	3,982	Total annualized cost divided by CO removal (504 TPY; gas at 5,260 hours (176 TPY removed), oil at 1,500 hours (77 TPY removed), and power augmentation at 2,000 hours (251 TPY removed))

Note: All calculations using machine performance were based on 59°F conditions.
Assumptions based on percentage of costs were adapted from EPA OAQPS Control Cost Manual (1990).

ATTACHMENT C

AAQS SO₂ AND PM EMISSION INVENTORIES OF MODELED SOURCES

Table C-1. Summary of Individual Source Emission and Operating Parameters for the SO₂ AAQS Modeling Analysis

APIS Number	Facility Name	Facility Location UTM E,N (km)		APIS Src #	Stack Height		Stack Diam.		Exit Velocity		Temperature		Maximum SO2 Emissions		
		Relative X,Y (m) ^a			(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(°F)	(K)	(lb/hr)	(TPY)	(g/s)
40HIL290008	Cargill/Gardiner Fertilizer Riverview	363.4	3082.4	04	149.6	45.6	7.5	2.29	41.5	12.64	152	340.0	366.7	1606	46.20
		-41600	24700	05	149.6	45.6	8.0	2.44	43.9	13.38	151	339.0	416.7	1825	52.50
				06 ^b	149.6	45.6	9.0	2.74	41.5	12.66	170	350.0	533.3	2336	67.20
				41	40.0	12.2	1.7	0.51	30.4	9.28	120	322.0	1.3	6	0.16
				55	132.5	40.4	7.0	2.13	52.8	16.09	115	319.0	7.6	33	0.96
				--	126.0	38.4	8.0	2.44	40.5	12.35	125	325.0	15.1	66	1.90
												TOTAL	1340.6	5872	168.92
40TPA530046	Cargill/Seminole Fertilizer Bartow	409.8	3087.0	21	132.0	40.2	7.0	2.13	86.6	26.40	110	316.3	0.5	2	0.06
		4800	29300	12,32,33 ^b	200.0	61.0	6.8	2.06	62.0	18.90	180	355.4	1141.0	4998	143.77
												TOTAL	1141.5	5000	143.83
40TPA530052	C.F. Industries Bartow Bonnie Mine Rd	408.4	3082.4	05 ^b	206.0	62.8	7.0	2.13	35.7	10.88	190	361.0	400.0	1752	50.40
		3400	24700	06 ^b	206.0	62.8	7.0	2.13	23.9	7.28	206	370.0	400.0	1752	50.40
				--	36.0	11.0	2.5	0.76	44.1	13.45	600	588.6	4.1	18	0.52
				-- ^b	220.1	67.1	8.5	2.59	32.4	9.87	172	351.0	333.3	1460	42.00
												TOTAL	1137.5	4982	143.32
40HIL290075	Consolidated Minerals Plant City	393.8	3096.3	20	20.0	6.1	1.2	0.37	66.3	20.21	630	605.4	1.0	4	0.13
		-11200	38600	22	152.0	46.3	5.8	1.77	39.8	12.13	80	299.8	91.8	402	11.57
				24	152.0	46.3	5.8	1.77	36.6	11.16	72	295.4	91.8	402	11.57
												TOTAL	184.6	809	23.26
40TPA530053	Farmland Industries Green Bay Plant	409.5	3079.5	03,04 ^b	100.0	30.5	7.5	2.29	30.4	9.27	179	355.0	533.0	2335	67.16
		4500	21800	05 ^b	150.0	45.7	8.0	2.44	38.0	11.58	180	355.4	400.0	1752	50.40
												TOTAL	933.0	4087	117.56
40PNL520011	FPC - Bartow	342.4	3082.6	01	300.0	91.4	9.0	2.74	119.0	36.27	312	428.7	3558.0	15584	448.31
		-62600	24900	02	300.0	91.4	9.0	2.74	102.0	31.09	305	424.8	3558.0	15584	448.31
				03	300.0	91.4	11.0	3.35	113.0	34.44	275	408.2	5635.0	24681	710.01
				04	30.0	9.1	3.0	0.91	17.0	5.18	515	541.5	14.4	63	1.81
				05	45.0	13.7	17.3	5.27	73.0	22.25	930	772.0	569.2	2493	71.72
				06	45.0	13.7	17.3	5.27	73.0	22.25	930	772.0	569.2	2493	71.72
				08	45.0	13.7	17.3	5.27	73.0	22.25	930	772.0	392.5	1719	49.46
												TOTAL	14296.3	62618	1801.33
40PNL520012	FPC - Higgins	336.5	3098.4	01	173.7	52.9	12.5	3.81	30.0	9.14	325	435.9	1496.0	6552	188.50
		-68500	40700	02	173.7	52.9	12.5	3.81	30.0	9.14	314	429.8	1375.0	6023	173.25
				03	173.7	52.9	12.5	3.81	22.0	6.71	302	423.2	1408.0	6167	177.41
				04	55.0	16.8	15.1	4.60	372.0	113.39	850	727.6	33.4	146	4.21
				05	55.0	16.8	15.1	4.60	372.0	113.39	850	727.6	44.7	196	5.63

Table C-1. Summary of Individual Source Emission and Operating Parameters for the SO₂ AAQS Modeling Analysis

APIS Number	Facility Name	Facility Location UTM E,N (km)		APIS Src. #	Stack Height		Stack Diam.		Exit Velocity		Temperature		Maximum SO2 Emissions		
		Relative X,Y (m) ^a			(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(°F)	(K)	(lb/hr)	(TPY)	(g/s)
				06	55.0	16.8	15.1	4.60	372.0	113.39	850	727.6	7.6	33	0.96
				07	53.0	16.2	15.1	4.60	372.0	113.39	850	727.6	114.6	502	14.44
												TOTAL	4479.3	19619	564.39
30ORL490014 FPC Intercession City		446.3	3126.0	01	20.0	6.1	14.6	4.46	175.0	53.34	760	677.6	361.7	1584	45.57
		41300	68300	02	20.0	6.1	14.6	4.46	175.0	53.34	760	677.6	361.7	1584	45.57
				03	20.0	6.1	14.6	4.46	175.0	53.34	760	677.6	361.7	1584	45.57
				04	20.0	6.1	14.6	4.46	175.0	53.34	760	677.6	361.7	1584	45.57
				05	20.0	6.1	14.6	4.46	175.0	53.34	760	677.6	361.7	1584	45.57
				06	20.0	6.1	14.6	4.46	175.0	53.34	760	677.6	361.7	1584	45.57
				07 ^b	50.0	15.2	13.8	4.21	184.4	56.21	1016	819.8	987.3	4324	124.40
				08 ^b	50.0	15.2	23.1	7.04	105.2	32.07	1126	880.8	876.2	3838	110.40
												TOTAL	4033.5	17667	508.22
NA	FPC Polk County Site	414.3	3073.9	-- ^b	113.0	34.4	13.5	4.11	133.0	40.54	260	400.0	98.0	429	12.35
		9300	16200	-- ^b	113.0	34.4	13.5	4.10	133.0	40.54	260	400.0	98.0	429	12.35
													TOTAL	196.0	859
40MAN410010FPL – Manatee		367.2	3054.1	01	475.0 ^c	144.8	26.2	7.99	56.0	17.07	307	425.9	9515.0	41676	1198.89
		-37800	-3600	02	475.0 ^c	144.8	26.2	7.99	56.0	17.07	307	425.9	9515.0	41676	1198.89
												TOTAL	19030.0	83351	2397.78
40TPA530044 Gardinier/Fort Meade		415.3	3063.3	01	63.0	19.2	9.5	2.90	23.0	7.01	62	290.0	267.9	1173	33.76
		10300	5600												
40HIL290057 Gulf Coast Lead		364.0	3093.5	01	150.0	45.7	2.0	0.61	123.3	37.59	160	344.3	384.2	1498	48.41
		-41000	35800												
40TPA530057 IMC Agrico/Conserve Nichols		398.4	3084.2	05 ^b	150.0	45.7	7.5	2.29	33.8	10.30	174	352.0	333.3	1460	42.00
		-6600	26500	12	81.0	24.7	7.5	2.29	12.4	3.78	130	327.6	26.5	116	3.34
				15	27.0	8.2	2.0	0.61	45.1	13.75	500	533.2	1.4	6	0.17
				16	39.0	11.9	3.2	0.98	29.2	8.90	500	533.2	2.6	11	0.33
												TOTAL	363.8	1593	45.83
40TPA530059 IMC Agrico– New Wales		396.6	3078.9	02 ^b	199.9	61.0	8.5	2.60	50.2	15.31	170	350.0	1500.0	6570	189.00
		-8400	21200	09	133.0	40.5	7.0	2.13	49.8	15.18	105	313.6	3.4	15	0.43
				13	95.0	29.0	5.6	1.71	56.1	17.10	556	564.1	569.4	2494	71.74
				27	172.0	52.4	7.9	2.40	43.0	13.10	127	326.0	1.6	7	0.20
				42 ^b	199.1	60.7	8.5	2.60	50.2	15.31	170	350.0	1000.0	4380	126.00
				44 ^b	120.0	36.6	6.0	1.83	66.1	20.15	115	319.1	44.0	193	5.54

Table C-1. Summary of Individual Source Emission and Operating Parameters for the SO₂ AAQS Modeling Analysis

APIS Number	Facility Name	Facility Location UTM E,N (km)		APIS Src #	Stack Height		Stack Diam.		Exit Velocity		Temperature		Maximum SO2 Emissions		
		Relative X,Y (m) ^a			(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(°F)	(K)	(lb/hr)	(TPY)	(g/s)
				45	171.0	52.1	6.0	1.83	58.9	17.97	110	316.3	21.9	96	2.76
				46 ^b	171.8	52.4	4.6	1.40	51.8	15.80	106	314.0	38.1	167	4.80
				TOTAL								3178.3	13921	400.47	
40TPA530027 IMC Agrico --Noralyn Mine		414.7 3080.3 9700 22600		01	76.0	23.2	6.5	1.98	56.8	17.30	250	394.0	9.8	43	1.24
				02	55.0	16.8	9.3	2.83	28.9	8.82	154	341.0	105.6	462	13.30
				TOTAL								115.4	505	14.54	
40TPA530055 IMC Agrico --S. Pierce		407.5 3071.3 2500 13600		01	35.0	10.7	4.8	1.46	51.7	15.76	430	494.3	63.5	278	8.00
				04 ^b	150.0	45.7	5.2	1.60	128.1	39.06	170	350.0	450.4	1973	56.75
				05 ^b	150.0	45.7	5.2	1.60	128.1	39.06	160	350.0	450.4	1973	56.75
				10 ^b	125.0	38.1	10.2	3.10	47.9	14.60	130	328.0	35.0	153	4.41
				TOTAL								999.3	4377	125.91	
40TPA530080 Imperial Phosphate		404.8 3069.5 -200 11800		01	90.0	27.4	5.0	1.52	67.0	20.42	140	333.0	54.8	240	6.90
				02	90.0	27.4	2.0	0.61	23.0	7.01	430	494.0	8.0	35	1.01
				TOTAL								62.8	275	7.91	
40HIL290018 Lafarge Corp.		357.7 3090.6 -47300 32900	29	146.0	44.5	8.0	2.44	132.0	40.24	431	494.8	4633.0	20293	583.76	
40TPA530003 Lakeland City Power Larsen		409.2 3102.8 4200 45100		01	165.0	50.3	10.0	3.05	18.0	5.49	320	433.0	740.5	3243	93.3
				02	165.0	50.3	10.0	3.05	21.0	6.40	340	444.0	3.2	14	0.4
				03	165.0	50.3	10.0	3.05	21.0	6.40	340	444.0	22.2	97	2.8
				04	165.0	50.3	10.0	3.05	22.0	6.71	340	444.0	148.4	650	18.7
				06	32.0	9.8	5.0	1.52	561.9	171.30	800	700.0	1.6	7	0.2
				07	32.0	9.8	5.0	1.52	561.9	171.30	800	700.0	0.08	0.3	0.01
				-- ^b	100.0	30.5	19.0	5.79	92.6	28.22	950	783.2	231.0	1012	29.11
				TOTAL								1147.0	5024	144.52	
40TPA530004 Lakeland City Power McIntosh		408.5 3105.8 3500 48100		01	150.0	45.7	9.0	2.74	78.0	23.77	295	419.3	2797.9	12255	352.54
				02	20.0	6.1	2.6	0.79	77.0	23.47	715	652.6	11.6	51	1.47
				03	20.0	6.1	2.6	0.79	77.0	23.47	715	652.6	11.6	51	1.46
				04	36.0	11.0	9.2	2.80	1.0	0.30	965	791.5	66.0	289	8.32
				05	156.0	47.6	10.4	3.17	69.0	21.03	265	402.6	203.7	892	25.67
				06 ^b	250.0	76.2	16.0	4.88	107.0	32.61	170	350.0	3888.0	17029	500.10
TOTAL								6978.8	30567	889.55					
40TPA530047 Mobil Mining Nichols		398.4 3085.3 -6600 27600		01	80.0	24.4	7.5	2.29	41.5	12.65	160	344.3	255.5	1119	32.20
				02	80.0	24.4	7.5	2.29	41.5	12.65	160	344.3	251.0	1099	31.63

Table C-1. Summary of Individual Source Emission and Operating Parameters for the SO₂ AAQS Modeling Analysis

APIS Number	Facility Name	Facility Location UTM E,N (km)		APIS Src #	Stack Height		Stack Diam.		Exit Velocity		Temperature		Maximum SO2 Emissions												
		Relative X,Y (m) ^a			(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(°F)	(K)	(lb/hr)	(TPY)	(g/s)										
40HIL290102	Mobil Mining Big Four Mine (AMAX)	394.85 3069.77 -10150 12070	01	^b	100.0	30.5	6.0	1.82	23.8	7.26	141	333.7	129.8	85	2.44										
														525.9	2304	66.27									
														TOTAL	568	16.35									
NA	Mulberry Cogeneration	413.6 3080.6 8600 22900	--	^b	125.0	38.1	15.0	4.57	61.9	18.87	219	377.0	100.8	441	12.70										
														5.2	23	0.65									
														TOTAL	106.0	464	13.35								
40TPA530048	Mulberry Phosphates (Royster)	406.8 3085.1 1800 27400	02	^b	200.0	61.0	7.0	2.13	32.5	9.90	200	366.5	283.3	1241	35.70										
														05	102.0	31.1	8.8	2.68	26.8	8.17	110	316.5	73.8	323	9.30
														09	45.0	13.7	3.7	1.13	8.4	2.56	80	299.8	102.4	449	12.91
40HIL290039	TECO – Big Bend ^d	361.9 3075.0 -43100 17300	01,02		490.0	149.4	24.0	7.32	94.0	28.65	300	422.0	42000.0	--	5292.00										
														33333.4	146000	--									
			03		490.0	149.4	24.0	7.32	47.0	14.33	292	417.6	21000.0	--	2646.00										
														16666.7	73000	--									
			04	^b	490.0	149.4	24.0	7.32	65.0	19.81	156	342.2	5190.0	15552	653.94										
														329.8	1445	41.55									
			05		75.0	22.9	14.0	4.27	26.8	8.17	928	770.9	329.8	1445	41.55										
														329.8	1445	41.55									
			06		75.0	22.9	14.0	4.27	26.8	8.17	928	770.9	329.8	1445	41.55										
														329.8	1445	41.55									
07		35.0	10.7	10.4	3.17	18.2	5.55	1010	816.5	94.2	413	11.87													
											TOTAL	68943.8	237854	8686.92											
40HIL290040	TECO – Gannon ^e	360.0 3087.5 -45000 29800	01		306.0	93.3	10.4	3.17	79.0	24.08	309	427.0	3017.0	--	380.14										
														--	9669	--									
			02		306.0	93.3	10.4	3.17	79.0	24.08	309	427.0	3017.0	--	380.14										
														--	9669	--									
			03		306.0	93.3	11.0	3.35	99.0	30.18	300	422.0	3838.0	--	483.59										
														--	12301	--									
			04		306.0	93.3	10.0	3.05	72.0	21.95	329	438.2	4502.0	--	567.25										
														--	14429	--									
05		306.0	93.3	10.8	3.29	123.7	37.70	288	415.4	5482.0	--	690.73													
											--	17570	--												
06		306.0	93.3	17.5	5.33	77.0	23.47	292	417.6	9115.0	--	1148.49													
											--	29214	--												
07		35.0	10.7	11.0	3.35	16.4	5.00	1010	816.5	94.4	413	11.89													
											--	--	--												

Table C-1. Summary of Individual Source Emission and Operating Parameters for the SO₂ AAQS Modeling Analysis

APIS Number	Facility Name	Facility Location UTM E,N (km)		APIS Src #	Stack Height		Stack Diam.		Exit Velocity		Temperature		Maximum SO2 Emissions			
		Relative X,Y (m) ^a			(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(°F)	(K)	(lb/hr)	(TPY)	(g/s)	
												TOTAL	29065.4	93265	3662.2	
40HIL290038	TECO – Hookers Point	358.0	3091.0	01	280.0	85.3	11.3	3.44	20.0	6.10	295	419.3	328.0	1437	41.33	
		-47000	33300	02	280.0	85.3	11.3	3.44	18.0	5.49	329	438.2	328.0	1437	41.33	
				03	280.0	85.3	12.0	3.66	26.0	7.93	322	434.3	452.7	1983	57.05	
				04	280.0	85.3	12.0	3.66	24.0	7.32	300	422.0	452.0	1980	56.95	
				05	280.0	85.3	11.3	3.44	36.0	10.98	347	448.2	671.0	2939	84.55	
				06	280.0	85.3	9.4	2.87	73.0	22.26	322	434.3	856.0	3749	107.86	
											TOTAL	3087.7	13524	389.06		
NA	TECO – Polk Power Station	402.50	3067.35	--	^b	20.0	6.1	3.0	0.90	43.0	13.10	500	533.0	2.6	11	0.33
		-2500	9650	--	^b	150.0	45.7	19.0	5.80	55.1	16.79	260	400.0	394.2	1727	49.67
				--	^b	199.0	60.7	3.5	1.07	30.0	9.14	1400	1033.0	62.1	272	7.82
												TOTAL	458.9	2010	57.82	
40TPA250015	TPS – Hardee Power Station (295 MW)	404.8	3057.3	01	^b	90.0	27.4	14.5	4.42	80.0	24.38	253	396.0	734.4	804 ^f	92.53
		-200	-400	02	^b	90.0	27.4	14.5	4.42	80.0	24.38	253	396.0	734.4	804 ^f	92.53
				03	^b	75.1	22.9	16.0	4.88	103.0	31.39	953	785.0	734.4	804 ^f	92.53
													2203.1	2412	277.59	
40TPA530051	US AgriChem – Fort Meade	416.0	3069.0	06		70.0	21.3	3.7	1.13	49.1	14.97	400	477.6	51.0	224	6.43
		11000	11300	16	^b	175.0	53.4	8.5	2.59	32.9	10.04	180	355.4	367.0	1607	46.24
				17	^b	175.0	53.4	8.5	2.59	32.9	10.04	180	355.4	367.0	1607	46.24
												TOTAL	785.0	3438	98.91	

Notes:

^a Location relative to the Proposed Hardee Unit 3 (East, North UTM location (km) are 405.0, 3057.7)

^b SO₂ PSD increment consuming source

^c GEP stack ht. Actual stack height is 499 feet.

^d TECO Big Bend units 1,2,3 are subject to a 3-hour limit of 31.5 tons per hour for all 3 units, and a 24-hour and annual limit of 25 tons per hour for all 3 units. The higher rate is applicable for the 3-hour impacts. Maximum impacts were predicted using the maximum emission rate, lb/hr.

^e TECO Gannon Units 1 through 6 have short term and annual emission rates. Maximum impacts were predicted using the maximum emission rate, lb/hr.

^f TPS Hardee is limited to 25% annual capacity by permit. The TPY reflects 25% of hourly emission rate over the entire year.

Table C-2. Summary of Modeling Parameters for the SO2 AAQS Modeling Analysis.

APIS Number	Facility Name	Facility Location Relative X,Y (m)		ISCST ID	APIS Src #	Stack Height		Stack Diam.		Exit Velocity		Temperature		Maximum SO2 Emissions (g/s)
						(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(°F)	(K)	
40HIL290008	Cargill/Gardiner Fertilizer Riverview	-41600	24700	CGRIV04	04	149.6	45.6	7.5	2.29	41.5	12.64	152	340.0	46.20
				CGRIV05	05	149.6	45.6	8.0	2.44	43.9	13.38	151	339.0	52.50
				CGRIV06	^a 06	149.6	45.6	9.0	2.74	41.5	12.66	170	350.0	67.20
				CGRIV41	41	40.0	12.2	1.7	0.51	30.4	9.28	120	322.0	0.16
				CGRIV55	55	132.5	40.4	7.0	2.13	52.8	16.09	115	319.0	0.96
				CGRIVAA	--	126.0	38.4	8.0	2.44	40.5	12.35	125	325.0	1.90
40TPA530046	Cargill/Seminole Fertilizer	4800	29300	CGBRT21	21	132.0	40.2	7.0	2.13	86.6	26.40	110	316.5	0.06
				CGBRTC3	^a 12,32,33	200.0	61.0	6.8	2.06	62.0	18.90	179	355.0	143.77
40TPA530052	C.F. Industries Bartow Bonnie Mine Rd	3400	24700	CFBON05	^a 05	206.0	62.8	7.0	2.13	35.7	10.88	190	361.0	50.40
				CFBON06	^a 06	206.0	62.8	7.0	2.13	23.9	7.28	206	370.0	50.40
				CFBONAA	--	36.0	11.0	2.5	0.76	44.1	13.45	600	588.6	0.52
				CFBONAB	^a --	220.1	67.1	8.5	2.59	32.4	9.87	172	351.0	42.00
				CFBONAC	^a --	119.4	36.4	7.0	2.13	52.9	16.11	151	339.0	3.97
40HIL290075	Consolidated Minerals Plant City	-11200	38600	CONMN20	20	20.0	6.1	1.2	0.37	66.3	20.21	630	605.4	0.13
					22	152.0	46.3	5.8	1.77	39.8	12.13	80	299.8	11.57
					24	152.0	46.3	5.8	1.77	36.6	11.16	72	295.4	11.57
		-11200	38600	CONMNC2	22,24	152.0	46.3	5.8	1.77	36.6	11.16	72	295.4	23.14
40TPA530053	Farmland Industries Green Bay Plant	4500	21800	FARMLC2	^a 03,04	100.0	30.5	7.5	2.29	30.4	9.27	179	355.0	67.16
				FARML05	^a 05	150.0	45.7	8.0	2.44	38.0	11.58	179	355.0	50.40
40PNL520011	FPC - Bartow				01	300.0	91.4	9.0	2.74	119.0	36.27	312	428.7	448.31
					02	300.0	91.4	9.0	2.74	102.0	31.09	305	424.8	448.31
		-62600	24900	FPCBTC2A	01,02	300.0	91.4	9.0	2.74	102.0	31.09	305	424.82	896.62
				FPCBT03	03	300.0	91.4	11.0	3.35	113.0	34.44	275	408.2	710.01
				FPCBT04	04	30.0	9.1	3.0	0.91	17.0	5.18	515	541.5	1.81
					05	45.0	13.7	17.3	5.27	73.0	22.25	930	772.0	71.72
					06	45.0	13.7	17.3	5.27	73.0	22.25	930	772.0	71.72
					08	45.0	13.7	17.3	5.27	73.0	22.25	930	772.0	49.46
		-62600	24900	FPCBTC3B	05,06,08	45.0	13.7	17.3	5.27	73.0	22.25	930	772.0	192.89

Table C-2. Summary of Modeling Parameters for the SO2 AAQS Modeling Analysis.

APIS Number	Facility Name	Facility Location Relative X,Y (m)		ISCST ID	APIS Src #	Stack Height		Stack Diam.		Exit Velocity		Temperature		Maximum SO2 Emissions (g/s)
						(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(°F)	(K)	
40PNL520012	FPC – Higgins				01	173.7	52.9	12.5	3.81	30.0	9.14	325	435.9	188.50
					02	173.7	52.9	12.5	3.81	30.0	9.14	314	429.8	173.25
		–68500	40700	FPOCHG02	01,02	173.7	52.9	12.5	3.81	30.0	9.14	314	429.8	361.75
		–68500	40700	FPOCHG03	03	173.7	52.9	12.5	3.81	22.0	6.71	302	423.2	177.41
					04	55.0	16.8	15.1	4.60	372.0	113.39	850	727.6	4.21
					05	55.0	16.8	15.1	4.60	372.0	113.39	850	727.6	5.63
					06	55.0	16.8	15.1	4.60	372.0	113.39	850	727.6	0.96
		–68500	40700	FPOCHG03	04,05,06	55.0	16.8	15.1	4.60	372.0	113.39	850	727.6	10.80
		–68500	40700	FPOCHG07	07	53.0	16.2	15.1	4.60	372.0	113.39	850	727.6	14.44
		30ORL490014	FPC Intercession City		01	20.0	6.1	14.6	4.46	175.0	53.34	760	677.6	45.57
					02	20.0	6.1	14.6	4.46	175.0	53.34	760	677.6	45.57
					03	20.0	6.1	14.6	4.46	175.0	53.34	760	677.6	45.57
	04			20.0	6.1	14.6	4.46	175.0	53.34	760	677.6	45.57		
	05			20.0	6.1	14.6	4.46	175.0	53.34	760	677.6	45.57		
	06			20.0	6.1	14.6	4.46	175.0	53.34	760	677.6	45.57		
	41300	68300	FPCINC6	01–06	20.0	6.1	14.6	4.46	175.0	53.34	760	677.6	273.42	
	41300	68300	FPCIN07	^a 07	50.0	15.2	13.8	4.21	184.4	56.21	1016	819.8	124.40	
		FPCIN08	^a 08	50.0	15.2	23.1	7.04	105.2	32.07	1126	880.8	110.40		
NA	FPC Polk County Site		--	113.0	34.4	13.5	4.11	133.0	40.54	260	400.0	12.35		
			--	113.0	34.4	13.5	4.11	133.0	40.54	260	400.0	12.35		
		9300	16200	FPCPKC2	^a --	113.0	34.4	13.5	4.11	133.0	40.54	260	400.0	24.70
40MAN410010	FPL – Manatee		01	475.0	144.8	26.2	8.00	56.0	17.07	307	425.9	1198.89		
			02	475.0	144.8	26.2	8.00	56.0	17.07	307	425.9	1198.89		
		–37800	–3600	FPLMNC2	01,02	475.0	144.8	26.2	8.00	56.0	17.07	307	425.9	2397.78

Table C-2. Summary of Modeling Parameters for the SO2 AAQS Modeling Analysis.

APIS Number	Facility Name	Facility Location Relative X,Y (m)		ISCST ID	APIS Src #	Stack Height		Stack Diam.		Exit Velocity		Temperature		Maximum SO2 Emissions (g/s)				
						(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(°F)	(K)					
40TPA530044	Gardinier/Fort Meade	10300	5600	GARDN01	01	63.0	19.2	9.5	2.90	23.0	7.01	62	290.0	33.76				
40HIL290057	Gulf Coast Lead	-41000	35800	GLEAD01	01	150.0	45.7	2.0	0.61	123.3	37.59	160	344.3	48.41				
40TPA530057	IMC Agrico/Conserve Nichols	-6600	26500	IANIC05	^a 05	150.0	45.7	7.5	2.29	33.8	10.30	174	352.0	42.00				
				IANIC12	12	81.0	24.7	7.5	2.29	12.4	3.78	130	327.6	3.34				
				IANIC15	15	27.0	8.2	2.0	0.61	45.1	13.75	500	533.2	0.17				
				IANIC16	16	39.0	11.9	3.2	0.98	29.2	8.90	500	533.2	0.32				
40TPA530059	IMC Agrico-- New Wales			02		199.9	61.0	8.5	2.60	50.2	15.31	170	350.0	189.00				
				42		199.1	60.7	8.5	2.60	50.2	15.31	170	350.0	126.00				
				-8400	21200	IAWALC2	^a 02,42	199.1	60.7	8.5	2.60	50.2	15.31	170	350.0	315.00		
						IAWAL09	09	133.0	40.5	7.0	2.13	49.8	15.18	105	313.6	0.43		
						IAWAL13	13	95.0	29.0	5.6	1.71	56.1	17.10	556	564.1	71.74		
						IAWAL27	^a 27	172.0	52.4	7.9	2.40	43.0	13.10	127	326.0	0.20		
						IAWAL44	^a 44	120.0	36.6	6.0	1.83	66.1	20.15	115	319.1	5.54		
						IAWAL45	45	171.0	52.1	6.0	1.83	58.9	17.97	110	316.3	2.76		
						IAWAL46	^a 46	171.8	52.4	4.6	1.40	51.8	15.80	106	314.0	4.80		
				40TPA530027	IMC Agrico --Noralyn Mine	9700	22600	IANOR01	01	76.0	23.2	6.5	1.98	56.8	17.30	250	394.0	1.24
								IANOR02	02	55.0	16.8	9.3	2.83	28.9	8.82	154	341.0	13.30
				40TPA530055	IMC Agrico --S. Pierce	2500	13600	IASOU01	01	35.0	10.7	4.8	1.46	51.7	15.76	430	494.3	8.00
	04	150.0	45.7					5.2	1.60	128.1	39.06	170	350.0	56.75				
	05	150.0	45.7					5.2	1.60	128.1	39.06	170	350.0	56.75				
2500	13600	IASOUC2	^a 04,05					150.0	45.7	5.2	1.60	128.1	39.06	170	350.0	113.50		
2500	13600	IASOU10	^a 10					125.0	38.1	10.2	3.10	47.9	14.60	130	328.0	4.41		
40TPA530080	Imperial Phosphate	-200	11800	IMPRLO1	01	90.0	27.4	5.0	1.52	67.0	20.42	140	333.0	6.90				
				IMPRLO2	02	90.0	27.4	2.0	0.61	23.0	7.01	430	494.0	1.01				

Table C-2. Summary of Modeling Parameters for the SO2 AAQS Modeling Analysis.

APIS Number	Facility Name	Facility Location Relative X,Y (m)		ISCST ID	APIS Src #	Stack Height		Stack Diam.		Exit Velocity		Temperature		Maximum SO2 Emissions (g/s)
						(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(°F)	(K)	
40HIL290018	Lafarge Corp.	-47300	32900	LAFRG29	29	146.0	44.5	8.0	2.44	132.0	40.24	431	494.8	583.76
40TPA530003	Lakeland City Power Larsen	4200	45100	LAKLR01	01	165.0	50.3	10.0	3.05	18.0	5.49	320	433.0	93.30
					02	165.0	50.3	10.0	3.05	21.0	6.40	340	444.0	0.40
					03	165.0	50.3	10.0	3.05	21.0	6.40	340	444.0	2.80
					04	165.0	50.3	10.0	3.05	22.0	6.71	340	444.0	18.70
		4200	45100	LAKLRC3	02,03,04	165.0	50.3	10.0	3.05	21.0	6.40	340	444.0	21.90
					06	32.0	9.8	5.0	1.52	561.9	171.30	800	700.0	0.20
		07	32.0	9.8	5.0	1.52	561.9	171.30	800	700.0	0.01			
		4200	45100	LAKLRC2	06,07	32.0	9.8	5.0	1.52	561.9	171.30	800	700.0	0.21
		4200	45100	LAKLRAA	^a --	100.0	30.5	19.0	5.79	92.6	28.22	950	783.2	29.11
		40TPA530004	Lakeland City Power McIntosh	3500	48100	LAKMC01	01	150.0	45.7	9.0	2.74	78.0	23.77	295
02	20.0						6.1	2.6	0.79	77.0	23.47	715	652.6	1.47
03	20.0						6.1	2.6	0.79	77.0	23.47	715	652.6	1.46
LAKMCC2	02,03			20.0	6.1	2.6	0.79	77.0	23.47	715	652.6	2.93		
	LAKMC04			04	36.0	11.0	9.2	2.80	1.0	0.30	965	791.5	8.32	
	LAKMC05			05	156.0	47.6	10.4	3.17	69.0	21.03	265	402.6	25.67	
LAKMC06	^a 06			250.0	76.2	16.0	4.88	107.0	32.61	170	350.0	500.10		
40TPA530047	Mobil Mining & Minerals Nichols			-6600	27600	MBNICC2	01	80.0	24.4	7.5	2.29	41.5	12.65	160
		02	80.0				24.4	7.5	2.29	41.5	12.65	160	344.3	31.63
		MBNIC04	01,02	80.0	24.4	7.5	2.29	41.5	12.65	160	344.3	63.82		
			^a 04	85.0	25.9	7.5	2.29	52.8	16.10	150	338.7	2.44		
40HIL290102	Mobil Mining Big Four Mine (AMAX)	-10150	12070	MBL#401	^a 01	100.0	30.5	6.0	1.82	23.8	7.26	142	334.0	16.35
		-10200	10020	MBL#4AA	^a --	24.8	7.6	1.3	0.41	26.9	8.20	449	505.0	0.60

Table C-2. Summary of Modeling Parameters for the SO2 AAQS Modeling Analysis.

APIS Number	Facility Name	Facility Location Relative X,Y (m)		ISCST ID	APIS Src #	Stack Height		Stack Diam.		Exit Velocity		Temperature		Maximum SO2 Emissions (g/s)
						(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(°F)	(K)	
NA	Mulberry Cogeneration	8600	22900	MULCNAA	^a --	125.0	38.1	15.0	4.57	61.9	18.87	219	377.0	12.70
				MULCNAB	^a --	125.0	38.1	6.5	1.98	30.5	9.31	300	422.0	0.65
40TPA530048	Mulberry Phosphates (Royster)	1800	27400	MLPHS02	^a 02	200.0	61.0	7.0	2.13	32.5	9.90	200	366.5	35.70
				MLPHS05	05	102.0	31.1	8.8	2.68	26.8	8.17	110	316.5	9.30
				MLPHS09	09	45.0	13.7	3.7	1.13	8.4	2.56	80	299.8	12.91
40HIL290039	TECO - Big Bend	-43100	17300	TECBBC2A	01,02	490.0	149.4	24.0	7.32	94.0	28.65	300	422.0	5292.00
				TECBB03	03	490.0	149.4	24.0	7.32	47.0	14.33	292	417.6	2646.00
				TECBB04	^a 04	490.0	149.4	24.0	7.32	65.0	19.81	156	342.2	653.94
					05	75.0	22.9	14.0	4.27	26.8	8.17	928	770.9	41.55
					06	75.0	22.9	14.0	4.27	26.8	8.17	928	770.9	41.55
				TECBBC2B	05,06	75.0	22.9	14.0	4.27	26.8	8.17	928	770.9	83.11
				TECBB07	07	35.0	10.7	10.4	3.17	18.2	5.55	1010	816.5	11.87
40HIL290040	TECO - Gannon	-45000	29800		01	306.0	93.3	10.4	3.17	79.0	24.08	309	427.0	380.14
					02	306.0	93.3	10.4	3.17	79.0	24.08	309	427.0	380.14
				TECGNC2	01,02	306.0	93.3	10.4	3.17	79.0	24.08	309	427.0	760.28
				TECGN03	03	306.0	93.3	11.0	3.35	99.0	30.18	300	422.0	483.59
				TECGN04	04	306.0	93.3	10.0	3.05	72.0	21.95	329	438.2	567.25
				TECGN05	05	306.0	93.3	10.8	3.29	123.7	37.70	288	415.4	690.73
				TECGN06	06	306.0	93.3	17.5	5.33	77.0	23.47	292	417.6	1148.49
				TECGN07	07	35.0	10.7	11.0	3.35	16.4	5.00	1010	816.5	11.89
40HIL290038	TECO - Hookers Point	-47000	33300		01	280.0	85.3	11.3	3.44	20.0	6.10	295	419.3	41.33
					02	280.0	85.3	11.3	3.44	18.0	5.49	329	438.2	41.33
				TECHKC2A	01,02	280.0	85.3	11.3	3.44	18.0	5.49	295	419.3	82.66
					03	280.0	85.3	12.0	3.66	26.0	7.93	322	434.3	57.05
					04	280.0	85.3	12.0	3.66	24.0	7.32	300	422.0	56.95
				TECHKC2B	03,04	280.0	85.3	12.0	3.66	24.0	7.32	300	422.0	114.00

Table C-2. Summary of Modeling Parameters for the SO2 AAQS Modeling Analysis.

APIS Number	Facility Name	Facility Location Relative X,Y (m)		ISCST ID	APIS Src #	Stack Height		Stack Diam.		Exit Velocity		Temperature		Maximum SO2 Emissions (g/s)
						(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(°F)	(K)	
NA	TECO – Polk Power Station	-2500	9650	TECHK05	05	280.0	85.3	11.3	3.44	36.0	10.98	347	448.2	84.55
				TECHK06	06	280.0	85.3	9.4	2.87	73.0	22.26	322	434.3	107.86
				TECPKAA	^ a --	20.0	6.1	3.0	0.90	43.0	13.10	500	533.0	0.33
				TECPKAB	^ a --	150.0	45.7	19.0	5.80	55.1	16.79	260	400.0	49.67
				TECPKAC	^ a --	199.0	60.7	3.5	1.07	30.0	9.14	1400	1033.0	7.82
40TPA250015	TPS – Hardee Power Station	-181	-378	HRDEX01	^ a 01	90.0	27.4	14.5	4.42	80.0	24.38	253	396.0	92.53
				HRDEX02	^ a 02	90.0	27.4	14.5	4.42	80.0	24.38	253	396.0	92.53
				HRDEX03	^ a 03	75.1	22.9	16.0	4.88	103.0	31.39	953	785.0	92.53
40TPA530051	US AgriChem – Fort Meade	11000	11300	UAFTM06	06	70.0	21.3	3.7	1.13	49.1	14.97	400	477.6	6.43
					16	175.0	53.3	8.5	2.59	32.9	10.04	180	355.4	46.24
					17	175.0	53.3	8.5	2.59	32.9	10.04	180	355.4	46.24
				UAFTMC2	^ a 16,17	175.0	53.3	8.5	2.59	32.9	10.04	180	355.4	92.48

Notes: Stacks at the same facility with the same diameter and height and similar velocity and temperature were combined to a single stack. The velocity and temperature for the combined stack are set equal to the lowest velocity and temperature among the individual stacks being combined.

Table C-3. Summary of Individual Source Emissions and Operating Parameters for the PM AAQS Modeling Analysis

APIS Number	Facility/Source	Facility Location UTM E , N (km)		APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions		
		Relative X,Y, (m) ^a			(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)	(lb/hr)	(TPY)	(g/s)
40HIL290008	Cargill/Gardiner Fertilizer Riverview	363.4	3082.4	22,23,24	133.0	40.5	7.0	2.13	50.5	15.38	108	315.2	20.1	88	2.53
		-41600	24700	07	126.0	38.4	8.0	2.44	37.1	11.32	132	328.6	19.4	85	2.45
				08	87.0	26.5	1.2	0.37	26.8	8.18	138	331.9	1.1	5	0.14
				34	20.0	6.1	4.0	1.22	52.1	15.89	420	488.6	9.6	42	1.21
				41	40.0	12.2	1.7	0.52	30.4	9.28	120	322.0	0.2	1	0.03
				51	30.0	9.1	3.5	1.07	43.3	13.20	78	298.6	4.4	19	0.55
				52	40.0	12.2	1.5	0.46	36.8	11.21	77	298.0	4.8	21	0.60
				53	50.0	15.2	2.5	0.76	40.7	12.42	87	303.6	3.2	14	0.40
				54	32.0	9.8	1.3	0.40	26.4	8.04	96	308.6	7.8	34	0.98
				56	20.0	6.1	1.2	0.37	53.5	16.31	78	298.6	0.7	3	0.09
				57	20.0	6.1	1.5	0.46	34.3	10.44	78	298.6	0.7	3	0.09
				58	30.0	9.1	1.2	0.37	53.5	16.31	78	298.6	0.7	3	0.09
				59	45.0	13.7	1.2	0.37	53.5	16.31	78	298.6	0.7	3	0.09
				60	75.0	22.9	1.9	0.58	40.7	12.42	78	298.6	1.1	5	0.14
				72	38.0	11.6	2.7	0.82	58.2	17.75	68	293.0	0.2	1	0.03
				--	55.0	16.8	4.3	1.31	65.4	19.93	123	323.6	30.6	134	3.86
				--	54.0	16.5	4.3	1.31	64.6	19.69	117	320.2	22.9	100	2.88
				--	74.0	22.6	4.0	1.22	25.7	7.84	90	305.2	17.9	78	2.25
				--	66.0	20.1	2.0	0.61	53.1	16.17	140	333.0	10.1	44	1.27
				--	68.0	20.7	3.5	1.07	3.8	1.16	115	319.1	8.3	36	1.04
				--	68.0	20.7	3.5	1.07	36.4	11.09	107	314.7	8.3	36	1.04
				--	90.0	27.4	3.3	1.01	72.0	21.96	142	334.1	5.7	25	0.72
				--	90.0	27.4	3.3	1.01	64.2	19.58	142	334.1	5.7	25	0.72
				--	65.0	19.8	4.0	1.22	38.5	11.74	86	303.0	5.2	23	0.66
				--	65.0	19.8	4.0	1.22	47.3	14.43	84	301.9	5.2	23	0.66
				--	90.0	27.4	3.5	1.07	56.8	17.32	141	333.6	5.0	22	0.63
				--	60.0	18.3	8.3	2.53	22.8	6.94	600	588.6	1.3	6	0.17
												TOTAL		201.0	880
40TPA530046	Cargill/Seminole Fertilizer Bartow	409.8	3087.0	01	99.0	30.2	7.5	2.29	53.2	16.21	135	330.4	30.0	131	3.78
		4800	29300	02	100.0	30.5	5.0	1.52	50.9	15.52	70	294.3	15.5	68	1.95
				04	80.0	24.4	2.5	0.76	27.5	8.38	70	294.3	25.0	110	3.15
				12 ^b	200.0	61.0	6.8	2.06	62.0	18.90	179	355.0	10.7	47	1.35
				21	132.0	40.2	7.0	2.13	86.6	26.40	110	316.5	29.9	98	3.77
				32 ^b	200.0	61.0	6.8	2.06	62.0	18.90	179	355.0	10.3	45	1.29
				33 ^b	200.0	61.0	6.8	2.06	62.0	18.90	179	355.0	10.3	45	1.29
											TOTAL		131.6	544	16.59
40HIL530052	CF Industries Bartow Bonnie Mine Road	408.4	3082.4	25 ^b	135.0	41.2	5.0	1.52	26.0	7.92	77	298.0	40.6	178	5.12
		3400	24700	-- ^b	120.0	36.6	7.5	2.29	56.3	17.17	140	333.0	19.4	85	2.45
				--	117.0	35.7	8.0	2.44	37.1	11.31	150	338.6	43.2	189	5.44
				-- ^b	121.0	36.9	6.0	1.83	61.5	18.76	150	338.6	40.5	177	5.10

Table C-3 . Summary of Individual Source Emissions and Operating Parameters for the PM AAQS Modeling Analysis

APIS Number	Facility/Source	Facility Location UTM E , N (km)		APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions		
		Relative X,Y, (m) ^a			(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)	(lb/hr)	(TPY)	(g/s)
				-- ^b	140.0	42.7	2.5	0.76	71.3	21.73	77	298.0	40.5	177	5.10
				-- ^b	136.0	41.5	9.3	2.83	59.2	18.05	140	333.0	39.3	172	4.95
				--	206.0	62.8	7.0	2.13	21.9	6.69	140	333.0	11.9	52	1.50
				--	36.0	11.0	2.5	0.76	44.1	13.45	600	588.6	11.0	48	1.38
				--	206.0	62.8	7.0	2.13	21.4	6.51	150	338.6	6.6	29	0.83
				--	55.0	16.8	4.5	1.37	29.6	9.01	77	298.0	10.1	44	1.27
				--	100.0	30.5	2.5	0.76	19.5	5.95	80	299.7	1.0	4	0.12
				--	140.1	42.7	2.6	0.80	70.9	21.60	77	298.0	121.2	531	15.27
				--	65.0	19.8	4.0	1.22	50.4	15.36	77	298.0	14.0	61	1.76
													TOTAL	399.1	1748
40HIL290075	Consolidated Minerals Plant City	393.8 -11200	3096.3 38600	01	100.0	30.5	4.5	1.37	39.3	11.98	149	338.0	13.3	58	1.67
				03	152.0	46.3	5.8	1.77	31.5	9.61	81	300.2	13.0	57	1.64
				05	150.0	45.7	5.8	1.77	60.2	18.34	104	313.0	15.1	66	1.90
				06	81.0	24.7	2.7	0.82	29.7	9.05	108	315.2	2.1	9	0.26
				07	107.0	32.6	1.2	0.37	110.5	33.69	77	298.0	1.3	6	0.17
				08	100.0	30.5	3.0	0.91	0.0	0.01	115	319.1	6.8	30	0.86
				09	97.0	29.6	1.0	0.30	44.6	13.58	77	298.0	0.5	2	0.06
				12	62.0	18.9	1.8	0.55	81.9	24.95	77	298.0	2.1	9	0.26
				13	67.0	20.4	1.5	0.46	37.7	11.50	77	298.0	1.1	5	0.14
				15	34.0	10.4	2.7	0.82	62.9	19.16	130	327.4	7.1	31	0.89
				16	57.0	17.4	1.5	0.46	94.3	28.75	77	298.0	1.6	7	0.20
				17	54.0	16.5	1.8	0.55	65.5	19.96	77	298.0	1.6	7	0.20
				18	45.0	13.7	1.8	0.55	46.5	14.17	170	349.7	1.6	7	0.20
				20	20.0	6.1	1.2	0.37	66.3	20.21	630	605.4	1.0	4	0.12
				21	80.0	24.4	4.5	1.37	259.9	79.21	95	308.0	34.9	153	4.40
				22	152.0	46.3	5.8	1.77	39.8	12.13	80	299.8	14.0	61	1.76
				23	32.0	9.8	1.5	0.46	35.3	10.76	73	295.8	5.2	23	0.66
				24	152.0	46.3	5.8	1.77	36.6	11.16	72	295.4	14.0	61	1.76
				28	50.0	15.2	0.5	0.15	67.9	20.70	70	294.1	0.2	1	0.03
				--	152.0	46.3	5.8	1.77	43.2	13.17	77	298.0	16.7	73	2.10
				--	80.0	24.4	5.5	1.68	20.3	6.20	115	319.1	14.0	61	1.76
				--	54.0	16.5	1.4	0.43	62.8	19.14	77	298.0	1.0	4	0.12
				--	52.0	15.9	1.4	0.43	62.8	19.14	77	298.0	1.0	4	0.12
				--	46.0	14.0	0.6	0.18	59.0	17.97	77	298.0	0.7	3	0.09
				--	70.0	21.3	1.2	0.37	104.6	31.89	77	298.0	0.7	3	0.09
				--	10.0	3.1	0.8	0.24	59.7	18.19	150	338.6	0.5	2	0.06
				--	70.0	21.3	0.6	0.18	41.3	12.58	77	298.0	0.2	1	0.03
													TOTAL	171.0	749
NA	Estech-Duette Phosphate Min	388.9 -16100	3047.2 -10500	--	125.0	38.1	3.5	1.07	99.2	30.24	119	321.3	57.1	250	7.20
				--	60.0	18.3	9.4	2.87	48.8	14.86	157	342.4	57.1	250	7.20

Table C-3 . Summary of Individual Source Emissions and Operating Parameters for the PM AAQS Modeling Analysis

APIS Number	Facility/Source	Facility Location UTM E , N (km)		APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions		
		Relative X,Y, (m) ^a			(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)	(lb/hr)	(TPY)	(g/s)
				--	60.0	18.3	2.8	0.85	99.4	30.31	113	318.0	57.1	250	7.20
												TOTAL	171.4	751	21.60
40TPA530053	Farmland Industries	409.5	3079.5	03	100.0	30.5	7.5	2.29	30.4	9.27	179	355.0	6.8	30	0.85
		4500	21800	07	129.0	39.3	7.5	2.29	40.7	12.41	129	327.0	23.4	103	2.95
				16	100.0	30.5	3.5	1.07	52.0	15.84	98	309.8	1.4	6	0.18
				20	131.0	39.9	8.0	2.44	32.5	9.92	77	298.0	30.3	133	3.82
				25	185.0	56.4	5.0	1.52	17.0	5.17	149	338.0	23.4	103	2.95
				28	95.0	29.0	5.5	1.68	11.7	3.58	630	605.4	0.2	1	0.03
				29 ^b	129.0	39.3	7.5	2.29	43.0	13.11	108	315.4	26.9	118	3.39
				30	40.0	12.2	2.0	0.61	0.1	0.03	200	366.5	0.9	2	0.11
				31	40.0	12.2	2.0	0.61	0.1	0.03	200	366.5	0.9	3	0.11
				32	40.0	12.2	2.0	0.61	0.1	0.03	200	366.5	0.9	3	0.11
				33	40.0	12.2	2.0	0.61	0.1	0.03	200	366.5	0.1	0.4	0.01
				34	10.0	3.0	0.8	0.24	54.7	16.68	200	366.5	0.5	2	0.06
				36	10.0	3.0	0.5	0.15	1.5	0.47	200	366.5	0.1	0.4	0.01
												TOTAL	115.7	503	14.58
40TPA530145	Florida Privatization	418.3	3048.0	01	36.0	11.0	3.0	0.91	66.0	20.12	350	449.8	64.2	281	8.09
		13300	-9700												
40PNL520011	FPC Bartow	342.4	3082.6	01	300.0	91.4	9.0	2.74	119.0	36.27	312	428.7	122.0	534	15.37
		-62600	24900	02	300.0	91.4	9.0	2.74	102.0	31.09	305	424.8	131.7	577	16.59
				03	300.0	91.4	11.0	3.35	113.0	34.44	275	408.2	1754.8	7686	221.10
				04	30.0	9.1	3.0	0.91	17.0	5.18	515	541.5	0.3	1	0.04
				05	45.0	13.7	17.3	5.27	73.0	22.25	930	772.0	25.4	111	3.20
				06	45.0	13.7	17.3	5.27	73.0	22.25	930	772.0	25.4	111	3.20
				07	45.0	13.7	17.3	5.27	74.0	22.55	930	772.0	25.4	111	3.20
				08	45.0	13.7	17.3	5.27	73.0	22.25	930	772.0	25.4	111	3.20
				09	25.0	7.6	0.9	0.27	0.1	0.04	77	298.1	0.1	0.3	0.01
												TOTAL	2110.4	9244	265.91
40MAN410010	Florida Power & Light Manatee	367.2	3054.1	01	475.0 ^c	144.8	26.2	7.99	56.0	17.07	307	425.9	535.3	2345	67.45
		-37800	-3600	02	475.0 ^c	144.8	26.2	7.99	56.0	17.07	307	425.9	8645.2	37866	1089.3
				--	100.0	30.5	4.3	1.30	40.0	12.20	115	319.0	126.6	554	15.95
												TOTAL	9307.1	40765	1172.7
40TPA530034	IMC Fertilizer Kingsford	398.2	3075.7	04	70.0	21.3	7.0	2.13	47.6	14.52	165	346.9	25.8	113	3.25
		-6800	18000	05	106.0	32.3	2.5	0.76	67.9	20.70	95	308.0	35.4	155	4.46
				06	35.0	10.7	2.5	0.76	34.0	10.35	75	296.9	6.2	27	0.78

Table C-3 . Summary of Individual Source Emissions and Operating Parameters for the PM AAQS Modeling Analysis

APIS Number	Facility/Source	Facility Location UTM E , N (km)		APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions		
		Relative X,Y, (m) ^a			(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)	(lb/hr)	(TPY)	(g/s)
				--	60.0	18.3	2.5	0.76	64.5	19.66	110	316.3	27.9	122	3.51
				--	58.0	17.7	1.9	0.58	50.0	15.23	100	310.8	1.1	5	0.14
												TOTAL	96.3	422	12.14
40TPA530057	IMC Agrico/Conserve Nichols	398.4	3084.2	01 ^b	42.0	12.8	4.0	1.22	34.8	10.60	100	310.8	39.0	171	4.92
		-6600	26500	02	52.0	15.9	2.5	0.76	66.2	20.18	120	321.9	9.4	41	1.18
				03	80.0	24.4	3.5	1.07	78.1	23.81	130	327.4	9.4	41	1.18
				04	72.0	22.0	3.2	0.98	102.0	31.08	190	360.8	9.4	41	1.18
				05 ^b	150.0	45.7	7.5	2.29	33.8	10.30	170	349.8	229.3	1004	28.89
				09	207.0	63.1	1.4	0.43	69.3	21.12	135	330.2	5.0	22	0.63
				10	207.0	63.1	1.4	0.43	69.3	21.12	135	330.2	5.0	22	0.63
				12	81.0	24.7	7.5	2.29	12.4	3.78	130	327.6	35.2	154	4.43
				15	27.0	8.2	2.0	0.61	45.0	13.72	500	533.2	2.3	10	0.29
				16	39.0	11.9	3.2	0.98	29.0	8.84	500	533.2	3.4	15	0.43
				19	207.0	63.1	0.9	0.27	168.0	51.22	140	333.0	11.0	48	1.38
				--	179.0	54.6	0.6	0.18	47.1	14.37	150	338.6	5.0	22	0.63
				--	182.0	55.5	1.4	0.43	9.7	2.97	100	310.8	1.6	7	0.20
												TOTAL	364.8	1598	45.97
40TPA530059	IMC-Agrico New Wales	396.6	3078.9	05	40.0	12.2	3.0	0.91	66.0	20.12	108	315.2	4.8	21	0.60
		-8400	21200	06	110.0	33.5	1.4	0.43	45.5	13.86	110	316.3	1.3	6	0.17
				09	133.0	40.5	7.0	2.13	49.8	15.18	105	313.6	28.6	125	3.60
				10	133.0	40.5	6.0	1.83	67.8	20.66	110	316.3	33.8	148	4.26
				11	133.0	40.5	4.0	1.22	70.3	21.43	140	333.0	15.3	67	1.93
				12	133.0	40.5	6.0	1.83	61.9	18.87	108	315.2	28.8	126	3.63
				15	65.0	19.8	1.0	0.30	169.8	51.75	105	313.6	3.7	16	0.46
				21	60.0	18.3	1.0	0.30	53.1	16.17	105	313.6	3.4	15	0.43
				23	112.0	34.1	1.0	0.30	34.0	10.35	105	313.6	3.4	15	0.43
				24	105.0	32.0	1.0	0.30	140.1	42.69	105	313.6	3.4	15	0.43
				25	117.0	35.7	1.0	0.30	127.3	38.81	105	313.6	3.4	15	0.43
				26	18.0	5.5	1.0	0.30	31.8	9.70	105	313.6	1.6	7	0.20
				28	112.0	34.1	98.4	30.00	34.0	10.35	105	313.6	3.4	15	0.43
				29	133.0	40.5	3.0	0.91	3.3	1.01	105	313.6	20.1	88	2.53
				30	60.0	18.3	1.0	0.30	31.8	9.70	105	313.6	3.4	15	0.43
				31	45.0	13.7	1.0	0.30	31.8	9.70	105	313.6	3.4	15	0.43
				32	87.0	26.5	1.5	0.46	282.9	86.24	330	438.6	3.4	15	0.43
				33	87.0	26.5	1.5	0.46	282.9	86.24	330	438.6	3.4	15	0.43
				34	17.0	5.2	1.3	0.40	125.6	38.27	225	380.2	3.4	15	0.43
				35	57.0	17.4	1.3	0.40	75.3	22.96	175	352.4	3.4	15	0.43
				37	107.0	32.6	1.8	0.55	68.8	20.96	105	313.6	3.4	15	0.43
				38	65.0	19.8	1.5	0.46	47.1	14.37	175	352.4	3.4	15	0.43
				43	104.0	31.7	1.6	0.49	70.5	21.48	105	313.6	3.4	15	0.43

Table C-3 . Summary of Individual Source Emissions and Operating Parameters for the PM AAQS Modeling Analysis

APIS Number	Facility/Source	Facility Location UTM E , N (km)		APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions		
		Relative X,Y, (m) ^a			(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)	(lb/hr)	(TPY)	(g/s)
				45	171.0	52.1	6.0	1.83	58.0	17.68	110	316.3	14.1	62	1.78
				47	94.0	28.7	6.0	1.83	35.4	10.78	175	352.4	4.6	20	0.58
				52	118.0	36.0	1.0	0.30	34.0	10.35	105	313.6	3.4	15	0.43
				55	25.0	7.6	4.3	1.31	34.4	10.49	140	333.0	5.2	23	0.66
				56	170.0	51.8	5.0	1.52	6.5	1.97	110	316.3	6.2	27	0.78
				--	171.0	52.1	6.0	1.83	59.0	17.97	110	316.3	14.1	62	1.78
				--	100.0	30.5	180.4	55.00	41.3	12.58	102	311.9	0.5	2	0.06
				--	172.0	52.4	4.5	1.37	52.4	15.97	105	313.6	26.5	116	3.34
				--	107.0	32.6	3.5	1.07	52.0	15.84	150	338.6	2.8	12	0.35
				--	71.0	21.6	1.0	0.30	34.0	10.35	80	299.7	16.9	74	2.13
				--	40.0	12.2	0.9	0.27	30.8	9.39	80	299.7	6.4	28	0.81
				--	86.0	26.2	0.7	0.21	54.1	16.50	80	299.7	1.6	7	0.20
				--	100.0	30.5	1.5	0.46	179.2	54.62	80	299.7	1.0	4	0.12
				--	172.0	52.4	8.0	2.44	43.1	13.14	120	321.9	36.8	161	4.64
												TOTAL	325.9	1427	41.06
40TPA530027	IMC Agrico Noralyn Mine	414.7	3080.3	01	76.0	23.2	6.5	1.98	56.8	17.30	250	394.0	34.8	152	4.38
		9700	22600	02	55.0	16.8	9.3	2.83	28.9	8.82	155	341.5	37.5	164	4.72
				03	54.0	16.5	1.0	0.30	63.6	19.40	115	319.1	10.1	44	1.27
				04	27.0	8.2	2.0	0.61	53.1	16.17	85	302.4	15.1	66	1.90
				08 ^b	38.0	11.6	1.9	0.58	23.5	7.17	140	333.0	30.4	133	3.83
				09 ^b	38.0	11.6	1.9	0.58	23.5	7.17	140	333.0	30.4	133	3.83
				10 ^b	38.0	11.6	1.9	0.58	23.5	7.17	140	333.0	41.3	181	5.21
				11	25.0	7.6	1.5	0.46	37.7	11.50	75	296.9	25.6	112	3.22
				12	27.0	8.2	2.0	0.61	15.9	4.85	75	296.9	2.8	12	0.35
				13	27.0	8.2	2.0	0.61	53.1	16.17	85	302.4	15.1	66	1.90
				14	135.0	41.2	2.8	0.85	55.0	16.75	60	288.6	34.5	151	4.35
				15	43.0	13.1	2.0	0.61	59.4	18.11	86	303.0	15.1	66	1.90
				16	24.0	7.3	2.0	0.61	26.5	8.09	110	316.3	19.0	83	2.39
				17	24.0	7.3	2.0	0.61	26.5	8.09	110	316.3	39.5	173	4.98
				18	150.0	45.7	3.5	1.07	52.0	15.84	100	310.8	34.9	153	4.40
												TOTAL	386.0	1690	48.63
40TPA530055	IMC-Agrico South Pierce	407.5	3071.3	01	35.0	10.7	4.8	1.46	51.7	15.77	430	494.3	1.8	8	0.22
		2500	13600	03 ^b	88.0	26.8	3.0	0.91	30.3	9.23	94	307.6	4.4	19	0.55
				12	96.0	29.3	1.3	0.40	3.8	1.15	77	298.1	0.03	0.1	0.004
				13	68.0	20.7	1.5	0.46	9.4	2.87	77	298.1	0.1	0.4	0.01
				14	53.0	16.2	1.5	0.46	5.6	1.72	77	298.1	0.1	0.2	0.01
				16	65.0	19.8	1.6	0.49	18.0	5.48	99	310.4	2.1	9	0.26
				17	65.0	19.8	1.6	0.49	290.2	88.45	81	300.4	0.2	1	0.02
				22 ^b	10.0	3.0	1.8	0.55	67.9	20.69	160	344.3	31.8	139	4.01
				23	140.0	42.7	9.0	2.74	35.0	10.66	89	304.8	35.0	153	4.41

Table C-3. Summary of Individual Source Emissions and Operating Parameters for the PM AAQS Modeling Analysis

APIS Number	Facility/Source	Facility Location UTM E , N (km)		APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions		
		Relative X,Y, (m) ^a			(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)	(lb/hr)	(TPY)	(g/s)
				24	80.0	24.4	11.0	3.35	25.6	7.80	75	297.0	20.1	88	2.53
				25	80.0	24.4	11.0	3.35	23.7	7.23	72	295.4	20.1	88	2.53
				26	60.0	18.3	1.0	0.30	31.8	9.70	122	323.1	34.2	150	4.30
				27	96.0	29.3	1.3	0.40	3.8	1.15	77	298.1	1.2	5	0.15
				28	96.0	29.3	1.3	0.40	3.8	1.15	77	298.1	0.3	1	0.04
				29	53.0	16.2	1.3	0.40	7.5	2.30	77	298.1	0.1	0.2	0.01
				30 - 45	24.0	7.3	1.0	0.30	3.3	1.00	200	366.5	44.6	195	5.62
											TOTAL		195.8	858	24.67
40TPA530080	Imperial Phosphate	404.8	3069.5	01	90.0	27.4	5.0	1.52	67.0	20.42	140	333.0	18.0	79	2.27
		-200	11800	02	90.0	27.4	2.0	0.61	23.0	7.01	430	494.0	1.0	4	0.12
				03	90.0	27.4	4.6	1.40	64.9	19.78	140	333.0	18.0	79	2.27
											TOTAL		37.0	162	4.66
40HIL290018	LaFarge Corp.	357.7	3090.6	01	98.0	29.9	1.6	0.49	39.8	12.13	77	298.0	1.1	5	0.14
		-47300	32900	02	98.0	29.9	1.6	0.49	39.8	12.13	77	298.0	1.1	5	0.14
				03	102.0	31.1	1.9	0.58	64.7	19.71	77	298.0	2.8	12	0.35
				05	100.0	30.5	2.5	0.76	40.7	12.42	77	298.0	3.2	14	0.40
				06	147.0	44.8	1.7	0.52	44.1	13.43	77	298.0	1.6	7	0.20
				07	147.0	44.8	1.7	0.52	44.1	13.43	77	298.0	1.6	7	0.20
				08	147.0	44.8	1.7	0.52	44.1	13.43	77	298.0	1.6	7	0.20
				09	171.0	52.1	1.1	0.34	84.2	25.66	77	298.0	1.1	5	0.14
				11	47.0	14.3	1.3	0.40	62.8	19.14	77	298.0	1.3	6	0.17
				12	83.0	25.3	2.3	0.70	80.2	24.45	77	298.0	5.0	22	0.63
				13	83.0	25.3	3.4	1.04	62.4	19.02	77	298.0	8.7	38	1.09
				14	57.0	17.4	2.2	0.67	57.0	17.37	157	342.4	1.6	7	0.20
				15	30.0	9.1	2.4	0.73	55.2	16.84	77	298.0	3.9	17	0.49
				16	83.0	25.3	3.4	1.04	62.4	19.02	77	298.0	8.7	38	1.09
				17	90.0	27.4	1.1	0.34	87.7	26.73	77	298.0	3.2	14	0.40
				18	16.0	4.9	2.4	0.73	55.2	16.84	77	298.0	3.9	17	0.49
				19	83.0	25.3	3.4	1.04	62.4	19.02	77	298.0	8.7	38	1.09
				20	57.0	17.4	2.2	0.67	57.0	17.37	77	298.0	3.2	14	0.40
				21	30.0	9.1	2.4	0.73	55.2	16.84	77	298.0	3.9	17	0.49
				23	49.0	14.9	2.2	0.67	35.1	10.69	77	298.0	2.1	9	0.26
				24	49.0	14.9	2.2	0.67	35.1	10.69	77	298.0	2.1	9	0.26
				25	72.0	22.0	0.8	0.24	265.3	80.85	77	298.0	2.1	9	0.26
				27	20.0	6.1	2.2	0.67	78.9	24.06	100	310.8	4.6	20	0.58
				29	146.0	44.5	8.0	2.44	132.0	40.24	431	494.8	95.1	416	11.98
				30	101.0	30.8	12.5	3.81	20.0	6.09	264	401.9	45.0	197	5.67
				31	49.0	14.9	2.0	0.61	63.6	19.40	77	298.0	2.9	13	0.37
				42	174.0	53.0	1.5	0.46	75.5	23.00	77	298.0	20.1	88	2.53
				43	174.0	53.0	1.5	0.46	94.3	28.75	77	298.0	2.3	10	0.29

Table C-3. Summary of Individual Source Emissions and Operating Parameters for the PM AAQS Modeling Analysis

APIS Number	Facility/Source	Facility Location UTM E , N (km)		APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions		
		Relative X,Y, (m) ^ a			(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)	(lb/hr)	(TPY)	(g/s)
				44	60.0	18.3	1.0	0.30	112.0	34.15	77	298.0	1.3	6	0.17
				45	60.0	18.3	1.0	0.30	112.0	34.15	77	298.0	1.3	6	0.17
				50	123.0	37.5	1.0	0.30	84.9	25.87	77	298.0	1.1	5	0.14
				--	57.0	17.4	2.2	0.67	57.0	17.37	77	298.0	3.2	14	0.40
				--	73.0	22.3	1.9	0.58	76.4	23.29	77	298.0	2.9	13	0.37
				--	33.0	10.1	2.4	0.73	55.2	16.84	196	364.1	2.9	13	0.37
				--	115.0	35.1	1.9	0.58	70.5	21.50	100	310.8	2.9	13	0.37
				--	5.0	1.5	1.9	0.58	58.8	17.92	100	310.8	2.5	11	0.32
				--	33.0	10.1	2.4	0.73	55.2	16.84	196	364.1	2.1	9	0.26
				--	83.0	25.3	3.4	1.04	62.4	19.02	180	355.2	2.1	9	0.26
				--	57.0	17.4	2.2	0.67	57.0	17.37	157	342.4	2.1	9	0.26
				--	34.0	10.4	1.1	0.34	107.0	32.61	77	298.0	1.6	7	0.20
				--	33.0	10.1	2.4	0.73	55.2	16.84	196	364.1	1.6	7	0.20
				--	83.0	25.3	3.4	1.04	62.4	19.02	180	355.2	1.6	7	0.20
				--	83.0	25.3	1.3	0.40	80.3	24.49	77	298.0	1.6	7	0.20
				--	90.0	27.4	1.0	0.30	106.1	32.34	77	298.0	1.3	6	0.17
				--	95.0	29.0	1.5	0.46	37.7	11.50	77	298.0	1.1	5	0.14
												TOTAL	275.5	1207	34.71
40TPA530004	Lakeland City Power McIntosh	408.5	3105.8	01 ^b	150.0	45.7	9.0	2.74	78.0	23.77	295	419.3	98.5	431	12.41
		3500	48100	02	20.0	6.1	2.6	0.79	77.0	23.47	715	652.6	1.0	4	0.12
				03	20.0	6.1	2.6	0.79	77.0	23.47	715	652.6	1.0	4	0.12
				04	36.0	11.0	9.2	2.80	1.0	0.30	965	791.5	4.6	20	0.58
				05	156.0	47.6	10.4	3.17	69.0	21.03	265	402.6	111.5	488	14.05
				06	250.0	76.2	16.0	4.88	107.0	32.61	170	350.0	3242.5	14202	408.56
												TOTAL	3459.0	15151	435.84
40TPA530047	Mobil Mining & Minerals Nichol	398.4	3085.3	01	80.0	24.4	7.5	2.29	41.5	12.65	160	344.3	36.1	158	4.55
		-6600	27600	02	80.0	24.4	7.5	2.29	41.5	12.65	160	344.3	43.7	191	5.50
				04 ^b	85.0	25.9	7.5	2.29	52.8	16.10	150	338.7	24.7	108	3.11
				07	15.0	4.6	1.4	0.43	54.1	16.50	103	312.6	1.1	5	0.14
				10	85.0	25.9	5.5	1.68	47.7	14.54	80	299.8	15.6	68	1.96
				11	85.0	25.9	5.0	1.52	63.6	19.40	75	297.0	55.6	243	7.00
				--	80.0	24.4	1.6	0.49	38.3	11.68	129	326.9	12.3	54	1.55
				--	80.0	24.4	1.6	0.49	38.3	11.68	129	326.9	11.2	49	1.41
				--	40.0	12.2	3.5	1.07	38.8	11.83	160	344.1	11.0	48	1.38
				--	100.0	30.5	3.6	1.10	62.4	19.02	150	338.6	8.9	39	1.12
				--	13.0	4.0	2.5	0.76	7.0	2.12	480	521.9	5.7	25	0.72
				--	79.0	24.1	0.8	0.24	48.0	14.64	170	349.7	0.5	2	0.06
												TOTAL	226.2	991	28.50
40TPA530048	Mulberry Phosphates (Royster)	406.8	3085.1	05	102.0	31.1	8.8	2.68	26.8	8.16	110	316.3	234.0	1025	29.48

Table C-3. Summary of Individual Source Emissions and Operating Parameters for the PM AAQS Modeling Analysis

APIS Number	Facility/Source	Facility Location UTM E , N (km)		APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions			
		Relative X,Y, (m) ^a			(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)	(lb/hr)	(TPY)	(g/s)	
40HIL290039	TECO Big Bend	1800	27400	02	80.0	24.4	3.0	0.91	35.6	10.85	91	305.8	38.7	169	4.87	
				--	200.0	61.0	7.0	2.13	32.5	9.90	200	366.3	30.4	133	3.83	
				--	74.0	22.6	3.5	1.07	12.5	3.80	95	308.0	15.3	67	1.93	
													TOTAL	318.3	1394	40.11
		361.9	3075.0	01,02	490.0	149.4	24.0	7.32	94.0	28.65	300	422.0	404.4	1771	50.96	
				--43100	03	490.0	149.4	24.0	7.32	47.0	14.33	292	417.6	412.5	1807	51.97
				04 ^b	490.0	149.4	24.0	7.32	65.0	19.81	156	342.2	433.4	1898	54.61	
				05	75.0	22.9	14.0	4.27	26.8	8.17	928	770.9	33.1	145	4.17	
				06	75.0	22.9	14.0	4.27	26.8	8.17	928	770.9	33.1	145	4.17	
				07	35.0	10.7	10.4	3.17	18.2	5.55	1010	816.5	33.1	145	4.17	
				08	102.0	31.1	2.5	0.76	52.6	16.04	250	394.1	5.2	23	0.66	
				09	113.0	34.4	0.9	0.27	406.1	123.77	250	394.1	16.7	73	2.10	
				14 ^b	139.0	42.4	1.6	0.49	59.7	18.19	140	333.0	0.2	1	0.03	
15	179.0			54.6	1.7	0.52	69.0	21.04	78	298.6	0.5	2	0.06			
16	179.0	54.6	1.7	0.52	69.0	21.04	78	298.6	0.5	2	0.06					
17	179.0	54.6	1.7	0.52	69.0	21.04	78	298.6	0.5	2	0.06					
											TOTAL	1373.1	6014	173.02		
40HIL290040	TECO Gannon	360.0	3087.5	01	306.0	93.3	10.4	3.17	79.0	24.08	309	427.0	126.1	552	15.89	
				--45000	02	306.0	93.3	10.4	3.17	79.0	24.08	309	427.0	126.1	552	15.89
				03	306.0	93.3	11.0	3.35	99.0	30.18	300	422.0	160.2	701	20.18	
		04	306.0	93.3	10.0	3.05	72.0	21.95	329	438.2	188.0	824	23.69			
		05	306.0	93.3	10.8	3.29	123.7	37.70	288	415.4	228.3	1000	28.76			
		06	306.0	93.3	17.5	5.33	77.0	23.47	292	417.6	380.2	1665	47.91			
		07	35.0	10.7	11.0	3.35	16.4	5.00	1010	816.5	122.2	535	15.40			
		09	72.0	21.9	0.7	0.21	36.0	10.96	350	449.7	0.2	1	0.03			
		10	107.0	32.6	1.0	0.30	99.6	30.37	350	449.7	1.1	5	0.14			
		11	104.0	31.7	2.0	0.61	59.9	18.27	350	449.7	2.9	13	0.37			
		13	175.0	53.3	1.7	0.52	70.5	21.49	78	298.6	0.2	1	0.03			
		14	175.0	53.3	1.7	0.52	70.5	21.49	78	298.6	0.2	1	0.03			
		15	177.0	53.9	2.0	0.61	50.9	15.52	78	298.6	0.2	1	0.03			
		16	175.0	53.3	1.7	0.52	70.5	21.49	78	298.6	0.2	1	0.03			
		17	174.0	53.0	1.2	0.37	79.6	24.26	78	298.6	0.2	1	0.03			
		18	175.0	53.3	1.7	0.52	70.5	21.49	78	298.6	0.2	1	0.03			
													TOTAL	1336.8	5855	168.44
NA	TECO - Polk	402.5	3067.4	--	20.0	6.1	3.0	0.90	43.0	13.10	500	533.0	16.0	70	2.02	
				--2500	--	150.0	45.7	19.0	5.80	55.1	16.79	260	400.0	59.0	258	7.43
				--	--	199.0	60.7	3.5	1.07	30.0	9.14	1400	1033.0	25.0	110	3.15
												TOTAL	100.0	438	12.60	

Table C-3 . Summary of Individual Source Emissions and Operating Parameters for the PM AAQS Modeling Analysis

APIS Number	Facility/Source	Facility Location UTM E , N (km)		APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions		
		Relative X,Y, (m) ^a			(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)	(lb/hr)	(TPY)	(g/s)
40TPA250015	TPS – Hardee Power Station	404.8	3057.3	01	90.0	27.4	14.5	4.42	80.0	24.38	253	396.0	10.0	11 ^d	1.26
		-200	-400	02	90.0	27.4	14.5	4.42	80.0	24.38	253	396.0	10.0	11 ^d	1.26
				03	75.0	22.9	16.0	4.88	103.0	31.39	953	785.0	10.0	11 ^d	1.26
											TOTAL	30.0	33		3.78
40TPA530051	USAgri–Chemicals Fort Mead	416.0	3069.0	03	52.0	15.9	6.0	1.83	36.4	11.10	146	336.3	19.4	85	2.45
		11000	11300	04	52.0	15.9	6.0	1.83	36.0	10.96	143	334.7	40.2	176	5.07
				06	70.0	21.3	3.7	1.13	49.1	14.98	400	477.4	100.1	438	12.61
				14	122.0	37.2	2.8	0.85	50.6	15.43	88	304.1	3.7	16	0.46
				28	6.0	1.8	0.3	0.09	344.0	104.86	270	405.2	3.9	17	0.49
				29	6.0	1.8	0.3	0.09	158.0	48.15	260	399.7	1.8	8	0.23
				--	80.0	24.4	2.5	0.76	12.6	3.83	108	315.2	24.4	107	3.08
				--	64.0	19.5	1.4	0.43	81.7	24.91	95	308.0	19.8	87	2.50
				--	69.0	21.0	1.7	0.52	72.7	22.16	108	315.2	19.7	86	2.48
				--	89.0	27.1	15.0	4.57	8.0	2.44	81	300.2	3.2	14	0.40
				--	93.0	28.4	5.0	1.52	35.0	10.66	129	326.9	1.8	8	0.23
				--	93.0	28.4	5.0	1.52	35.0	10.66	129	326.9	1.6	7	0.20
				--	53.0	16.2	1.5	0.46	28.3	8.62	180	355.2	1.0	4	0.12
				--	53.0	16.2	1.5	0.46	28.3	8.62	180	355.2	1.0	4	0.12
				--	58.0	17.7	1.5	0.46	28.3	8.62	100	310.8	1.0	4	0.12
				--	53.0	16.2	1.5	0.46	28.3	8.62	100	310.8	1.0	4	0.12
											TOTAL	243.5	1066		30.68

Notes:

PM inventory data based on TECO PPS Inventory. Some point sources included in the TECO PPS data were identified with an APIS source number.

^a Location relative to the proposed Hardee Unit 3 (East, North UTM location (km) are 405.0, 3057.7)

^b PM PSD Increment consuming source

^c GEP stack ht

^d TPS Hardee limited to 25% annual capacity. The TPY reflects 25% of the hourly emission rate over the entire year.

Table C-4. Summary of Modeling Parameters for the PM AQS Modeling Analysis.

APIS Number	Facility/Source	Facility Location Relative X,Y, (m)		ISCST ID	APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions (g/s)	Merged Stack Parameter M Test ^b
						(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)		
40HIL290008	Cargill/Gardiner Fertilizer Riverview	-41600	24700	CGRIVBA	--	55.0	16.8	4.3	1.31	65.4	19.93	123	323.6	3.86	
					--	54.0	16.5	4.3	1.31	64.6	19.69	117	320.2	2.88	
				CGRIVBB											
					07	126.0	38.4	8.0	2.44	37.1	11.32	132	328.6	2.45	272685
					08	87.0	26.5	1.2	0.37	26.8	8.18	138	331.9	0.14	55297
				22,23,24	133.0	40.5	7.0	2.13	50.5	15.38	108	315.2	2.53	276793	
					34	20.0	6.1	4.0	1.22	52.1	15.89	420	488.6	1.21	45754
					41	40.0	12.2	1.7	0.52	30.4	9.28	120	322.0	0.03	257859
					51	30.0	9.1	3.5	1.07	43.3	13.20	78	298.6	0.55	58899
					52	40.0	12.2	1.5	0.46	36.8	11.21	77	298.0	0.60	11279
					53	50.0	15.2	2.5	0.76	40.7	12.42	87	303.6	0.40	65173
					54	32.0	9.8	1.3	0.40	26.4	8.04	96	308.6	0.98	3102 Lowest M
					56	20.0	6.1	1.2	0.37	53.5	16.31	78	298.6	0.09	35492
					57	20.0	6.1	1.5	0.46	34.3	10.44	78	298.6	0.09	35114
					58	30.0	9.1	1.2	0.37	53.5	16.31	78	298.6	0.09	53179
					59	45.0	13.7	1.2	0.37	53.5	16.31	78	298.6	0.09	79827
					60	75.0	22.9	1.9	0.58	40.7	12.42	78	298.6	0.14	159995
					72	38.0	11.6	2.7	0.82	58.2	17.75	68	293.0	0.03	1060159
				--	68.0	20.7	3.5	1.07	3.8	1.16	115	319.1	1.04	6634	
				--	74.0	22.6	4.0	1.22	25.7	7.84	90	305.2	2.25	28046	
				--	66.0	20.1	2.0	0.61	53.1	16.17	140	333.0	1.27	24930	
				--	68.0	20.7	3.5	1.07	36.4	11.09	107	314.7	1.04	62554	
				--	90.0	27.4	3.3	1.01	64.2	19.58	142	334.1	0.72	199671	
				--	90.0	27.4	3.3	1.01	72.0	21.96	142	334.1	0.72	223942	
				--	65.0	19.8	4.0	1.22	38.5	11.74	86	303.0	0.66	124813	
				--	60.0	18.3	8.3	2.53	22.8	6.94	600	588.6	0.17	2209406	
				--	65.0	19.8	4.0	1.22	47.3	14.43	84	301.9	0.66	152855	
				--	90.0	27.4	3.5	1.07	56.8	17.32	141	333.6	0.63	226213	
				CGRIVMM		32.0	9.8	1.3	0.40	26.4	8.04	96	308.6	18.58	
40TPA530046	Cargill/Seminole Fertilizer Bartow	4800	29300	CGBRT01	01	99.0	30.2	7.5	2.29	53.2	16.21	135	330.4	3.78	
				CGBRT04	04	80.0	24.4	2.5	0.76	27.5	8.38	70	294.3	3.15	
				CGBRT21	21	132.0	40.2	7.0	2.13	86.6	26.40	110	316.5	3.77	
					02	100.0	30.5	5.0	1.52	50.9	15.52	70	294.3	1.95	129352 Lowest M
				CGBRT12 ^a	12	200.0	61.0	6.8	2.06	62.0	18.90	179	355.0	1.35	1010997
				CGBRT32 ^a	32	200.0	61.0	6.8	2.06	62.0	18.90	179	355.0	1.29	1052920
				CGBRT33 ^a	33	200.0	61.0	6.8	2.06	62.0	18.90	179	355.0	1.29	1052920
				CGBRTMM		100.0	30.5	5.0	1.52	50.9	15.52	70	294.3	5.89	

Table C-4. Summary of Modeling Parameters for the PM AAQS Modeling Analysis.

APIS Number	Facility/Source	Facility Location Relative X,Y, (m)		ISCST ID	APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions (g/s)	Merged Stack Parameter M Test ^b
						(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)		
40HIL530052	CF Industries Bartow	3400	24700	CFBON25 ^a	25	135.0	41.2	5.0	1.52	26.0	7.92	77	298.0	5.12	
					--	140.0	42.7	2.6	0.80	70.9	21.60	77	298.0	15.27	
					--	117.0	35.7	8.0	2.44	37.1	11.31	150	338.6	5.44	
					--	121.0	36.9	6.0	1.83	61.5	18.76	150	338.6	5.10	
					--	140.0	42.7	2.5	0.76	71.3	21.73	77	298.0	5.10	
					--	136.0	41.5	9.3	2.83	59.2	18.05	140	333.0	4.95	
				CFBONBF ^a	--	120.0	36.6	7.5	2.29	56.3	17.17	140	333.0	2.45	351603
					--	65.0	19.8	4.0	1.22	50.4	15.36	77	298.0	1.76	60227
					--	206.0	62.8	7.0	2.13	21.9	6.69	140	333.0	1.50	332291
					--	36.0	11.0	2.5	0.76	44.1	13.45	600	588.6	1.38	28549 Lowest M
					--	55.0	16.8	4.5	1.37	29.6	9.01	77	298.0	1.27	52233
					--	206.0	62.8	7.0	2.13	21.4	6.51	150	338.6	0.83	594196
					--	100.0	30.5	2.5	0.76	19.5	5.95	80	299.7	0.12	205473
				CFBONMM		36.0	11.0	2.5	0.76	44.1	13.45	600	588.6	9.31	
40HIL290075	Consolidated Minerals	-11200	38600	CONMN21	21	80.0	24.4	4.5	1.37	259.9	79.21	95	308.0	4.40	
					01	100.0	30.5	4.5	1.37	39.3	11.98	149	338.0	1.67	108944
					03	152.0	46.3	5.8	1.77	31.5	9.61	81	300.2	1.64	200534
					05	150.0	45.7	5.8	1.77	60.2	18.34	104	313.0	1.90	339886
					06	81.0	24.7	2.7	0.82	29.7	9.05	108	315.2	0.26	143054
					07	107.0	32.6	1.2	0.37	110.5	33.69	77	298.0	0.17	207068
					08	100.0	30.5	3.0	0.91	0.0	0.01	115	319.1	0.86	74 Lowest M
					09	97.0	29.6	1.0	0.30	44.6	13.58	77	298.0	0.06	140977
					12	62.0	18.9	1.8	0.55	81.9	24.95	77	298.0	0.26	128408
					13	67.0	20.4	1.5	0.46	37.7	11.50	77	298.0	0.14	83071
					15	34.0	10.4	2.7	0.82	62.9	19.16	130	327.4	0.89	38562
					16	57.0	17.4	1.5	0.46	94.3	28.75	77	298.0	0.20	123660
					17	54.0	16.5	1.8	0.55	65.5	19.96	77	298.0	0.20	116303
					18	45.0	13.7	1.8	0.55	46.5	14.17	170	349.7	0.20	80762
					20	20.0	6.1	1.2	0.37	66.3	20.21	630	605.4	0.12	66873
					22	152.0	46.3	5.8	1.77	39.8	12.13	80	299.8	1.76	235547
					23	32.0	9.8	1.5	0.46	35.3	10.76	73	295.8	0.66	7814
					24	152.0	46.3	5.8	1.77	36.6	11.16	72	295.4	1.76	213531
					28	50.0	15.2	0.5	0.15	67.9	20.70	70	294.1	0.03	54651
					--	10.0	3.1	0.8	0.24	59.7	18.19	150	338.6	0.06	14164
					--	70.0	21.3	1.2	0.37	104.6	31.89	77	298.0	0.09	242279
					--	152.0	46.3	5.8	1.77	43.2	13.17	77	298.0	2.10	213050
					--	46.0	14.0	0.6	0.18	59.0	17.97	77	298.0	0.09	21228
					--	52.0	15.9	1.4	0.43	62.8	19.14	77	298.0	0.12	109404

APIS Number	Facility/Source	Facility Location Relative X,Y, (m)	ISCST ID	APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions	Merged Stack Parameter M
					(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)	(g/s)	Test ^ b
				--	54.0	16.5	1.4	0.43	62.8	19.14	77	298.0	0.12	113614
				--	80.0	24.4	5.5	1.68	20.3	6.20	115	319.1	1.76	60750
				--	70.0	21.3	0.6	0.18	41.3	12.58	77	298.0	0.03	67859
			CONMNM		100.0	30.5	3.0	0.91	0.0	0.01	115	319.1	17.15	
NA	Estech—Duette Phosphate Mine	-16100 -10500	ESTDUBA	--	125.0	38.1	3.5	1.07	99.2	30.24	119	321.3	7.20	
			ESTDUBB	--	60.0	18.3	9.4	2.87	48.8	14.86	157	342.4	7.20	
			ESTDUBC	--	60.0	18.3	2.8	0.85	99.4	30.31	113	318.0	7.20	
40TPA530053	Farmland Industries	4500 21800	FARML07	07	129.0	39.3	7.5	2.29	40.7	12.41	129	327.0	2.95	
			FARML20	20	131.0	39.9	8.0	2.44	32.5	9.92	77	298.0	3.82	
			FARML25	25	185.0	56.4	5.0	1.52	17.0	5.17	149	338.0	2.95	
			FARML29 ^a	29	129.0	39.3	7.5	2.29	43.0	13.11	108	315.4	3.39	
			FARML03 ^a	03	100.0	30.5	7.5	2.29	30.4	9.27	179	355.0	0.85	485746
				16	100.0	30.5	3.5	1.07	52.0	15.84	98	309.8	0.18	741995
				30	40.0	12.2	2.0	0.61	0.1	0.03	200	366.5	0.11	356 Lowest M
				31	40.0	12.2	2.0	0.61	0.1	0.03	200	366.5	0.11	356 Lowest M
				32	40.0	12.2	2.0	0.61	0.1	0.03	200	366.5	0.11	356 Lowest M
				33	40.0	12.2	2.0	0.61	0.1	0.03	200	366.5	0.01	3109
				34	10.0	3.0	0.8	0.24	54.7	16.68	200	366.5	0.06	13380
				36	10.0	3.0	0.5	0.15	1.5	0.47	200	366.5	0.01	760
				28	95.0	29.0	5.5	1.68	11.7	3.58	630	605.4	0.03	5496784
			FARMLMM		40.0	12.2	2.0	0.61	0.1	0.03	200	366.5	1.47	
40TPA530145	Florida Privatization	13300 -9700	FLPRVT01	01	36.0	11.0	3.0	0.91	66.0	20.12	350	449.8	8.09	
40PNL520011	FPC Bartow			01	300.0	91.4	9.0	2.74	119.0	36.27	312	428.7	15.37	
				02	300.0	91.4	9.0	2.74	102.0	31.09	305	424.8	16.59	
		-62600 24900	FPCBTC2	01,02	300.0	91.4	9.0	2.74	102.0	31.09	305	424.8	31.96	
			FPCBT03	03	300.0	91.4	11.0	3.35	113.0	34.44	275	408.2	221.10	
			FPCBT04	04	30.0	9.1	3.0	0.91	17.0	5.18	515	541.5	0.04	
				05	45.0	13.7	17.3	5.27	73.0	22.25	930	772.0	3.20	
				06	45.0	13.7	17.3	5.27	73.0	22.25	930	772.0	3.20	
				07	45.0	13.7	17.3	5.27	74.0	22.55	930	772.0	3.20	
				08	45.0	13.7	17.3	5.27	73.0	22.25	930	772.0	3.20	

Table C-4. Summary of Modeling Parameters for the PM AQS Modeling Analysis.

APIS Number	Facility/Source	Facility Location Relative X,Y, (m)		ISCST ID	APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions (g/s)	Merged Stack Parameter M Test ^b			
						(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)					
40MAN410010	Florida Power & Light Manatee	-37800	-3600	FPCBTD4	05-08	45.0	13.7	17.3	5.27	73.0	22.25	930	772.0	12.80				
				FPCBT09	09	25.0	7.6	0.9	0.27	0.1	0.04	77	298.1	0.01				
					01	475.0 ^c	144.8	26.2	8.00	56.0	17.07	307	425.9	67.45				
					02	475.0 ^c	144.8	26.2	8.00	56.0	17.07	307	425.9	1089.30				
				FPLMNC2	01,02	475.0	144.8	26.2	8.00	56.0	17.07	307	425.9	1156.75				
				FPLMNBA	--	100.0	30.5	4.3	1.30	40.0	12.20	115	319.0	15.95				
40TPA530034	IMC Fertilizer Kingsford	-6800	18000	IMKNG04	04	70.0	21.3	7.0	2.13	47.6	14.52	165	346.9	3.25				
				IMKNG05	05	106.0	32.3	2.5	0.76	67.9	20.70	95	308.0	4.46				
				IMKNG06	06	35.0	10.7	2.5	0.76	34.0	10.35	75	296.9	0.78				
				IMKNGBA	--	60.0	18.3	2.5	0.76	64.5	19.66	110	316.3	3.51				
				IMKNGBB	--	58.0	17.68	1.9	0.58	50.0	15.23	100	310.8	0.14				
40TPA530057	IMC Agrico/Conserve Nichols	-6600	26500	IANIC01 ^a	01	42.0	12.8	4.0	1.22	34.8	10.60	100	310.8	4.92				
					IANIC05 ^a	05	150.0	45.7	7.5	2.29	33.8	10.30	170	349.8	28.89			
						IANIC12	12	81.0	24.7	7.5	2.29	12.4	3.78	130	327.6	4.43		
					02	52.0	15.9	2.5	0.76	66.2	20.18	120	321.9	1.18	39583			
					03	80.0	24.4	3.5	1.07	78.1	23.81	130	327.4	1.18	144826			
					04	72.0	22.0	3.2	0.98	102.0	31.08	190	360.8	1.18	157341			
					06	110.0	33.5	1.4	0.43	45.5	13.86	110	316.3	0.17	125567			
					09	207.0	63.1	1.4	0.43	69.3	21.12	135	330.2	0.63	101419			
					10	207.0	63.1	1.4	0.43	69.3	21.12	135	330.2	0.63	101419			
					15	27.0	8.2	2.0	0.61	45.0	13.72	500	533.2	0.29	60673			
					16	39.0	11.9	3.2	0.98	29.0	8.84	500	533.2	0.43	98310			
					19	207.0	63.1	0.9	0.27	168.0	51.22	140	333.0	1.38	44646			
					--	179.0	54.6	0.6	0.18	47.1	14.37	150	338.6	0.63	10723			
					--	182.0	55.5	1.4	0.43	9.7	2.97	100	310.8	0.20	37179			
				40TPA530059	IMC-Agrico New Wales	-8400	21200	IANICMM		179.0	54.6	0.6	0.18	47.1	14.37	149.8	338.6	7.9
IAWAL09	09	133.0	40.5					7.0	2.13	49.8	15.18	105	313.6	3.60				
IAWAL10	10	133.0	40.5					6.0	1.83	67.8	20.66	110	316.3	4.26				
IAWAL12	12	133.0	40.5					6.0	1.83	61.9	18.87	108	315.2	3.63				
IAWALBA	--	172.0	52.4					8.0	2.44	43.1	13.14	120	321.9	4.64				
IAWALBB	--	172.0	52.4	4.5	1.37	52.4	15.97	105	313.6	3.34								

Table C-4. Summary of Modeling Parameters for the PM AAQS Modeling Analysis.

APIS Number	Facility/Source	Facility Location Relative X,Y, (m)	ISCST ID	APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions	Merged Stack Parameter M
					(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)	(g/s)	Test ^ b
				11	133.0	40.5	4.0	1.22	70.3	21.43	140	333.0	1.93	175228
				15	65.0	19.8	1.0	0.30	169.8	51.75	105	313.6	0.46	49402
				21	60.0	18.3	1.0	0.30	53.1	16.17	105	313.6	0.43	15246
				23	112.0	34.1	1.0	0.30	34.0	10.35	105	313.6	0.43	18216
				24	105.0	32.0	1.0	0.30	140.1	42.69	105	313.6	0.43	70423
				25	117.0	35.7	1.0	0.30	127.3	38.81	105	313.6	0.43	71345
				26	18.0	5.5	1.0	0.30	31.8	9.70	105	313.6	0.20	5902
				28	112.0	34.1	1.0	0.30	34.0	10.35	105	313.6	0.43	18216
				29	133.0	40.5	3.0	0.91	3.3	1.01	105	313.6	2.53	3301
				30	60.0	18.3	1.0	0.30	31.8	9.70	105	313.6	0.43	9146
				31	45.0	13.7	1.0	0.30	31.8	9.70	105	313.6	0.43	6861
				32	87.0	26.5	1.5	0.46	282.9	86.24	330	438.6	0.43	387693
				33	87.0	26.5	1.5	0.46	282.9	86.24	330	438.6	0.43	387693
				34	17.0	5.2	1.3	0.40	125.6	38.27	225	380.2	0.43	22026
				35	57.0	17.4	1.3	0.40	75.3	22.96	175	352.4	0.43	41072
				37	107.0	32.6	1.8	0.55	68.8	20.96	105	313.6	0.43	118431
				38	65.0	19.8	1.5	0.46	47.1	14.37	175	352.4	0.43	38772
				43	104.0	31.7	1.6	0.49	70.5	21.48	105	313.6	0.43	93645
				45	171.0	52.1	6.0	1.83	58.0	17.68	110	316.3	1.78	430683
				47	94.0	28.7	6.0	1.83	35.4	10.78	175	352.4	0.58	493564
				52	118.0	36.0	1.0	0.30	34.0	10.35	105	313.6	0.43	19192
				55	25.0	7.6	4.3	1.31	34.4	10.49	140	333.0	0.66	54358
				56	170.0	51.8	5.0	1.52	6.5	1.97	110	316.3	0.78	75118
				--	86.0	26.2	0.7	0.21	54.1	16.50	80	299.7	0.20	22446
				--	100.0	30.5	1.5	0.46	179.2	54.62	80	299.7	0.12	690999
				--	71.0	21.6	1.0	0.30	34.0	10.35	80	299.7	2.13	2228 Lowest M
				--	171.0	52.1	6.0	1.83	59.0	17.97	110	316.3	1.78	437748
				--	40.0	12.2	0.9	0.27	30.8	9.39	80	299.7	0.81	2425
				--	107.0	32.6	3.5	1.07	52.0	15.84	150	338.6	0.35	449347
				--	100.0	30.5	1.8	0.55	41.3	12.58	102	311.9	0.06	473560
			IAWALMM		71.0	21.6	1.0	0.30	34.0	10.35	80	299.7	21.42	
40TPA530027	IMC Agrico Noralyn Mine	9700	22600	IANOR01	01	76.0	23.2	6.5	1.98	56.8	17.30	250	394.0	4.38
				IANOR02	02	55.0	16.8	9.3	2.83	28.9	8.82	155	341.5	4.72
				IANOR08 ^a	08	38.0	11.6	1.9	0.58	23.5	7.17	140	333.0	3.83
				IANOR09 ^a	09	38.0	11.6	1.9	0.58	23.5	7.17	140	333.0	3.83
				IANOR10 ^a	10	38.0	11.6	1.9	0.58	23.5	7.17	140	333.0	5.21
				IANOR11	11	25.0	7.6	1.5	0.46	37.7	11.50	75	296.9	3.22
				IANOR14	14	135.0	41.2	2.8	0.85	55.0	16.75	60	288.6	4.35
				IANOR17	17	24.0	7.3	2.0	0.61	26.5	8.09	110	316.3	4.98
				IANOR18	18	150.0	45.7	3.5	1.07	52.0	15.84	100	310.8	4.40

Table C-4. Summary of Modeling Parameters for the PM AAQS Modeling Analysis.

APIS Number	Facility/Source	Facility Location Relative X,Y, (m)		ISCST ID	APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions (g/s)	Merged Stack Parameter M Test ^b		
						(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)				
40TPA530055 IMC-Agrico South Pierce	2500 13600					03	54.0	16.5	1.0	0.30	63.6	19.40	115	319.1	1.27	5671	
						04	27.0	8.2	2.0	0.61	53.1	16.17	85	302.4	1.90	6190	
						12	27.0	8.2	2.0	0.61	15.9	4.85	75	296.9	0.35	9895	
						13	27.0	8.2	2.0	0.61	53.1	16.17	85	302.4	1.90	6190	
						15	43.0	13.1	2.0	0.61	59.4	18.11	86	303.0	1.90	11065	
						16	24.0	7.3	2.0	0.61	26.5	8.09	110	316.3	2.39	2290 Lowest M	
						IANORMM	24.0	7.3	2.0	0.61	26.5	8.09	110	316.3	9.71		
						IASOU22 ^a	22	10.0	3.0	1.8	0.55	67.9	20.69	160	344.3	4.01	
						IASOU23	23	140.0	42.7	9.0	2.74	35.0	10.66	89	304.8	4.41	
						IASOU26	26	60.0	18.3	1.0	0.30	31.8	9.70	122	323.1	4.30	
						IASOUC15	30 - 45	24.0	7.3	1.0	0.30	3.3	1.00	200	366.5	5.62	
						IASOU03 ^a	01	35.0	10.7	4.8	1.46	51.7	15.76	430	494.3	0.22	630012
							03	88.0	26.8	3.0	0.91	30.3	9.23	94	307.6	0.55	90204
							12	96.0	29.3	1.3	0.40	3.8	1.15	77	298.1	0.00	327236
							13	68.0	20.7	1.5	0.46	9.4	2.87	77	298.1	0.01	259872
							14	53.0	16.2	1.5	0.46	5.6	1.72	77	298.1	0.01	218497
							16	65.0	19.8	1.6	0.49	18.0	5.48	99	310.4	0.26	24017
							17	65.0	19.8	1.6	0.49	290.2	88.45	81	300.4	0.02	5251731
							24	80.0	24.4	11.0	3.35	25.6	7.80	75	297.0	2.53	197084
							25	80.0	24.4	11.0	3.35	23.7	7.23	72	295.4	2.53	181667
							27	96.0	29.3	1.3	0.40	3.8	1.15	77	298.1	0.15	8181 Lowest M
							28	96.0	29.3	1.3	0.40	3.8	1.15	77	298.1	0.04	32724
							29	53.0	16.2	1.3	0.40	7.5	2.30	77	298.1	0.01	216794
						IASOUMM	96.0	29.3	1.3	0.40	3.8	1.15	77	298.1	6.33		
40TPA530080 Imperial Phosphate	-200 11800					01	90.0	27.4	5.0	1.52	67.0	20.42	140	333.0	2.27		
						02	90.0	27.4	2.0	0.61	23.0	7.01	430	494.0	0.12		
						03	90.0	27.4	4.6	1.40	64.0	19.51	140	333.0	2.27		
40HIL290018 LaFarge Corp.	-47300 32900					LAFRG29	29	146.0	44.5	8.0	2.44	132.0	40.24	431	494.8	11.98	
						LAFRG30	30	101.0	30.8	12.5	3.81	20.0	6.09	264	401.9	5.67	
						01	98.0	29.9	1.6	0.49	39.8	12.13	77	298.0	0.14	145434	
						02	98.0	29.9	1.6	0.49	39.8	12.13	77	298.0	0.14	145434	
						03	102.0	31.1	1.9	0.58	64.7	19.71	77	298.0	0.35	137848	
						05	100.0	30.5	2.5	0.76	40.7	12.42	77	298.0	0.40	127941	
						06	147.0	44.8	1.7	0.52	44.1	13.43	77	298.0	0.20	190429	

Table C-4. Summary of Modeling Parameters for the PM AAQS Modeling Analysis.

APIS Number	Facility/Source	Facility Location Relative X,Y, (m)	ISCST ID	APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions	Merged Stack Parameter M
					(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)	(g/s)	Test ^b
				07	147.0	44.8	1.7	0.52	44.1	13.43	77	298.0	0.20	190429
				08	147.0	44.8	1.7	0.52	44.1	13.43	77	298.0	0.20	190429
				09	171.0	52.1	1.1	0.34	84.2	25.66	77	298.0	0.14	258462
				11	47.0	14.3	1.3	0.40	62.8	19.14	77	298.0	0.17	60418
				12	83.0	25.3	2.3	0.70	80.2	24.45	77	298.0	0.63	112606
				13	83.0	25.3	3.4	1.04	62.4	19.02	77	298.0	1.09	111758
				14	57.0	17.4	2.2	0.67	57.0	17.37	157	342.4	0.20	182114
				15	30.0	9.1	2.4	0.73	55.2	16.84	77	298.0	0.49	39178
				16	83.0	25.3	3.4	1.04	62.4	19.02	77	298.0	1.09	111758
				17	90.0	27.4	1.1	0.34	87.7	26.73	77	298.0	0.40	49594
				18	16.0	4.9	2.4	0.73	55.2	16.84	77	298.0	0.49	20918
				19	83.0	25.3	3.4	1.04	62.4	19.02	77	298.0	1.09	111758
				20	57.0	17.4	2.2	0.67	57.0	17.37	77	298.0	0.40	79249
				21	30.0	9.1	2.4	0.73	55.2	16.84	77	298.0	0.49	39178
				23	49.0	14.9	2.2	0.67	35.1	10.69	77	298.0	0.26	64537
				24	49.0	14.9	2.2	0.67	35.1	10.69	77	298.0	0.26	64537
				25	72.0	22.0	0.8	0.24	265.3	80.85	77	298.0	0.26	92017
				27	20.0	6.1	2.2	0.67	78.9	24.06	100	310.8	0.58	27728
				31	49.0	14.9	2.0	0.61	63.6	19.40	77	298.0	0.37	68221
				42	174.0	53.0	1.5	0.46	75.5	23.00	77	298.0	2.53	23880
				43	174.0	53.0	1.5	0.46	94.3	28.75	77	298.0	0.29	260415
				44	60.0	18.3	1.0	0.30	112.0	34.15	77	298.0	0.17	77393
				45	60.0	18.3	1.0	0.30	112.0	34.15	77	298.0	0.17	77393
				50	123.0	37.5	1.0	0.30	84.9	25.87	77	298.0	0.14	145926
				--	33.0	10.1	2.4	0.73	55.2	16.84	196	364.1	0.37	69774
				--	5.0	1.5	1.9	0.58	58.8	17.92	100	310.8	0.32	6990 Lowest M
				--	95.0	29.0	1.5	0.46	37.7	11.50	77	298.0	0.14	117812
				--	57.0	17.4	2.2	0.67	57.0	17.37	77	298.0	0.40	79249
				--	73.0	22.3	1.9	0.58	76.4	23.29	77	298.0	0.37	110271
				--	115.0	35.1	1.9	0.58	70.5	21.50	100	310.8	0.37	167244
				--	33.0	10.1	2.4	0.73	55.2	16.84	196	364.1	0.20	129082
				--	90.0	27.4	1.0	0.30	106.1	32.34	77	298.0	0.17	109917
				--	34.0	10.4	1.1	0.34	107.0	32.61	77	298.0	0.20	45703
				--	83.0	25.3	3.4	1.04	62.4	19.02	180	355.2	0.26	558454
				--	57.0	17.4	2.2	0.67	57.0	17.37	157	342.4	0.26	140088
				--	83.0	25.3	3.4	1.04	62.4	19.02	180	355.2	0.20	725990
				--	83.0	25.3	1.3	0.40	80.3	24.49	77	298.0	0.20	116013
				--	33.0	10.1	2.4	0.73	55.2	16.84	196	364.1	0.26	99294
			LAFRGMM		5.0	1.5	1.9	0.58	58.8	17.92	100	310.8	17.06	
40TPA530004	Lakeland City Power McIntosh	3500	48100	LAKMC01 ^a	01	150.0	45.7	9.0	2.74	78.0	23.77	295	419.3	12.41

Table C-4. Summary of Modeling Parameters for the PM AQS Modeling Analysis.

APIS Number	Facility/Source	Facility Location Relative X,Y, (m)	ISCST ID	APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions (g/s)	Merged Stack Parameter M Test ^b
					(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)		
40TPA530047	Mobil Mining & Minerals Nichols	-6600 27600	LAKMCD2	02	20.0	6.1	2.6	0.79	77.0	23.47	715	652.6	0.12	
				03	20.0	6.1	2.6	0.79	77.0	23.47	715	652.6	0.12	
				02,03	20.0	6.1	2.6	0.79	77.0	23.47	715	652.6	0.24	
				LAKMC04	04	36.0	11.0	9.2	1.0	0.30	965	791.5	0.58	
				LAKMC05	05	156.0	47.6	10.4	3.17	69.0	21.03	265	402.6	
				LAKMC06	06	250.0	76.2	16.0	4.88	107.0	32.61	170	350.0	
			MBNIC01 MBNIC02 MBNIC04 ^a MBNIC11	01	80.0	24.4	7.5	2.29	41.5	12.65	160	344.3	4.55	
				02	80.0	24.4	7.5	2.29	41.5	12.65	160	344.3	5.50	
				04	85.0	25.9	7.5	2.29	52.8	16.10	150	338.7	3.11	
				11	85.0	25.9	5.0	1.52	63.6	19.40	75	296.9	7.00	
				07	15.0	4.6	1.4	0.43	54.1	16.50	103	312.4	0.14	
				10	85.0	25.9	5.5	1.68	47.7	14.54	80	299.7	1.96	
				--	80.0	24.4	1.6	0.49	38.3	11.68	129	326.9	1.55	
				--	80.0	24.4	1.6	0.49	38.3	11.68	129	326.9	1.41	
				--	40.0	12.2	3.5	1.07	38.8	11.83	160	344.1	1.38	
				--	100.0	30.5	3.6	1.10	62.4	19.02	150	338.6	1.12	
				--	13.0	4.0	2.5	0.76	7.0	2.12	480	521.9	0.72	
				--	79.0	24.1	0.8	0.24	48.0	14.64	170	349.7	0.06	
				MBNICMM		13.0	4.0	2.5	7.0	2.12	480	521.9	8.34	
			MLPHS02 MLPHS05 MLPHSBA MLPHSBB	02	200.0	61.0	7.0	2.13	32.5	9.90	200	366.3	3.83	
				05	102.0	31.1	8.8	2.68	26.8	8.16	110	316.3	29.48	
				--	80.0	24.4	3.0	0.91	35.6	10.85	91	305.8	4.87	
				--	74.0	22.6	3.5	1.07	12.5	3.80	95	308.0	1.93	
40HIL290039	TECO Big Bend	-43100 17300	TECBB02A TECBB03 TECBB04 ^a	01,02	490.0	149.4	24.0	7.32	94.0	28.65	300	422.0	50.96	
				03	490.0	149.4	24.0	7.32	47.0	14.33	292	417.6	51.97	
				04	490.0	149.4	24.0	7.32	65.0	19.81	156	342.2	54.61	
				05	75.0	22.9	14.0	4.27	26.8	8.17	928	770.9	4.17	
				06	75.0	22.9	14.0	4.27	26.8	8.17	928	770.9	4.17	
			TECBB02B	05,06	75.0	22.9	14.0	4.27	26.8	8.17	928	770.9	8.34	
			TECBB07	07	35.0	10.7	10.4	3.17	18.2	5.55	1010	816.5	4.17	
			TECBB08	08	102.0	31.1	2.5	0.76	52.6	16.04	250	394.1	0.66	
			TECBB09	09	113.0	34.4	0.9	0.27	406.1	123.77	250	394.1	2.10	

Table C-4. Summary of Modeling Parameters for the PM AAQS Modeling Analysis.

APIS Number	Facility/Source	Facility Location Relative X,Y, (m)		ISCST ID	APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions (g/s)	Merged Stack Parameter M Test ^ b	
						(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)			
40HIL290040	TECO Gannon	-45000	29800	TECBB14 ^ a	14	139.0	42.4	1.6	0.49	59.7	18.19	140	333.0	0.03		
					15	179.0	54.6	1.7	0.52	69.0	21.04	78	298.6	0.06		
					16	179.0	54.6	1.7	0.52	69.0	21.04	78	298.6	0.06		
					17	179.0	54.6	1.7	0.52	69.0	21.04	78	298.6	0.06		
				TECBBD3	15,16,17	179.0	54.6	1.7	0.52	69.0	21.04	78	298.6	0.18		
					01	306.0	93.3	10.4	3.17	79.0	24.08	309	427.0	15.89		
					02	306.0	93.3	10.4	3.17	79.0	24.08	309	427.0	15.89		
				TECGND2	01,02	306.0	93.3	10.4	3.17	79.0	24.08	309	427.0	31.78		
					03	306.0	93.3	11.0	3.35	99.0	30.18	300	422.0	20.18		
				TECGN04	04	306.0	93.3	10.0	3.05	72.0	21.95	329	438.2	23.69		
				TECGN05	05	306.0	93.3	10.8	3.29	123.7	37.70	288	415.4	28.76		
				TECGN06	06	306.0	93.3	17.5	5.33	77.0	23.47	292	417.6	47.91		
				TECGN07	07	35.0	10.7	11.0	3.35	16.4	5.00	1010	816.5	15.40		
				TECGN09	09	72.0	21.9	0.7	0.21	36.0	10.96	350	449.7	0.03		
				TECGN10	10	107.0	32.6	1.0	0.30	99.6	30.37	350	449.7	0.14		
				TECGN11	11	104.0	31.7	2.0	0.61	59.9	18.27	350	449.7	0.37		
					13	175.0	53.3	1.7	0.52	70.5	21.49	78	298.6	0.03		
					14	175.0	53.3	1.7	0.52	70.5	21.49	78	298.6	0.03		
					16	175.0	53.3	1.7	0.52	70.5	21.49	78	298.6	0.03		
					18	175.0	53.3	1.7	0.52	70.5	21.49	78	298.6	0.03		
				TECGND3A	13,14,18	175.0	53.3	1.7	0.52	70.5	21.49	78	298.6	0.12		
				TECGN15	15	177.0	53.9	2.0	0.61	50.9	15.52	78	298.6	0.03		
				TECGN17	17	174.0	53.0	1.2	0.37	79.6	24.26	78	298.6	0.03		
NA	TECO - Polk Power Station	-2500	9650	TECPKBA ^ a	--	20.0	6.1	3.0	0.90	43.0	13.10	500	533.0	2.02		
				TECPKBB ^ a	--	150.0	45.7	19.0	5.80	55.1	16.79	260	400.0	7.43		
				TECPKBC ^ a	--	199.0	60.7	3.5	1.07	30.0	9.14	1400	1033.0	3.15		
40TPA250015	TPS - Hardee Power Station	-181	-378	HRDEX01 ^ a	01	90.0	27.4	14.5	4.42	80.0	24.38	253	396.0	1.26		
		-181	-392	HRDEX02 ^ a	02	90.0	27.4	14.5	4.42	80.0	24.38	253	396.0	1.26		
		-146	-509	HRDEX03 ^ a	03	75.0	22.9	16.0	4.88	103.0	31.39	953	785.0	1.26		
40TPA530051	USAgri-Chemicals Fort Meade	11000	11300	UAFTM03	03	52.0	15.9	6.0	1.83	36.4	11.10	146	336.3	2.45		
				UAFTM04	04	52.0	15.9	6.0	1.83	36.0	10.96	143	334.7	5.07		

Table C-4. Summary of Modeling Parameters for the PM AQS Modeling Analysis.

APIS Number	Facility/Source	Facility Location Relative X,Y, (m)	ISCST ID	APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions	Merged Stack Parameter M
					(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)	(g/s)	Test ^b
			UAFTM06	06	70.0	21.3	3.7	1.13	49.1	14.97	400	477.4	12.61	
			UAFTM14	14	122.0	37.2	2.8	0.85	50.6	15.43	88	304.1	0.46	
			UAFTM28	28	6.0	1.8	0.3	0.09	344.0	104.86	270	405.2	0.49	
			UAFTM29	29	6.0	1.8	0.3	0.09	158.0	48.15	260	399.7	0.23	
			UAFTMBA	--	53.0	16.2	1.5	0.46	28.3	8.62	100	310.8	0.12	
			UAFTMBB	--	53.0	16.2	1.5	0.46	28.3	8.62	180	355.2	0.12	
			UAFTMBC	--	58.0	17.7	1.5	0.46	28.3	8.62	100	310.8	0.12	
			UAFTMBD	--	64.0	19.5	1.4	0.43	81.7	24.91	95	308.0	2.50	
			UAFTMBE	--	80.0	24.4	2.5	0.76	12.6	3.83	108	315.2	3.08	
			UAFTMBF	--	93.0	28.4	5.0	1.52	35.0	10.66	129	326.9	0.23	
			UAFTMBG	--	69.0	21.0	1.7	0.52	72.7	22.16	108	315.2	2.48	
			UAFTMBH	--	89.0	27.1	15.0	4.57	8.0	2.44	81	300.2	0.40	
			UAFTMBI	--	93.0	28.4	5.0	1.52	35.0	10.66	129	326.9	0.20	
			UAFTMBJ	--	53.0	16.2	1.5	0.46	28.3	8.62	180	355.2	0.12	

Notes:

Some point sources provided by TECO PPS data were identified with an APIS source number.

The facility UTM location was based upon data provided by FDEP.

^a PM PSD increment consuming source. Note that some PSD increment consuming sources are combined into merged stacks in the AQS inventory.

^b M parameter used for merging multiple stacks at a single facility. Where $M = (\text{Stack ht (m)} \times \text{Airflow (m}^3/\text{s)} \times \text{Exit Temperature (K)}) / \text{Maximum emissions (g/s)}$, based on Screening Procedures for Estimating Air Quality Impacts From Stationary Sources (EPA, 1992)

For each industrial facility within 20 km from the proposed SECI Hardee Unit 3, individual sources emitting less than 100 TPY (2.68 g/s) each were merged. The parameters for the merged stack are equal to the parameters of the individual stack with the minimum M parameter. The emissions for the merged stack is the sum of emissions from the individual stacks being merged at that facility.

^c GEP stack ht

ATTACHMENT D

**PSD CLASS II SO₂ AND PM EMISSION INVENTORIES AND PSD CLASS I SO₂
EMISSION INVENTORY OF MODELED SOURCES**

Table D-1. Summary of Individual Source Emission and Operating Parameters for the SO₂ PSD Class II Modeling Analysis

APIS ID #	APIS Source No.	Facility/Source Description	Facility Location UTM E,N (km)		Stack Height		Stack Diameter		Exit Velocity		Exit Temperature		Maximum SO ₂ Emissions (g/s)
			Relative X,Y (m) ^a		(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(F)	(K)	
NA		Borden Hillsborough	394.6	3069.6	100.0	30.5	6.0	1.82	48.5	14.79	160	344.0	-6.48
			-10400	11900									
40HIL290008		Cargill/Gardinier Riverview	363.4	3082.4									
		SAP 4,5,6	-41600	24700	74.1	22.6	5.0	1.52	23.0	7.00	194	363.0	-187.70
		SAP 7			149.6	45.6	7.5	2.29	30.2	9.20	152	340.0	-26.25
		SAP 8			149.6	45.6	8.0	2.44	45.7	13.93	151	339.0	-41.16
		SAP 9 Baseline			149.6	45.6	9.0	2.74	33.8	10.30	170	350.0	-54.60
	06	SAP 9 Proposed Mod.			149.6	45.6	9.0	2.74	41.5	12.66	170	350.0	67.20
40TPA530046		Cargill/Seminole Bartow	409.8	3087.0									
		SAP 1	4800	29300	150.0	45.7	4.5	1.37	54.1	16.50	174	352.0	-108.00
		SAP 2			150.0	45.7	4.5	1.37	54.1	16.50	174	352.0	-108.00
		SAP 3			150.0	45.7	5.0	1.52	54.8	16.70	100	311.0	-52.50
	12,32,33	SAP 4,5,6 current			200.0	61.0	6.8	2.06	62.0	18.90	179	355.0	143.77
		Dryer			50.0	15.2	6.7	2.04	56.8	17.32	129	327.0	-39.66
40TPA530052		CF Industries Bartow Bonnie Mine Rd	408.4	3082.4									
	--	DAP 1-3	3400	24700	119.4	36.4	7.0	2.13	52.9	16.11	151	339.0	3.97
	05	SAP 5			206.0	62.8	7.0	2.13	35.7	10.88	190	361.0	50.40
	06	SAP 6			206.0	62.8	7.0	2.13	23.9	7.28	206	370.0	50.40
	--	SAP 7			220.0	67.1	7.9	2.40	32.2	9.80	172	351.0	42.00
		SAP 1			100.0	30.5	4.5	1.37	40.0	12.20	170	350.0	-60.90
		SAP 2			100.0	30.5	5.5	1.68	34.0	10.37	170	350.0	-110.25
		SAP 3			100.0	30.5	9.0	2.74	14.0	4.27	196	364.0	-107.10
		SAP 4			100.0	30.5	7.0	2.13	26.0	7.93	185	358.0	-174.83
		SAP 5			206.0	62.8	7.0	2.13	35.0	10.67	185	358.0	-226.80
		SAP 6			206.0	62.8	7.0	2.13	34.0	10.37	187	359.0	-170.10
NA		Dolime	404.8	3069.5									
		Dryers	-200	11800	90.0	27.4	5.0	1.52	67.8	20.67	140	333.0	-5.68
		Boilers			90.0	27.4	2.0	0.61	23.8	7.25	430	494.1	-4.52
NA		Estech/Swift Polk	411.5	3074.2									
		Dryer	6500	16500	60.0	18.3	9.7	2.95	27.8	8.47	151	339.0	-23.94
		Dryer			61.5	18.8	9.7	2.95	16.6	5.06	152	340.0	-22.80
		SAP			101.0	30.8	7.0	2.13	12.8	3.90	185	358.0	-92.87

Table D--1. Summary of Individual Source Emission and Operating Parameters for the SO₂ PSD Class II Modeling Analysis

APIS ID #	APIS Source No.	Facility/Source Description	Facility Location UTM E,N (km)		Stack Height		Stack Diameter		Exit Velocity		Exit Temperature		Maximum SO ₂ Emissions (g/s)
			Relative X,Y (m) ^a		(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(F)	(K)	
40TPA530053	03,04	Farmland Industries -- Green Bay	409.5	3079.5									
		1,2 H ₂ SO ₄	4500	21800	100.0	30.5	4.5	1.37	66.2	20.18	100	311.0	-83.98
		3,4 H ₂ SO ₄			100.0	30.5	7.5	2.29	30.4	9.27	179	355.0	67.16
		5 H ₂ SO ₄			150.0	45.7	8.0	2.44	38.0	11.58	179	355.0	50.40
30ORL490014	07 08	FPC Intercession City	446.3	3126.0									
		4 CTs 7EA	41300	68300	50.0	15.2	13.8	4.21	184.4	56.21	1016	819.8	124.40
		2 CTs 7FA			50.0	15.2	23.1	7.04	105.2	32.07	1126	880.8	110.40
NA		FPC Polk County Site	414.3	3073.9	113.0	34.4	13.5	4.11	133.0	40.54	260	400.0	24.70
			9300	16200									
40TPA530057	05	IMC--Agrico/Conserve Nichols	398.4	3084.2									
		--	-6600	26500	100.0	30.5	5.9	1.80	62.0	18.90	95	308.0	-15.20
		H ₂ SO ₄ #1			150.0	45.7	7.5	2.29	33.8	10.30	174	352.0	42.00
		Rock Dryer			80.0	24.4	5.0	1.52	42.3	12.90	151	339.0	-3.88
40TPA530059	44 46 02 42	IMC--Agrico New Wales	396.6	3078.9									
		DAP	-8400	21200	120.0	36.6	6.0	1.83	66.1	20.15	115	319.1	5.54
		Multiphos			172.0	52.4	4.6	1.40	51.8	15.80	106	314.0	4.80
		SAP 1,2,3 projected			200.0	61.0	8.5	2.60	50.2	15.31	170	350.0	189.00
		SAP 4,5 projected			199.0	60.7	8.5	2.60	50.2	15.31	170	350.0	126.00
		Rock dryer			69.0	21.0	7.0	2.13	61.0	18.60	165	347.0	-34.27
		SAP 1,2,3 baseline			200.1	61.0	8.5	2.60	46.9	14.28	170	350.0	-146.00
		AFI plant			172.0	52.4	7.9	2.40	43.0	13.10	120	322.0	0.20
NA		IMC--Agrico Pierce	404.1	3079.0									
		Dryers 1,2	-900	21300	80.0	24.4	5.0	1.52	42.5	12.94	151	339.0	-24.32
		Dryers 3,4			80.0	24.4	8.0	2.43	61.7	18.82	151	339.0	-23.00
40TPA530055	04,05 10	IMC--Agrico South Pierce	407.5	3071.3									
		Baseline	2500	13600	150.0	45.7	5.2	1.60	86.6	26.40	170	350.0	-75.60
		#10,11			150.0	45.7	5.2	1.60	128.1	39.06	170	350.0	113.50
		DAP			125.0	38.1	10.2	3.10	47.9	14.60	131	328.0	4.41

Table D-1. Summary of Individual Source Emission and Operating Parameters for the SO₂ PSD Class II Modeling Analysis

APIS ID #	APIS Source No.	Facility/Source Description	Facility Location UTM E,N (km)		Stack Height		Stack Diameter		Exit Velocity		Exit Temperature		Maximum SO ₂ Emissions (g/s)
			Relative X,Y (m) ^ a		(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(F)	(K)	
40TPA530080		Imperial Phosphates (Brewer)	404.8 -200	3069.5 11800	90.0	27.4	7.5	2.29	50.0	15.25	151	339.0	-19.26
40TPA530003		Lakeland Utilities Larsen CT	409.2 4200	3102.8 45100	100.0	30.5	19.0	5.79	92.6	28.22	950	783.2	29.11
40TPA530004	06	Lakeland Utilities McIntosh 3	408.5 3500	3105.8 48100	250.0	76.2	16.0	4.88	107.0	32.61	170	350.0	500.10
40TPA530060		Mobil Electrophos Division	405.6	3079.4									
		Boiler	600	21700	24.0	7.3	3.0	0.91	10.6	3.23	376	464.0	-6.53
		Boiler			20.0	6.1	3.0	0.91	25.3	7.71	376	464.0	-10.05
		Rock Dryer			60.0	18.3	6.0	1.83	22.3	6.79	170	350.0	-21.81
		Calciner			84.0	25.6	7.0	2.13	22.9	6.97	91	306.0	-7.11
		Coke Dryer			60.0	18.3	2.3	0.70	75.0	22.87	120	322.0	-3.17
		Furnace			96.0	29.3	7.0	2.13	28.0	8.52	106	314.0	-47.25
40HIL290102		Mobil Big Four Mine /AMAX Dryer	394.80 -10200	3067.72 10020	27.0	8.2	1.3	0.41	24.8	7.57	449	505.0	0.60
	01	Dryer	394.85 -10150	3069.77 12070	100.0	30.5	6.0	1.82	23.8	7.26	142	334.0	16.35
40TPA530047		Mobil Mining & Minerals Nichols	398.4	3085.3									
	04	Rock Surge Dryer	-6600	27600	85.0	25.9	7.5	2.29	52.8	16.10	150	338.7	2.44
		Boiler			93.2	28.4	3.6	1.09	63.1	19.24	152	340.0	-13.89
		Boiler			13.0	4.0	2.6	0.80	5.9	1.80	480	522.0	-0.87
NA		Mulberry Cogeneration	413.6	3080.6									
		CT	8600	22900	125.0	38.1	15.0	4.57	61.9	18.87	219	377.0	12.70
		Duct Burner			125.0	38.1	6.5	1.98	30.5	9.31	300	422.0	0.65
40TPA530048		Mulberry Phosphates (Royster)	406.8	3085.1									
		Unit #1	1800	27400	167.3	51.0	7.0	2.13	32.5	9.90	181	356.0	-257.60
	02	Unit #2			200.0	61.0	7.0	2.13	32.5	9.90	200	366.5	35.70
40HIL290039		TECO Big Bend	361.9	3075.0									

Table D-1. Summary of Individual Source Emission and Operating Parameters for the SO₂ PSD Class II Modeling Analysis

APIS ID #	APIS Source No.	Facility/Source Description	Facility Location UTM E,N (km)		Stack Height		Stack Diameter		Exit Velocity		Exit Temperature		Maximum SO ₂ Emissions (g/s)
			Relative X,Y (m) ^ a		(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(F)	(K)	
NA	04	Unit 3 (24-hr)	-43100	17300	490.0	149.4	24.0	7.32	47.0	14.33	293	418.0	-1218.00
		Unit 4			490.0	149.4	24.0	7.32	65.0	19.81	156	342.2	653.94
		Units 1,2 (24-hr)			490.0	149.4	24.0	7.32	94.0	28.65	300	422.0	-2436.00
		TECO Polk Power	402.50	3067.35	20.0	6.1	3.0	0.90	43.0	13.10	500	533.0	0.33
		Aux Boiler	-2500	9650									
		IGCC											
		Thermal Ox + Tail Gas											
	40TPA250015	TPS - Hardee ^ b	404.8	3057.3	90.0	27.4	14.5	4.42	80.0	24.38	253	396.0	92.53
		Unit 1A	-200	-400									
		Unit 1B											
	03	Unit 2A Simple Cycle			75.0	22.9	16.0	4.88	103.0	31.39	953	785.0	92.53
40TPA530050		US Agri-Chem Bartow	413.2	3086.3	51.8	15.8	6.0	1.83	32.8	10.01	138	332.0	-3.41
		Dryer	8200	28600									
40TPA530051	16	SAP			95.0	29.0	7.0	2.12	24.6	7.50	89	305.0	-42.00
		US Agri-Chem Ft Meade	416.0	3069.0	95.0	29.0	9.9	3.02	22.2	6.77	106	314.0	-78.80
		H ₂ SO ₄ X	11000	11300									
		H ₂ SO ₄ 1											
		H ₂ SO ₄ 2											
		GTSP											
	17				175.0	53.3	8.5	2.59	32.9	10.04	180	355.4	46.24
					175.0	53.3	8.5	2.59	32.9	10.04	180	355.4	46.24
					93.0	28.3	5.0	1.52	57.7	17.60	134	330.0	-18.27

Note : The APIS source number is shown for SO₂ PSD increment consuming sources that are also included in the AAQS inventory.

^ a Locations are relative to the proposed Hardee Unit 3 (UTM location East,North (km) of 405.0, 3057.7)

^ b Site specific coordinates were used in modeling analysis (see following table).

Table D-2. Summary of Modeling Parameters for SO2 PSD Class II Modeling Analysis.

APIS ID #	APIS Source No.	Facility/Source Description	ISCST ID	Relative Location (m)		Stack Height		Stack Diameter		Exit Velocity		Exit Temperature		Maximum SO2 Emissions (g/s)
				X	Y	(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(F)	(K)	
NA		Borden Hillsborough	BORDHIL	-10400	11900	100.0	30.5	6.0	1.82	48.5	14.79	160	344.0	-6.48
40HIL29008		Cargill Fertilizer (Gardiner) Riverview												
		SAP 4,5,6	CGRIV456	-41600	24700	74.1	22.6	5.0	1.52	23.0	7.00	194	363.0	-187.70
		SAP 7	CGRIV7			149.6	45.6	7.5	2.29	30.2	9.20	152	340.0	-26.25
		SAP 8	CGRIV8			149.6	45.6	8.0	2.44	45.7	13.93	151	339.0	-41.16
		SAP 9 Baseline	CGRIV9B			149.6	45.6	9.0	2.74	33.8	10.30	170	350.0	-54.60
	06	SAP 9 Proposed Mod.	CGRIV06			149.6	45.6	9.0	2.74	41.5	12.66	170	350.0	67.20
40TPA530046		Cargill Fertilizer (Seminole) Bartow												
		SAP 1		4800	29300	150.0	45.7	4.5	1.37	54.1	16.50	174	352.0	-108.00
		SAP 2				150.0	45.7	4.5	1.37	54.1	16.50	174	352.0	-108.00
			CFBRT12			150.0	45.7	4.5	1.37	54.1	16.50	174	352.0	-216.00
		SAP 3 baseline	CGBRT3A			150.0	45.7	5.0	1.52	54.8	16.70	100	311.0	-52.50
	12,32,33	SAP 4,5,6 current	CGBRTC3			200.0	61.0	6.8	2.06	62.4	19.02	179	355.0	143.77
		Dryer	CGBRTDRY			50.0	15.2	6.7	2.04	56.8	17.32	129	327.0	-39.66
40TPA530052		CF Industries Bartow Bonnie Mine Rd												
	--	DAP 1-3	CFBONAC	3400	24700	119.4	36.4	7.0	2.13	52.9	16.11	151	339.0	3.97
	05	SAP 5	CFBON05			206.0	62.8	7.0	2.13	35.7	10.88	190	361.0	50.40
	06	SAP 6	CFBON06			206.0	62.8	7.0	2.13	23.9	7.28	206	370.0	50.40
	--	SAP 7	CFBONAB			220.0	67.1	7.9	2.40	32.2	9.80	172	351.0	42.00
		SAP 1	CFBON1			100.0	30.5	4.5	1.37	40.0	12.20	170	350.0	-60.90
		SAP 2	CFBON2			100.0	30.5	5.5	1.68	34.0	10.37	170	350.0	-110.25
		SAP 3	CFBON3			100.0	30.5	9.0	2.74	14.0	4.27	196	364.0	-107.10
		SAP 4	CFBON4			100.0	30.5	7.0	2.13	26.0	7.93	185	358.0	-174.83
		SAP 5				206.0	62.8	7.0	2.13	35.0	10.67	185	358.0	-226.80
		SAP 6				206.0	62.8	7.0	2.13	34.0	10.37	187	359.0	-170.10
			CFBON56			206.0	62.8	7.0	2.13	35.0	10.67	187	359.0	-396.9
NA		Dolime Dryers	DOLIMEDRY	-200	11800	90.0	27.4	5.0	1.52	67.8	20.67	140	333.0	-5.68
		Boilers	DOLIMEBLR			90.0	27.4	2.0	0.61	23.8	7.25	430	494.1	-4.52
NA		Estech/Swift Polk Dryer	ESTDRY1	6500	16500	60.0	18.3	9.7	2.95	27.8	8.47	151	339.0	-23.94
		Dryer	ESTDRY2			61.5	18.8	9.7	2.95	16.6	5.06	152	340.0	-22.80
		SAP	ESTSAP			101.0	30.8	7.0	2.13	12.8	3.90	185	358.0	-92.87

Table D-2. Summary of Modeling Parameters for SO2 PSD Class II Modeling Analysis.

APIS ID #	APIS Source No.	Facility/Source Description	ISCST ID	Relative Location (m)		Stack Height		Stack Diameter		Exit Velocity		Exit Temperature		Maximum SO2 Emissions (g/s)
				X	Y	(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(F)	(K)	
40TPA530053		Farmland Industries Green Bay Plant												
		1,2 H2SO4	FARML12	4500	21800	100.0	30.5	4.5	1.37	66.2	20.18	100	311.0	-83.98
	03,04	3,4 H2SO4	FARMLC2			100.0	30.5	7.5	2.29	30.4	9.27	179	355.0	67.16
	05	5 H2SO4	FARML05			150.0	45.7	8.0	2.44	38.0	11.58	179	355.0	50.40
30ORL490014		FPC Intercession City												
	07	4 CTs 7EA	FPCIN07	41300	68300	50.0	15.2	13.8	4.21	184.4	56.21	1016	819.8	124.40
	08	2 CTs 7FA	FPCIN08			50.0	15.2	23.1	7.04	105.2	32.07	1126	880.8	110.40
NA		FPC Polk County Site	FPCPKC2	9300	16200	113.0	34.4	13.5	4.11	133.0	40.54	260	400.0	24.70
40TPA530057		MC-Agrico/Conserve Nichols												
		--	IANIC	-660	26500	100.0	30.5	5.9	1.80	62.0	18.90	95	308.0	-15.20
	05	H2SO4 #1	IANIC05			150.0	45.7	7.5	2.29	33.8	10.30	174	352.0	42.00
		Rock Dryer	IANICDRY			80.0	24.4	5.0	1.52	42.3	12.90	151	339.0	-3.88
40TPA530059		MC-Agrico New Wales												
	44	DAP	IAWAL44	-8400	21200	120.0	36.6	6.0	1.83	66.1	20.15	115	319.1	5.54
	46	Multiphos	IAWAL46			172.0	52.4	4.6	1.40	51.8	15.80	106	314.0	4.80
		Rock dryer	IAWALDRY			69.0	21.0	7.0	2.13	61.0	18.60	165	347.0	-34.27
		SAP 1,2,3 baseline	IAWAL			200.1	61.0	8.5	2.60	46.9	14.28	170	350.0	-146.00
	27	AFI plant	IAWAL27			172.0	52.4	7.9	2.40	43.0	13.10	120	322.0	0.20
	02	SAP 1,2,3 projected				200.0	61.0	8.5	2.60	50.2	15.31	170	350.0	189.00
	42	SAP 4,5 projected				199.0	60.7	8.5	2.60	50.2	15.31	170	350.0	126.00
			IAWALC2			199.0	60.7	8.5	2.60	50.2	15.31	170	350.0	315.00
NA		MC-Agrico Pierce												
		Dryers 1,2	IAPRC12	-900	21300	80.0	24.4	5.0	1.52	42.5	12.94	151	339.0	-24.32
		Dryers 3,4	IAPRC34			80.0	24.4	8.0	2.43	61.7	18.82	151	339.0	-23.00
40TPA530055		MC-Agrico South Pierce												
		Baseline	IASOUB	2500	13600	150.0	45.7	5.2	1.60	86.6	26.40	170	350.0	-75.60
	04,05	#10,11	IASOUC2			150.0	45.7	5.2	1.60	128.1	39.06	170	350.0	113.50
	10	DAP	IASOU10			125.0	38.1	10.2	3.10	47.9	14.60	131	328.0	4.41
40TPA530080		Imperial Phosphates (Brewer)	IMPRLX	-200	11800	90.0	27.4	7.5	2.29	50.0	15.25	151	339.0	-19.26
40TPA530003		Lakeland Utilities Larsen CT	LAKLRAA	4200	45100	100.0	30.5	19.0	5.79	92.6	28.22	950	783.2	29.11

Table D-2. Summary of Modeling Parameters for SO2 PSD Class II Modeling Analysis.

APIS ID #	APIS Source No.	Facility/Source Description	ISCST ID	Relative Location (m)		Stack Height		Stack Diameter		Exit Velocity		Exit Temperature		Maximum SO2 Emissions (g/s)
				X	Y	(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(F)	(K)	
40TPA530004	06	Lakeland Utilities McIntosh 3	LAKMC06	3500	48100	250.0	76.2	16.0	4.88	107.0	32.61	170	350.0	500.10
40TPA530060		Mobil Electrophos Division												
		Boiler	MOBELE1	600	21700	24.0	7.3	3.0	0.91	10.6	3.23	376	464.0	-6.53
		Boiler	MOBELE2			20.0	6.1	3.0	0.91	25.3	7.71	376	464.0	-10.05
		Rock Dryer	MOBELE3			60.0	18.3	6.0	1.83	22.3	6.79	170	350.0	-21.81
		Calciner	MOBELE4			84.0	25.6	7.0	2.13	22.9	6.97	91	306.0	-7.11
		Coke Dryer	MOBELE5			60.0	18.3	2.3	0.70	75.0	22.87	120	322.0	-3.17
		Furnace	MOBELE6			96.0	29.3	7.0	2.13	28.0	8.52	106	314.0	-47.25
40HIL290102		Mobil Big Four Mine /AMAX												
		Dryer	MBL#4AA	-10200	10020	27.0	8.2	1.3	0.41	24.8	7.57	449	505.0	0.60
	01	Dryer	MBL#401	-10150	12070	100.0	30.5	6.0	1.82	23.8	7.26	142	334.0	16.35
40TPA530047		Mobil Mining & Minerals Nichols												
		Rock Surge Dryer	MBNIC04	-6600	27600	85.0	25.9	7.5	2.29	52.8	16.10	150	338.7	2.44
	04	Boiler	MBNIC1			93.2	28.4	3.6	1.09	63.1	19.24	152	340.0	-13.89
		Boiler	MBNIC2			13.0	4.0	2.6	0.80	5.9	1.80	480	522.0	-0.87
NA		Mulberry Cogeneration												
		CT	MULCNAA	8600	22900	125.0	38.1	15.0	4.57	61.9	18.87	219	377.0	12.70
		Duct Burner	MULCNAB			125.0	38.1	6.5	1.98	30.5	9.31	300	422.0	0.65
40TPA530048		Mulberry Phosphates (Royster)												
		Unit #1	MULPHS1	1800	27400	167.3	51.0	7.0	2.13	32.5	9.90	181	356.0	-257.60
	02	Unit #2	MULPH02			200.0	61.0	7.0	2.13	32.5	9.90	200	366.5	35.70
40HIL290039		TECO Big Bend												
		Unit 3 (24-hr)	TECBB3X	-43100	17300	490.0	149.4	24.0	7.32	47.0	14.33	293	418.0	-1218.00
	04	Unit 4	TECBB04			490.0	149.4	24.0	7.32	65.0	19.81	156	342.2	653.94
		Units 1,2 (24-hr)	TECBB12X			490.0	149.4	24.0	7.32	94.0	28.65	300	422.0	-2436.00
NA		TECO Polk Power												
		Aux Boiler	TECPKAA	-2500	9650	20.0	6.1	3.0	0.90	43.0	13.10	500	533.0	0.33
		IGCC	TECPKAB			150.0	45.7	19.0	5.80	55.1	16.79	260	400.0	49.67
		Thermal Ox + Tail Gas	TECPKAC			199.0	60.7	3.5	1.07	30.0	9.14	1400	1033.0	7.82
40TPA250015		TPS - Hardee												
	01	Unit 1A	HARDEX01	-181	-378	90.0	27.4	14.5	4.42	80.0	24.38	253	396.0	92.53
	02	Unit 1B	HARDEX02	-181	-392	90.0	27.4	14.5	4.42	80.0	24.38	253	396.0	92.53
	03	Unit 2A Simple Cycle Unit	HARDEX03	-146	-509	75.0	22.9	16.0	4.88	103.0	31.39	953	785.0	92.53

Table D-2. Summary of Modeling Parameters for SO2 PSD Class II Modeling Analysis.

APIS ID #	APIS Source No.	Facility/Source Description	ISCST ID	Relative Location (m)		Stack Height		Stack Diameter		Exit Velocity		Exit Temperature		Maximum SO2 Emissions (g/s)
				X	Y	(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(F)	(K)	
40TPA530050		US Agri-Chem Bartow Dryer SAP	UAGBAR1	8200	28600	51.8	15.8	6.0	1.83	32.8	10.01	138	332.0	-3.41
			UAGBAR2			95.0	29.0	7.0	2.12	24.6	7.50	89	305.0	-42.00
40TPA530051	16 17	US Agri-Chem Ft Meade H2SO4 X H2SO4 1 H2SO4 2 GTSP	UAFTMX	11000	11300	95.0	29.0	9.9	3.02	22.2	6.77	106	314.0	-78.80
						175.0	53.3	8.5	2.59	32.9	10.04	180	355.4	46.24
						175.0	53.3	8.5	2.59	32.9	10.04	180	355.4	46.24
			UAFTMC2			175.0	53.3	8.5	2.59	32.9	10.04	180	355.4	92.48
			UAFTMGT			93.0	28.3	5.0	1.52	57.7	17.60	134	330.0	-18.27

Notes: The APIS source number is shown for PSD consuming sources that are also included in the AAQS inventory.
The UTM location for the proposed SECI Hardee Unit 3 is 405.0 km E, 3057.7 km N.

Table D-3. Summary of Individual Source Emissions and Operating Parameters for PM PSD Class II Modeling Analysis.

APIS Number	Facility/Source	Facility Location UTM E, N (km)		APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions		
		Relative X,Y (m)	^a		(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)	(lb/hr)	(TPY)	(g/s)
40TPA530046	Cargill/Seminole Fertilizer	409.8 4800	3087.0 29300	12,32,33	200.0	61.0	6.8	2.06	62.0	18.90	179	355.0	31.2	137	3.93
40HIL530052	CF Industries Bartow	408.4	3082.4	25	135.0	41.2	5.0	1.52	26.0	7.92	77	298.0	40.6	178	5.12
		3400	24700	--	120.0	36.6	7.5	2.29	56.3	17.17	140	333.0	19.4	85	2.45
		--	136.0	41.5	9.3	2.83	59.2	18.05	140	333.0	39.3	172	4.95		
		--	140.0	42.7	2.5	0.76	71.3	21.73	77	298.0	40.5	177	5.10		
		--	121.0	36.9	6.0	1.83	61.5	18.76	150	338.6	40.5	177	5.10		
40TPA530053	Farmland Industries Green Bay Plant	409.5	3079.5	03	100.0	30.5	7.5	2.29	30.4	9.27	179	354.8	6.8	30	0.85
		4500	21800	29	129.0	39.3	7.5	2.29	43.0	13.11	108	315.4	26.9	118	3.39
40TPA530057	IMC Agrico/Conserve Nichols	398.4	3084.2	01	42.0	12.8	4.0	1.22	34.8	10.60	100	310.8	39.0	171	4.92
		-6600	26500	05	150.0	45.7	7.5	2.29	33.8	10.30	170	349.8	229.3	1004	28.89
40TPA530027	IMC Agrico Noralyn Mine	414.7	3080.3	08	38.0	11.6	1.9	0.58	23.5	7.17	140	333.0	30.4	133	3.83
		9700	22600	09	38.0	11.6	1.9	0.58	23.5	7.17	140	333.0	30.4	133	3.83
				10	38.0	11.6	1.9	0.58	23.5	7.17	140	333.0	41.3	181	5.21
40TPA530055	IMC-Agrico South Pierce	407.5	3071.3	03	88.0	26.8	3.0	0.91	30.3	9.23	94	307.6	4.4	19	0.55
		2500	13600	04	150.0	45.7	1.6	5.25	128.1	39.06	170	350.0	11.3	49	1.42
				05	150.0	45.7	1.6	5.25	128.1	39.06	170	350.0	263.5	1154	33.20
				22	10.0	3.0	1.8	0.55	67.9	20.69	160	344.3	31.8	139	4.01
40TPA530004	Lakeland City Power McIntosh	408.5	3105.8	01	150.0	45.7	9.0	2.74	78.0	23.77	295	419.3	98.5	431	12.41
		3500	48100	06	250.0	76.2	16.0	4.88	107.0	32.61	170	350.0	3242.5	14202	408.56
40TPA530047	Mobil Mining & Minerals Nichols	398.4 -6600	3085.3 27600	04	85.0	25.9	7.5	2.29	52.8	16.10	150	338.7	24.7	108	3.11
40HIL290039	TECO Big Bend	361.9 -43100	3075.0 17300	04	490.0	149.4	24.0	7.32	65.0	19.81	156	342.2	433.4	1898	54.61
NA	TECO -- Polk Power Station	402.5	3067.4	--	20.0	6.1	3.0	0.90	43.0	13.10	500	533.0	16.0	70	2.02
		-2500	9650	--	150.0	45.7	19.0	5.80	55.1	16.79	260	400.0	59.0	258	7.43
				--	199.0	60.7	3.5	1.07	30.0	9.14	1400	1033.0	25.0	110	3.15

Table D-3. Summary of Individual Source Emissions and Operating Parameters for PM PSD Class II Modeling Analysis.

APIS Number	Facility/Source	Facility Location UTM E, N (km)		APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions		
		Relative X,Y (m) ^ a			(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)	(lb/hr)	(TPY)	(g/s)
40TPA250015	TPS—Hardee Power Station ^ b	404.8	3057.3	01	90.0	27.4	14.5	4.42	80.0	24.38	253	396.0	10.0	11 ^ c	1.26
		-200	-400	02	90.0	27.4	14.5	4.42	80.0	24.38	253	396.0	10.0	11 ^ c	1.26
				03	75.0	22.9	16.0	4.88	103.0	31.39	953	785.0	10.0	11 ^ c	1.26

Notes:

Some point sources provided by TECO PPS data were identified with an APIS source number.

^a Locations relative to proposed Hardee Unit 3. (UTM location East, North (km) of 405.0, 3057.7)

^b Site specific point locations used in the modeling (see following table)

^c TPS Hardee limited to 25% annual capacity by permit. The TPY reflects 25% of the hourly emission rate over the entire year.

Table D-4. Summary of Modeling Parameters for the PM PSD Class II Modeling Analysis.

APIS Number	Facility/Source	Facility Location Relative X,Y, (m)		ISCST ID	APIS Src #	Stack Height		Stack Diameter		Exit Velocity		Temperature		Maximum PM Emissions (g/s)
						(ft)	(m)	(ft)	(m)	(ft/s)	(m/s)	(F)	(K)	
40TPA530046	Cargill/Seminole Fertilizer Bartow	4800	29300		12	200.0	61.0	6.8	2.06	62.0	18.90	179	355.0	1.35
					32	200.0	61.0	6.8	2.06	62.0	18.90	179	355.0	1.29
					33	200.0	61.0	6.8	2.06	62.0	18.90	179	355.0	1.29
				CGBRTD3	12,32,33	200.0	61.0	6.8	2.06	62.0	18.90	179	355.0	3.94
40HIL530052	CF Industries Bartow Bonnie Mine Road	3400	24700	CFBON25	25	135.0	41.2	5.0	1.52	26.0	7.92	77	298.0	5.12
				CFBONBC	--	121.0	36.9	6.0	1.83	61.5	18.76	150	338.6	5.10
				CFBONBD	--	140.0	42.7	2.5	0.76	71.3	21.73	77	298.0	5.10
				CFBONBE	--	136.0	41.5	9.3	2.83	59.2	18.05	140	333.0	4.95
				CFBONBF	--	120.0	36.6	7.5	2.29	56.3	17.17	140	333.0	2.45
40TPA530053	Farmland Industries	4500	21800	FARML03	03	100.0	30.5	7.5	2.29	30.4	9.27	179	355.0	0.85
				FARML29	29	129.0	39.3	7.5	2.29	43.0	13.11	108	315.4	3.39
40TPA530057	IMC Agrico/Conserve Nichols	-6600	26500	IANIC01	01	42.0	12.8	4.0	1.22	34.8	10.60	100	310.8	4.92
				IANIC05	05	150.0	45.7	7.5	2.29	33.8	10.30	170	349.8	28.89
40TPA530027	IMC Agrico Noralyn Mine	9700	22600		08	38.0	11.6	1.9	0.58	23.5	7.17	140	333.0	3.83
					09	38.0	11.6	1.9	0.58	23.5	7.17	140	333.0	3.83
					10	38.0	11.6	1.9	0.58	23.5	7.17	140	333.0	5.21
				IANORD3A	08,09,10	38.0	11.6	1.9	0.58	23.5	7.17	140	333.0	12.87
40TPA530055	IMC-Agrico South Pierce	2500	13600	IASOU03	03	88.0	26.8	3.0	0.91	30.3	9.23	94	307.6	0.55
				IASOU22	22	10.0	3.0	1.8	0.55	67.9	20.69	160	344.3	4.01
40TPA530004	Lakeland City Power McIntosh	3500	48100	LAKMC01	01	150.0	45.7	9.0	2.74	78.0	23.77	295	419.3	12.41
40TPA530047	Mobil Mining & Minerals Nichols	-6600	27600	MBNIC04	04	85.0	25.9	7.5	2.29	52.8	16.10	150	338.7	3.11
40HIL290039	TECO Big Bend	-43100	17300	TECBB04	04	490.0	149.4	24.0	7.32	65.0	19.81	156	342.2	54.61
				TECBB14	14	139.0	42.4	1.6	0.49	59.7	18.19	140	333.0	0.03
NA	TECO -- Polk Power Station	-2500	9650	TECPKBA	--	20.0	6.1	3.0	0.90	43.0	13.10	500	533.0	2.02
				TECPKBB	--	150.0	45.7	19.0	5.80	55.1	16.79	260	400.0	7.43
				TECPKBC	--	199.0	60.7	3.5	1.07	30.0	9.14	1400	1033.0	3.15
40TPA250015	TPS -- Hardee Power Station	-181	-387	HRDEX01	01	90.0	27.4	14.5	4.42	80.0	24.38	253	396.0	1.26
		-181	-392	HRDEX02	02	90.0	27.4	14.5	4.42	80.0	24.38	253	396.0	1.26
		-146	-509	HRDEX03	03	75.0	22.9	16.0	4.88	103.0	31.39	953	785.0	1.26

Table D-5. Summary of Individual Source Emissions and Operating Parameters for the SO2 PSD Class I Modeling Analysis.

APIS ID #	APIS Source No.	Facility/Source Description	UTM Location (km)		Stack Height		Stack Diameter		Exit Velocity		Exit Temperature		Maximum SO2 Emissions (g/s)
			East	North	(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(F)	(K)	
40TPA270024		Asphalt Pavers 3	359.9	3162.4	40.0	12.2	4.5	1.37	34.7	10.58	219	377.0	2.25
40TPA270015		Asphalt Pavers 4	361.4	3168.4	28.0	8.5	3.5	1.08	35.9	10.95	184	357.4	2.25
40TPA530221		Auburndale Cogeneration	420.8	3103.3	160.1	48.8	18.0	5.50	46.9	14.30	280	411.0	6.40
NA		Borden Hillsborough	394.6	3069.6	100.0	30.5	6.0	1.82	48.5	14.79	160	344.0	-6.48
NA		Borden Polk	414.5	3109.0	56.0	17.1	7.7	2.34	27.1	8.26	140	333.0	-5.29
40HIL290008		Cargill/Gardinier Riverview											
		SAP 4,5,6	363.4	3082.4	74.1	22.6	5.0	1.52	23.0	7.00	194	363.0	-187.70
		SAP 7			149.6	45.6	7.5	2.29	30.2	9.20	152	340.0	-26.25
		SAP 8			149.6	45.6	8.0	2.44	45.7	13.93	151	339.0	-41.16
		SAP 9 Baseline			149.6	45.6	9.0	2.74	33.8	10.30	170	350.0	-54.60
	06	SAP 9 Proposed Mod.			149.6	45.6	9.0	2.74	41.5	12.66	170	350.0	67.20
40TPA530046		Cargill/Seminole Bartow											
		SAP 1	409.8	3087.0	150.0	45.7	4.5	1.37	54.1	16.50	174	352.0	-108.00
		SAP 2			150.0	45.7	4.5	1.37	54.1	16.50	174	352.0	-108.00
		SAP 3 baseline			150.0	45.7	5.0	1.52	54.8	16.70	100	311.0	-52.50
	12,32,33	SAP 4,5,6 current			200.0	61.0	6.8	2.06	62.0	18.90	179	355.0	143.77
		Dryer			50.0	15.2	6.7	2.04	56.8	17.32	129	327.0	-39.66
40TPA530052		CF Industries Bartow Bonnie Mine Rd											
	---	DAP 1-3	408.4	3082.4	119.4	36.4	7.0	2.13	52.9	16.11	151	339.0	3.97
	05	SAP 5			206.0	62.8	7.0	2.13	35.7	10.88	190	361.0	50.40
	06	SAP 6			206.0	62.8	7.0	2.13	23.9	7.28	206	370.0	50.40
	---	SAP 7			220.0	67.1	7.9	2.40	32.2	9.80	172	351.0	42.00
		SAP 1			100.0	30.5	4.5	1.37	40.0	12.20	170	350.0	-60.90
		SAP 2			100.0	30.5	5.5	1.68	34.0	10.37	170	350.0	-110.25
		SAP 3			100.0	30.5	9.0	2.74	14.0	4.27	196	364.0	-107.10
		SAP 4			100.0	30.5	7.0	2.13	26.0	7.93	185	358.0	-174.83
		SAP 5			206.0	62.8	7.0	2.13	35.0	10.67	185	358.0	-226.80
		SAP 6			206.0	62.8	7.0	2.13	34.0	10.37	187	359.0	-170.10
40HIL290005		CF Industries Zephyrhills											

Table D-5. Summary of Individual Source Emissions and Operating Parameters for the SO2 PSD Class I Modeling Analysis.

APIS ID #	APIS Source No.	Facility/Source Description	UTM Location (km)		Stack Height		Stack Diameter		Exit Velocity		Exit Temperature		Maximum SO2 Emissions (g/s)
			East	North	(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(F)	(K)	
		--	388.0	3116.0	110.0	33.5	4.9	1.50	64.0	19.50	109	316.0	88.20
		Proposed D			198.0	60.4	8.0	2.44	58.3	17.77	176	353.0	54.60
		Proposed C			198.0	60.4	8.0	2.44	58.3	17.77	176	353.0	54.60
		Baseline C			198.0	60.4	8.0	2.44	53.8	16.40	176	353.0	-50.40
		Baseline D			198.0	60.4	8.0	2.44	53.8	16.40	176	353.0	-50.40
		--			61.7	18.8	5.0	1.52	61.7	18.80	109	316.0	-105.00
NA		CLM Chemical	361.8	3088.3	98.4	30.0	2.0	0.61	65.6	20.00	215	375.0	21.02
40TPA510066		Couch Const-Zephyrhills (Asphalt)	390.3	3129.4	20.0	6.1	4.5	1.38	68.9	21.00	300	422.0	3.54
40TPA510041		Couch Const-Odessa (Asphalt)	340.7	3119.5	30.0	9.1	4.6	1.40	73.2	22.30	325	436.0	7.25
		Dris Paving (Asphalt)	340.6	3119.2	40.0	12.2	10.0	3.05	21.2	6.47	151	339.0	0.23
NA		Dolime Dryers	404.8	3069.5	90.0	27.4	5.0	1.52	67.8	20.67	140	333.0	-5.68
		Boilers			90.0	27.4	2.0	0.61	23.8	7.25	430	494.1	-4.52
NA		Estech/Swift Polk Dryer	411.5	3074.2	60.0	18.3	9.7	2.95	27.8	8.47	151	339.0	-23.94
		Dryer			61.5	18.8	9.7	2.95	16.6	5.06	152	340.0	-22.80
		SAP			101.0	30.8	7.0	2.13	12.8	3.90	185	358.0	-92.87
NA		Evans Packing	383.3	3135.8	40.4	12.3	1.3	0.40	30.2	9.20	379	466.2	0.20
40TPA270017		E R Jahna (Lime Dryer)	386.7	3155.8	35.0	10.7	6.0	1.83	29.5	8.99	129	327.0	0.82
40TPA530053		Farmland Industries - Green Bay Plant											
	03,04	1,2 H2SO4	409.5	3079.5	100.0	30.5	4.5	1.37	66.2	20.18	100	311.0	-83.98
		3,4 H2SO4			100.0	30.5	7.5	2.29	30.4	9.27	179	355.0	67.16
		5 H2SO4			150.0	45.7	8.0	2.44	38.0	11.58	179	355.0	50.40
NA		FDOC Boiler #3	382.2	3166.1	30.0	9.1	2.0	0.61	15.0	4.57	401	478.0	2.99
40TPA270021		FL Crushed Stone Kiln 1	360.0	3162.4	320.2	97.6	16.0	4.88	91.2	27.80	385	469.3	98.40
40TPA270010		FL Mining and Materials Kiln	356.2	3169.9	105.0	32.0	14.0	4.27	32.5	9.90	250	394.3	1.45

Table D-5. Summary of Individual Source Emissions and Operating Parameters for the SO₂ PSD Class I Modeling Analysis.

APIS ID #	APIS Source No.	Facility/Source Description	UTM Location (km)		Stack Height		Stack Diameter		Exit Velocity		Exit Temperature		Maximum SO ₂ Emissions (g/s)
			East	North	(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(F)	(K)	
40TPA090004		FPC - Crystal River											
		Crystal River 1	334.2	3204.5	498.7	152.0	15.0	4.57	138.1	42.10	300	422.0	-314.00
		Crystal River 2			502.0	153.0	16.0	4.88	138.1	42.10	300	422.0	-1859.00
		Crystal River 4			584.6	178.2	25.5	7.77	68.9	21.00	253	396.0	1008.80
		Crystal River 5			584.6	178.2	25.5	7.77	68.9	21.00	253	396.0	1008.80
30ORL640028		FPC Debary	467.5	3197.2	50.0	15.2	13.8	4.21	184.4	56.21	1016	819.8	466.40
30ORL490014		FPC Intercession City											
	07	4 CTs 7EA	446.3	3126.0	50.0	15.2	13.8	4.21	184.4	56.21	1016	819.8	124.40
	08	2 CTs 7FA			50.0	15.2	23.1	7.04	105.2	32.07	1126	880.8	110.40
NA		FPC Polk County Site	414.3	3073.9	113.0	34.4	13.5	4.11	133.0	40.54	260	400.0	24.70
NA		General Portland Cement #4	358.0	3090.6	118.0	36.0	9.0	2.74	57.8	17.61	450	505.2	-62.99
NA		General Portland Cement #5	358.0	3090.6	149.0	45.4	12.5	3.81	19.0	5.80	430	494.1	-69.30
40HIL290261		Hillsborough Cty RRF	368.2	3092.7	220.0	67.1	11.5	3.51	55.0	16.76	430	494.3	22.17
NA		Hospital Corp of America											
		Boiler #1	333.4	3141.0	36.0	11.0	1.0	0.31	13.1	4.00	500	533.0	0.08
		Boiler #2			36.0	11.0	1.0	0.31	13.1	4.00	500	533.0	0.08
40TPA530057		IMC-Agrico/Conserve Nichols											
	05	--	398.4	3084.2	100.0	30.5	5.9	1.80	62.0	18.90	95	308.0	-15.20
		H ₂ SO ₄ #1			150.0	45.7	7.5	2.29	33.8	10.30	174	352.0	42.00
		Rock Dryer			80.0	24.4	5.0	1.52	42.3	12.90	151	339.0	-3.88
40TPA530059		IMC-Agrico New Wales											
	44	DAP	396.6	3078.9	120.0	36.6	6.0	1.83	66.1	20.15	115	319.1	5.54
	46	Multiphos			172.0	52.4	4.6	1.40	51.8	15.80	106	314.0	4.80
	02	SAP 1,2,3 projected			200.0	61.0	8.5	2.60	50.2	15.31	170	350.0	189.00
	42	SAP 4,5 projected			199.0	60.7	8.5	2.60	50.2	15.31	170	350.0	126.00
		Rock dryer			69.0	21.0	7.0	2.13	61.0	18.60	165	347.0	-34.27
		SAP 1,2,3 baseline			200.1	61.0	8.5	2.60	46.9	14.28	170	350.0	-146.00
	27	AFI plant			172.0	52.4	7.9	2.40	43.0	13.10	120	322.0	0.20

Table D-5. Summary of Individual Source Emissions and Operating Parameters for the SO2 PSD Class I Modeling Analysis.

APIS ID #	APIS Source No.	Facility/Source Description	UTM Location (km)		Stack Height		Stack Diameter		Exit Velocity		Exit Temperature		Maximum SO2 Emissions (g/s)
			East	North	(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(F)	(K)	
NA		IMC-Agrico Pierce Dryers 1,2 Dryers 3,4	404.1	3079.0	80.0 80.0	24.4 24.4	5.0 8.0	1.52 2.43	42.5 61.7	12.94 18.82	151 151	339.0 339.0	-24.32 -23.00
40TPA530055	04,05 10	IMC-Agrico South Pierce Baseline	407.5	3071.3	150.0	45.7	5.2	1.60	86.6	26.40	170	350.0	-75.60
		#10,11			150.0	45.7	5.2	1.60	128.1	39.06	170	350.0	113.50
		DAP			125.0	38.1	10.2	3.10	47.9	14.60	131	328.0	4.41
40TPA530080		Imperial Phosphates (Brewer)	404.8	3069.5	90.0	27.4	7.5	2.29	50.0	15.25	151	339.0	-19.26
NA		Kissimmee Utilities	447.7	3127.9	40.0	12.2	10.0	3.05	95.5	29.10	718	654.0	29.40
30ORL490001		Kissimmee Utilities Exist	460.1	3129.3	60.0	18.3	12.0	3.66	124.7	38.00	300	422.0	32.10
40TPA530003		Lakeland Utilities Larsen CT	409.2	3102.8	100.0	30.5	19.0	5.79	92.6	28.22	950	783.2	29.11
40TPA530004	06	Lakeland Utilities McIntosh 3	408.5	3105.8	250.0	76.2	16.0	4.88	107.0	32.61	170	350.0	500.10
NA		Lake Cogen	434.0	3198.8	100.0	30.5	11.0	3.35	56.2	17.13	232	384.3	5.04
40HIL290127		McKay Bay RRF	360.0	3091.9	150.0	45.7	4.3	1.30	69.9	21.30	440	500.0	21.44
40TPA530060		Mobil Electrophos Division											
		Boiler	405.6	3079.4	24.0	7.3	3.0	0.91	10.6	3.23	376	464.0	-6.53
		Boiler			20.0	6.1	3.0	0.91	25.3	7.71	376	464.0	-10.05
		Rock Dryer			60.0	18.3	6.0	1.83	22.3	6.79	170	350.0	-21.81
		Calciner			84.0	25.6	7.0	2.13	22.9	6.97	91	306.0	-7.11
		Coke Dryer			60.0	18.3	2.3	0.70	75.0	22.87	120	322.0	-3.17
		Furnace			96.0	29.3	7.0	2.13	28.0	8.52	106	314.0	-47.25
40HIL290102		Mobil Big Four Mine /AMAX											
	01	Dryer	394.80	3067.72	27.0	8.2	1.3	0.41	24.8	7.57	449	505.0	0.60
		Dryer	394.85	3069.77	100.0	30.5	6.0	1.82	23.8	7.26	142	334.0	16.35
40TPA530047	04	Mobil Mining & Minerals Nichols Rock Surge Dryer	398.4	3085.3	85.0	25.9	7.5	2.29	52.8	16.10	150	338.7	2.44

Table D-5. Summary of Individual Source Emissions and Operating Parameters for the SO2 PSD Class I Modeling Analysis.

APIS ID #	APIS Source No.	Facility/Source Description	UTM Location (km)		Stack Height		Stack Diameter		Exit Velocity		Exit Temperature		Maximum SO2 Emissions (g/s)
			East	North	(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(F)	(K)	
		Boiler			93.2	28.4	3.6	1.09	63.1	19.24	152	340.0	-13.89
		Boiler			13.0	4.0	2.6	0.80	5.9	1.80	480	522.0	-0.87
NA		Mulberry Cogeneration											
		CT	413.6	3080.6	125.0	38.1	15.0	4.57	61.9	18.87	219	377.0	12.70
		Duct Burner			125.0	38.1	6.5	1.98	30.5	9.31	300	422.0	0.65
40TPA530048		Mulberry Phosphates (Royster)											
		Unit #1	406.7	3085.2	167.3	51.0	7.0	2.13	32.5	9.90	181	356.0	-257.60
	02	Unit #2			200.0	61.0	7.0	2.13	32.5	9.90	200	366.5	35.70
NA		New Pt Richey Hospital											
		Boiler #1	331.2	3124.5	36.0	11.0	1.0	0.31	12.7	3.88	520	544.0	0.06
		Boiler #2			36.0	11.0	1.0	0.31	12.7	3.88	520	544.0	0.03
NA		Oman Construction	359.8	3164.9	25.0	7.6	6.0	1.83	20.6	6.29	165	347.0	2.09
30ORL480137		Orlando Utilities Commission - Stanton											
		Unit 1	483.5	3150.6	550.0	167.6	19.0	5.80	70.9	21.60	127	325.7	601.00
		Unit 2 (24-hour)			550.0	167.6	19.0	5.80	77.1	23.50	124	324.2	91.80
40TPA510028		Overstreet Paving	355.9	3143.7	30.0	9.1	4.3	1.30	52.5	16.00	275	408.0	3.67
40TPA510056		Pasco Cty RRF	347.1	3139.2	275.0	83.8	10.0	3.05	51.0	15.54	250	394.3	14.10
NA		Pasco Cogen	385.6	3139.0	100.0	30.5	11.0	3.35	56.2	17.13	232	384.3	5.04
40PNL520117		Pinellas RRF	335.3	3084.4	161.0	49.1	9.0	2.74	88.0	26.82	450	505.5	64.26
30ORL48109		Reedy Creek Energy Services - EPCOT											
		Generator 1	442.0	3139.0	17.0	5.2	1.8	0.55	144.8	44.12	650	616.5	1.83
		Generator 2			17.0	5.2	1.8	0.55	144.8	44.12	650	616.5	1.83
30ORL480110		Reedy Creek Energy Services	443.1	3144.3	65.0	19.8	11.2	3.41	51.0	15.56	285	413.7	0.15
NA		Ridge Cogeneration	416.7	3100.4	325.0	99.1	10.0	3.05	47.6	14.50	170	350.0	13.80
40PNL520042		Stauffer Shutdown											

Table D-5. Summary of Individual Source Emissions and Operating Parameters for the SO₂ PSD Class I Modeling Analysis.

APIS ID #	APIS Source No.	Facility/Source Description	UTM Location (km)		Stack Height		Stack Diameter		Exit Velocity		Exit Temperature		Maximum SO ₂ Emissions (g/s)
			East	North	(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(F)	(K)	
		Boiler	325.6	3116.7	24.0	7.3	3.0	0.91	10.6	3.23	376	464.0	-4.86
		Dryer			60.0	18.3	2.3	0.70	75.0	22.87	120	322.0	-1.50
		Furnace			160.8	49.0	3.9	1.20	11.8	3.60	143	335.0	-50.93
		Kiln			84.0	25.6	7.0	2.13	22.9	6.97	91	306.0	-7.36
		Roaster			84.0	25.6	3.0	0.91	22.9	6.97	120	322.0	-0.45
40HIL290039	04	TECO Big Bend Unit 3 (24-hr)	361.9	3075.0	490.0	149.4	24.0	7.32	47.0	14.33	293	418.0	-1218.00
		Unit 4			490.0	149.4	24.0	7.32	65.0	19.81	156	342.2	653.94
		Units 1,2 (24-hr)			490.0	149.4	24.0	7.32	94.0	28.65	300	422.0	-2436.00
NA		TECO Polk Power											
		Aux Boiler	402.50	3067.35	20.0	6.1	3.0	0.90	43.0	13.10	500	533.0	0.33
		IGCC	402.48	3067.36	150.0	45.7	19.0	5.80	55.1	16.79	260	400.0	49.67
		Thermal Ox + Tail Gas	402.28	3067.41	199.0	60.7	3.5	1.07	30.0	9.14	1400	1033.0	7.82
40TPA250015	01 02 03	TPS -- Hardee											
		Unit 1A	404.8	3057.3	90.0	27.4	14.5	4.42	80.0	24.38	253	396.0	92.53
		Unit 1B			90.0	27.4	14.5	4.42	80.0	24.38	253	396.0	92.53
		Unit 2A			75.0	22.9	16.0	4.88	103.0	31.39	953	785.0	92.53
40TPA530050		US Agri-Chem Bartow											
		Dryer	413.2	3086.3	51.8	15.8	6.0	1.83	32.8	10.01	138	332.0	-3.41
		SAP			95.0	29.0	7.0	2.12	24.6	7.50	89	305.0	-42.00
40TPA530051	16 17	US Agri-Chem Ft Meade											
		H ₂ SO ₄ X	416.0	3069.0	95.0	29.0	9.9	3.02	22.2	6.77	106	314.0	-78.80
		H ₂ SO ₄ 1			175.0	53.3	8.5	2.59	32.9	10.04	180	355.4	46.24
		H ₂ SO ₄ 2			175.0	53.3	8.5	2.59	32.9	10.04	180	355.4	46.24
		GTSP			93.0	28.3	5.0	1.52	57.7	17.60	134	330.0	-18.27

Notes: The APIS source number is shown for SO₂ PSD increment consuming sources that are also included in the AAQS inventory.

Table D-6. Summary of Modeling Parameter for the SO2 PSD Class I Modeling Analysis.

APIS ID #	APIS Source No.	Facility/Source Description	ISCST ID	UTM Location (km)		Stack Height		Stack Diameter		Exit Velocity		Exit Temperature		Maximum SO2 Emissions (g/s)
				East	North	(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(F)	(K)	
40TPA270024		Asphalt Pavers 3	ASPHALT3	359.9	3162.4	40.0	12.2	4.5	1.37	34.7	10.58	219	377.0	2.25
40TPA270015		Asphalt Pavers 4	ASPHALT4	361.4	3168.4	28.0	8.5	3.5	1.08	35.9	10.95	184	357.4	2.25
40TPA530221		Auburndale Cogeneration	AUBURN	420.8	3103.3	160.1	48.8	18.0	5.50	46.9	14.30	280	411.0	6.40
NA		Borden Hillsborough	BORDHIL	394.6	3069.6	100.0	30.5	6.0	1.82	48.5	14.79	160	344.0	-6.48
NA		Borden Polk	BORDPLK	414.5	3109.0	56.0	17.1	7.7	2.34	27.1	8.26	140	333.0	-5.29
40HIL290008		Cargill/Gardiner Riverview												
		SAP 4,5,6	CGRIV456	363.4	3082.4	74.1	22.6	5.0	1.52	23.0	7.00	194	363.0	-187.70
		SAP 7	CGRIV7			149.6	45.6	7.5	2.29	30.2	9.20	152	340.0	-26.25
		SAP 8	CGRIV8			149.6	45.6	8.0	2.44	45.7	13.93	151	339.0	-41.16
		SAP 9 Baseline	CGRIV9B			149.6	45.6	9.0	2.74	33.8	10.30	170	350.0	-54.60
	06	SAP 9 Proposed Mod.	CGRIV06			149.6	45.6	9.0	2.74	41.5	12.66	170	350.0	67.20
40TPA530046		Cargill/Seminole Bartow												
		SAP 1		409.8	3087.0	150.0	45.7	4.5	1.37	54.1	16.50	174	352.0	-108.00
		SAP 2				150.0	45.7	4.5	1.37	54.1	16.50	174	352.0	-108.00
			CFBRT12			150.0	45.7	4.5	1.37	54.1	16.50	174	352.0	-216.00
		SAP 3 baseline	CGBRT3A			150.0	45.7	5.0	1.52	54.8	16.70	100	311.0	-52.50
	12,32,33	SAP 4,5,6 current	CGBRTC3			200.0	61.0	6.8	2.06	62.0	18.90	179	355.0	143.77
		Dryer	CGBRTDRY			50.0	15.2	6.7	2.04	56.8	17.32	129	327.0	-39.66
40TPA530052		CF Industries Bartow Bonnie Mine Rd												
--		DAP 1-3	CFBONAC	408.4	3082.4	119.4	36.4	7.0	2.13	52.9	16.11	151	339.0	3.97
05		SAP 5	CFBON05			206.0	62.8	7.0	2.13	35.7	10.88	190	361.0	50.40
06		SAP 6	CFBON06			206.0	62.8	7.0	2.13	23.9	7.28	206	370.0	50.40
--		SAP 7	CFBONAB			220.0	67.1	7.9	2.40	32.2	9.80	172	351.0	42.00
		SAP 1	CFBON1			100.0	30.5	4.5	1.37	40.0	12.20	170	350.0	-60.90
		SAP 2	CFBON2			100.0	30.5	5.5	1.68	34.0	10.37	170	350.0	-110.25
		SAP 3	CFBON3			100.0	30.5	9.0	2.74	14.0	4.27	196	364.0	-107.10
		SAP 4	CFBON4			100.0	30.5	7.0	2.13	26.0	7.93	185	358.0	-174.83
		SAP 5				206.0	62.8	7.0	2.13	35.0	10.67	185	358.0	-226.80
		SAP 6				206.0	62.8	7.0	2.13	34.0	10.37	187	359.0	-170.10
			CFBON56			206.0	62.8	7.0	2.13	34.0	10.37	187	359.0	-396.9

Table D-6. Summary of Modeling Parameter for the SO2 PSD Class I Modeling Analysis.

APIS ID #	APIS Source No.	Facility/Source Description	ISCST ID	UTM Location (km)		Stack Height		Stack Diameter		Exit Velocity		Exit Temperature		Maximum SO2 Emissions (g/s)
				East	North	(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(F)	(K)	
40HIL290005		CF Industries Zephyrhills	CFZEP1	388.0	3116.0	110.0	33.5	4.9	1.50	64.0	19.50	109	316.0	88.20

		Proposed D				198.0	60.4	8.0	2.44	58.3	17.77	176	353.0	54.60
		Proposed C												
						198.0	60.4	8.0	2.44	58.3	17.77	176	353.0	109.2
		Baseline C												
		Baseline D				198.0	60.4	8.0	2.44	53.8	16.40	176	353.0	-50.40
		---				61.7	18.8	5.0	1.52	61.7	18.80	109	316.0	-105.00
NA	CLM Chemical	CLM	361.8	3088.3	98.4	30.0	2.0	0.61	65.6	20.00	215	375.0	21.02	
40TPA510066		Couch Const--Zephyrhills (Asphalt)	COUCHZEP	390.3	3129.4	20.0	6.1	4.5	1.38	68.9	21.00	300	422.0	3.54
40TPA510041		Couch Const--Odessa (Asphalt)	COUCHODES	340.7	3119.5	30.0	9.1	4.6	1.40	73.2	22.30	325	436.0	7.25
		Drisc Paving (Asphalt)	DRIS	340.6	3119.2	40.0	12.2	10.0	3.05	21.2	6.47	151	339.0	0.23
		Dolime Dryers	DOLIMEDRY	404.8	3069.5	90.0	27.4	5.0	1.52	67.8	20.67	140	333.0	-5.68
NA	Estech/Swift Polk Dryer	ESTDRY1	411.5	3074.2	60.0	18.3	9.7	2.95	27.8	8.47	151	339.0	-23.94	
	Dryer	ESTDRY2			61.5	18.8	9.7	2.95	16.6	5.06	152	340.0	-22.80	
	SAP	ESTSAP			101.0	30.8	7.0	2.13	12.8	3.90	185	358.0	-92.87	
NA	Evans Packing	EVANS	383.3	3135.8	40.4	12.3	1.3	0.40	30.2	9.20	379	466.2	0.20	
40TPA270017		E R Jahna (Lime Dryer)	ERJAHNA	386.7	3155.8	35.0	10.7	6.0	1.83	29.5	8.99	129	327.0	0.82
40TPA530053	03,04 05	Farmland Industries -- Green Bay Plant	FARML12	409.5	3079.5	100.0	30.5	4.5	1.37	66.2	20.18	100	311.0	-83.98
1,2 H2SO4		FARMLC2				100.0	30.5	7.5	2.29	30.4	9.27	179	355.0	67.16
3,4 H2SO4		FARML05				150.0	45.7	8.0	2.44	38.0	11.58	179	355.0	50.40
5 H2SO4														

Table D-6. Summary of Modeling Parameter for the SO2 PSD Class I Modeling Analysis.

APIS ID #	APIS Source No.	Facility/Source Description	ISCST ID	UTM Location (km)		Stack Height		Stack Diameter		Exit Velocity		Exit Temperature		Maximum SO2 Emissions (g/s)
				East	North	(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(F)	(K)	
NA		FDOC Boiler #3	FDOC	382.2	3166.1	30.0	9.1	2.0	0.61	15.0	4.57	401	478.0	2.99
40TPA270021		FL Crushed Stone Kiln 1	FCS1	360.0	3162.4	320.2	97.6	16.0	4.88	91.2	27.80	385	469.3	98.40
40TPA270010		FL Mining and Materials Kiln	FMM	356.2	3169.9	105.0	32.0	14.0	4.27	32.5	9.90	250	394.3	1.45
40TPA090004		FPC - Crystal River												
		Crystal River 1	CRYRIV1B	334.2	3204.5	498.7	152.0	15.0	4.57	138.1	42.10	300	422.0	-314.00
		Crystal River 2	CRYRIV2B			502.0	153.0	16.0	4.88	138.1	42.10	300	422.0	-1859.00
		Crystal River 4				584.6	178.2	25.5	7.77	68.9	21.00	253	396.0	1008.80
		Crystal River 5				584.6	178.2	25.5	7.77	68.9	21.00	253	396.0	1008.80
			CRYRIV45			584.6	178.2	25.5	7.77	68.9	21.00	253	396.0	2017.6
30ORL640028		FPC Debarry	DEBARY	467.5	3197.2	50.0	15.2	13.8	4.21	184.4	56.21	1016	819.8	466.40
30ORL490014		FPC Intercession City												
	07	4 CTs 7EA	FPCIN07	446.3	3126.0	50.0	15.2	13.8	4.21	184.4	56.21	1016	819.8	124.40
	08	2 CTs 7FA	FPCIN08			50.0	15.2	23.1	7.04	105.2	32.07	1126	880.8	110.40
NA		FPC Polk County Site	FPCPKC2	414.3	3073.9	113.0	34.4	13.5	4.11	133.0	40.54	260	400.0	24.70
NA		General Portland Cement #4	GPCEM4B	358.0	3090.6	118.0	36.0	9.0	2.74	57.8	17.61	450	505.2	-62.99
NA		General Portland Cement #5	GPCEM5B	358.0	3090.6	149.0	45.4	12.5	3.81	19.0	5.80	430	494.1	-69.30
40HIL290261		Hillsborough Cty RRF	HCRRF	368.2	3092.7	220.0	67.1	11.5	3.51	55.0	16.76	430	494.3	22.17
NA		Hospital Corp of America												
		Boiler #1		333.4	3141.0	36.0	11.0	1.0	0.31	13.1	4.00	500	533.0	0.08
		Boiler #2				36.0	11.0	1.0	0.31	13.1	4.00	500	533.0	0.08
			HCOA12			36.0	11.0	1.0	0.31	13.1	4.00	500	533.0	0.16
40TPA530057		MC-Agrico/Conserve Nichols												
		--	IANIC	398.4	3084.2	100.0	30.5	5.9	1.80	62.0	18.90	95	308.0	-15.20
	05	H2SO4 #1	IANIC05			150.0	45.7	7.5	2.29	33.8	10.30	174	352.0	42.00
		Rock Dryer	IANICDRY			80.0	24.4	5.0	1.52	42.3	12.90	151	339.0	-3.88

Table D-6. Summary of Modeling Parameter for the SO2 PSD Class I Modeling Analysis.

APIS ID #	APIS Source No.	Facility/Source Description	ISCST ID	UTM Location (km)		Stack Height		Stack Diameter		Exit Velocity		Exit Temperature		Maximum SO2 Emissions (g/s)
				East	North	(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(F)	(K)	
40TPA530059		MC-Agrico New Wales												
	44	DAP	IAWAL44	396.6	3078.9	120.0	36.6	6.0	1.83	66.1	20.15	115	319.1	5.54
	46	Multiphos	IAWAL46			172.0	52.4	4.6	1.40	51.8	15.80	106	314.0	4.80
	02	SAP 1,2,3 projected	IAWAL02			200.0	61.0	8.5	2.60	50.2	15.31	170	350.0	189.00
	42	SAP 4,5 projected	IAWAL42			199.0	60.7	8.5	2.60	50.2	15.31	170	350.0	126.00
		Rock dryer	IAWALDRY			69.0	21.0	7.0	2.13	61.0	18.60	165	347.0	-34.27
		SAP 1,2,3 baseline	IAWAL			200.1	61.0	8.5	2.60	46.9	14.28	170	350.0	-146.00
	27	AFI plant	IAWAL27			172.0	52.4	7.9	2.40	43.0	13.10	120	322.0	0.20
NA		MC-Agrico Pierce												
		Dryers 1,2	IAPRC12	404.1	3079.0	80.0	24.4	5.0	1.52	42.5	12.94	151	339.0	-24.32
		Dryers 3,4	IAPRC34			80.0	24.4	8.0	2.43	61.7	18.82	151	339.0	-23.00
40TPA530055		MC-Agrico South Pierce												
		Baseline		407.5	3071.3	150.0	45.7	5.2	1.60	86.6	26.40	170	350.0	-75.60
	04,05	#10,11	IASOUC2			150.0	45.7	5.2	1.60	128.1	39.06	170	350.0	113.50
	10	DAP	IASOU10			125.0	38.1	10.2	3.10	47.9	14.60	131	328.0	4.41
40TPA530080		Imperial Phosphates (Brewer)	IMPR LX	404.8	3069.5	90.0	27.4	7.5	2.29	50.0	15.25	151	339.0	-19.26
NA		Kissimmee Utilities	KISSUT	447.7	3127.9	40.0	12.2	10.0	3.05	95.5	29.10	718	654.0	29.40
30ORL490001		Kissimmee Utilities Exist	KISSEX	460.1	3129.3	60.0	18.3	12.0	3.66	124.7	38.00	300	422.0	32.10
40TPA530003		Lakeland Utilities Larsen CT	LAKLRAA	409.2	3102.8	100.0	30.5	19.0	5.79	92.6	28.22	950	783.2	29.11
40TPA530004	06	Lakeland Utilities McIntosh 3	LAKMC06	408.5	3105.8	250.0	76.2	16.0	4.88	107.0	32.61	170	350.0	500.10
NA		Lake Cogen	LAKECOGN	434.0	3198.8	100.0	30.5	11.0	3.35	56.2	17.13	232	384.3	5.04
40HIL290127		McKay Bay RRF	MCKAY	360.0	3091.9	150.0	45.7	4.3	1.30	69.9	21.30	440	500.0	21.44
40TPA530060		Mobil Electrophos Division												
		Boiler	MOBELE1	405.6	3079.4	24.0	7.3	3.0	0.91	10.6	3.23	376	464.0	-6.53
		Boiler	MOBELE2			20.0	6.1	3.0	0.91	25.3	7.71	376	464.0	-10.05
		Rock Dryer	MOBELE3			60.0	18.3	6.0	1.83	22.3	6.79	170	350.0	-21.81
		Calcliner	MOBELE4			84.0	25.6	7.0	2.13	22.9	6.97	91	306.0	-7.11
		Coke Dryer	MOBELE5			60.0	18.3	2.3	0.70	75.0	22.87	120	322.0	-3.17
		Furnace	MOBELE6			96.0	29.3	7.0	2.13	28.0	8.52	106	314.0	-47.25
40HIL290102		Mobil Big Four Mine /AMAX Dryer	MBL#4AA	394.80	3067.72	27.0	8.2	1.3	0.41	24.8	7.57	449	505.0	0.60

Table D-6. Summary of Modeling Parameter for the SO2 PSD Class I Modeling Analysis.

APIS ID #	APIS Source No.	Facility/Source Description	ISCST ID	UTM Location (km)		Stack Height		Stack Diameter		Exit Velocity		Exit Temperature		Maximum SO2 Emissions (g/s)
				East	North	(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(F)	(K)	
	01	Dryer	MBL#401	394.85	3069.77	100.0	30.5	6.0	1.82	23.8	7.26	142	334.0	16.35
40TPA530047	04	Mobil Mining & Minerals Nichols Rock Surge Dryer	MBNIC04	398.4	3085.3	85.0	25.9	7.5	2.29	52.8	16.10	150	338.7	2.44
		Boiler	MBNIC1			93.2	28.4	3.6	1.09	63.1	19.24	152	340.0	-13.89
		Boiler	MBNIC2			13.0	4.0	2.6	0.80	5.9	1.80	480	522.0	-0.87
NA		Mulberry Cogeneration CT	MULCNAA	413.6	3080.6	125.0	38.1	15.0	4.57	61.9	18.87	219	377.0	12.70
		Duct Burner	MULCNAB			125.0	38.1	6.5	1.98	30.5	9.31	300	422.0	0.65
40TPA530048		Mulberry Phosphates (Royster) Unit #1	MULPHS1	406.7	3085.2	167.3	51.0	7.0	2.13	32.5	9.90	181	356.0	-257.60
	02	Unit #2	MULPH02			200.0	61.0	7.0	2.13	32.5	9.90	200	366.5	35.70
NA		New Pt Richey Hospital Boiler #1		331.2	3124.5	36.0	11.0	1.0	0.31	12.7	3.88	520	544.0	0.06
		Boiler #2				36.0	11.0	1.0	0.31	12.7	3.88	520	544.0	0.03
			NEWPTR12			36.0	11.0	1.0	0.31	12.7	3.88	520	544.0	0.09
NA		Oman Construction	OMAN	359.8	3164.9	25.0	7.6	6.0	1.83	20.6	6.29	165	347.0	2.09
30ORL480137		Orlando Utilities Commission - Stanton Unit 1	OUC1	483.5	3150.6	550.0	167.6	19.0	5.80	70.9	21.60	127	325.7	601.00
		Unit 2 (24-hour)	OUC2			550.0	167.6	19.0	5.80	77.1	23.50	124	324.2	91.80
40TPA510028		Overstreet Paving	OVERST	355.9	3143.7	30.0	9.1	4.3	1.30	52.5	16.00	275	408.0	3.67
40TPA510056		Pasco Cty RRF	PASCORRF	347.1	3139.2	275.0	83.8	10.0	3.05	51.0	15.54	250	394.3	14.10
NA		Pasco Cogen	PASCOGN	385.6	3139.0	100.0	30.5	11.0	3.35	56.2	17.13	232	384.3	5.04
40PNL520117		Pinellas RRF	PNLRRF	335.3	3084.4	161.0	49.1	9.0	2.74	88.0	26.82	450	505.5	64.26
30ORL48109		Reedy Creek Energy Services - EPCOT Generator 1		442.0	3139.0	17.0	5.2	1.8	0.55	144.8	44.12	650	616.5	1.83
		Generator 2				17.0	5.2	1.8	0.55	144.8	44.12	650	616.5	1.83
			EPCOT12			17.0	5.2	1.8	0.55	144.8	44.12	650	616.5	3.66
30ORL480110		Reedy Creek Energy Services	REEDY	443.1	3144.3	65.0	19.8	11.2	3.41	51.0	15.56	285	413.7	0.15

Table D-6. Summary of Modeling Parameter for the SO2 PSD Class I Modeling Analysis.

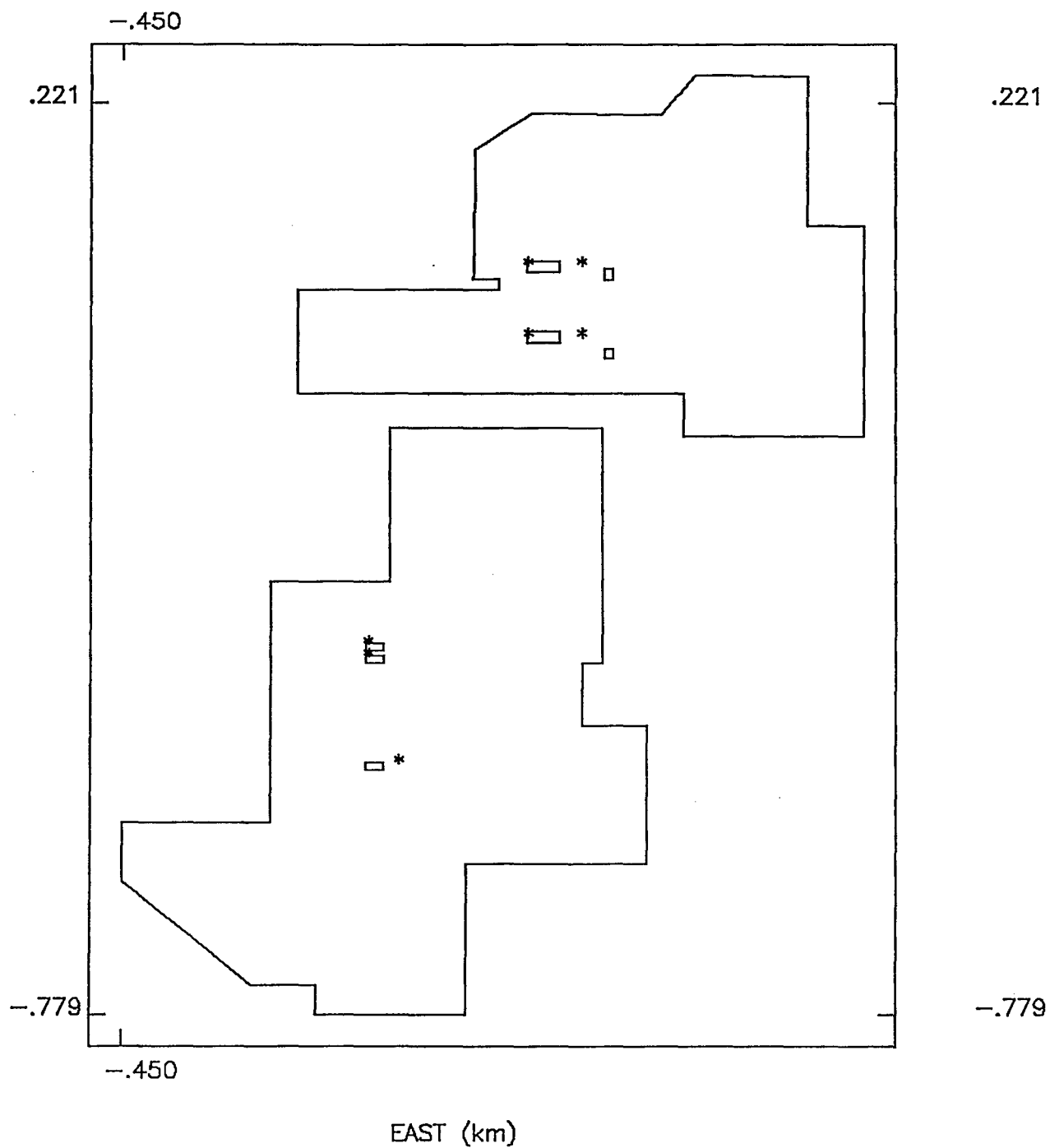
APIS ID #	APIS Source No.	Facility/Source Description	ISCST ID	UTM Location (km)		Stack Height		Stack Diameter		Exit Velocity		Exit Temperature		Maximum SO2 Emissions (g/s)
				East	North	(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(F)	(K)	
NA		Ridge Cogeneration	RIDGE	416.7	3100.4	325.0	99.1	10.0	3.05	47.6	14.50	170	350.0	13.80
40PNL520042		Stauffer Shutdown												
		Boiler	STAUFR1	325.6	3116.7	24.0	7.3	3.0	0.91	10.6	3.23	376	464.0	-4.86
		Dryer	STAUFR2			60.0	18.3	2.3	0.70	75.0	22.87	120	322.0	-1.50
		Furnace	STAUFR3			160.8	49.0	3.9	1.20	11.8	3.60	143	335.0	-50.93
		Kiln	STAUFR4			84.0	25.6	7.0	2.13	22.9	6.97	91	306.0	-7.36
		Roaster	STAUFR5			84.0	25.6	3.0	0.91	22.9	6.97	120	322.0	-0.45
40HIL290039		TECO Big Bend												
		Unit 3 (24-hr)	TECBB3X	361.9	3075.0	490.0	149.4	24.0	7.32	47.0	14.33	293	418.0	-1218.00
	04	Unit 4	TECBB04			490.0	149.4	24.0	7.32	65.0	19.81	156	342.2	653.94
		Units 1,2 (24-hr)	TECBB12X			490.0	149.4	24.0	7.32	94.0	28.65	300	422.0	-2436.00
NA		TECO Polk Power												
		Aux Boiler	TECPKAA	402.50	3067.35	20.0	6.1	3.0	0.90	43.0	13.10	500	533.0	0.33
		IGCC	TECPKAB	402.48	3067.36	150.0	45.7	19.0	5.80	55.1	16.79	260	400.0	49.67
		Thermal Ox + Tail Gas	TECPKAC	402.28	3067.41	199.0	60.7	3.5	1.07	30.0	9.14	1400	1033.0	7.82
40TPA250015		TPS - Hardee												
	01	Unit 1A	HARDEX01	404.8	3057.3	90.0	27.4	14.5	4.42	80.0	24.38	253	396.0	92.53
	02	Unit 1B	HARDEX02			90.0	27.4	14.5	4.42	80.0	24.38	253	396.0	92.53
	03	Unit 2A	HARDEX03			75.0	22.9	16.0	4.88	103.0	31.39	953	785.0	92.53
40TPA530050		US Agri-Chem Bartow												
		Dryer	UAGBAR1	413.2	3086.3	51.8	15.8	6.0	1.83	32.8	10.01	138	332.0	-3.41
		SAP	UAGBAR2			95.0	29.0	7.0	2.12	24.6	7.50	89	305.0	-42.00
40TPA530051		US Agri-Chem Ft Meade												
		H2SO4 X	UAFTMX	416.0	3069.0	95.0	29.0	9.9	3.02	22.2	6.77	106	314.0	-78.80
	16	H2SO4 1				175.0	53.3	8.5	2.59	32.9	10.04	180	355.4	46.24
	17	H2SO4 2				175.0	53.3	8.5	2.59	32.9	10.04	180	355.4	46.24
			UAFTMC2			175.0	53.3	8.5	2.59	32.9	10.04	180	355.4	92.48
		GTSP	UAFTMGT			93.0	28.3	5.0	1.52	57.7	17.60	134	330.0	-18.27

Notes: The APIS source number is shown for SO2 PSD increment consuming sources that are also included in the AAQS inventory.

ATTACHMENT E

BUILDING DATA USED IN BUILDING DOWNWASH ANALYSES

NORTH (km)



TRN01PIP data for Seminole Electric buildings and stacks 2/1/94'

'ST'

'METERS' 1.00

'UTMN' 0.00

4

'North HRSG Bldg' 1 0.0

4 21.34

4.600 35.100

4.600 46.900

41.800 46.900

41.800 35.100

'South HRSG Bldg' 1 0.0

4 21.34

4.600 -42.700

4.600 -30.800

41.800 -30.800

41.800 -42.700

'North Air Heater' 1 0.0

4 12.19

92.700 25.900

92.700 38.100

102.700 38.100

102.700 25.900

'South Air Heater' 1 0.0

4 12.19

92.700 -60.000

92.700 -50.000

102.700 -50.000

102.700 -60.000

4

'HD3HRSGN' 0.0 27.4 0.0 39.3

'HD3HRSGS' 0.0 27.4 0.0 -39.3

'CL50T95N' 0.0 22.9 60.7 39.3

'CL50T95S' 0.0 22.9 60.7 -39.3

0

DATE : 3/18/94
 TIME : 15: 1:44
 BPIP data for Seminole Electric buildings and stacks 2/1/94

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BPIP PROCESSING INFORMATION:

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The ST flag has been set for processing for an ISCST2 run.

The inputs units are in: METERS Multiplying METERS by a conversion
 factor of 1.0000 will produce internal BPIP results 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 .00 degrees with respect to True North.
 BPIP data for Seminole Electric buildings and stacks 2/1/94

PRELIMINARY* GEP STACK HEIGHT RESULTS TABLE
 (Input Units: METERS)

Stack Name	Stack Height	GEP** EQN1	Preliminary* GEP Stack Height Value
HD3HRSGN	27.40	53.35	27.40
HD3HRSGS	27.40	53.35	27.40
CL50T95N	22.90	53.35	22.90
CL50T95S	22.90	53.35	22.90

* Results based on Table 3.1 of the GEP Technical Support Document.

Consult Table 3.1 for any additional steps that may be required.

** Results using Equation 1, page 6 of GEP Technical Support Document.

DATE : 3/18/94
 TIME : 15: 1:44

BPIP data for Seminole Electric buildings and stacks 2/1/94

BPIP output in METERS

SO BUILDHGT HD3HRSGN	21.34	21.34	21.34	21.34	21.34	21.34
SO BUILDHGT HD3HRSGN	21.34	21.34	21.34	21.34	21.34	21.34
SO BUILDHGT HD3HRSGN	21.34	21.34	21.34	21.34	21.34	21.34
SO BUILDHGT HD3HRSGN	21.34	21.34	21.34	21.34	21.34	21.34
SO BUILDHGT HD3HRSGN	21.34	21.34	21.34	21.34	21.34	21.34
SO BUILDHGT HD3HRSGN	21.34	21.34	21.34	21.34	21.34	21.34
SO BUILDWID HD3HRSGN	38.68	38.99	38.12	36.08	32.95	28.82
SO BUILDWID HD3HRSGN	23.81	18.08	11.80	18.08	23.81	28.82
SO BUILDWID HD3HRSGN	32.95	36.08	38.12	38.99	38.68	37.20
SO BUILDWID HD3HRSGN	38.68	38.99	38.12	36.08	32.95	28.82
SO BUILDWID HD3HRSGN	23.81	18.08	11.80	18.08	23.81	28.82

SO BUILDWID HD3HRSGN	32.95	36.08	38.17	39.03	38.70	37.20
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SO BUILDHGT HD3HRSGS	21.34	21.34	21.34	21.34	21.34	21.34
SO BUILDHGT HD3HRSGS	21.34	21.34	21.34	21.34	21.34	21.34
SO BUILDHGT HD3HRSGS	21.34	21.34	21.34	21.34	21.34	21.34
SO BUILDHGT HD3HRSGS	21.34	21.34	21.34	21.34	21.34	21.34
SO BUILDHGT HD3HRSGS	21.34	21.34	21.34	21.34	21.34	21.34
SO BUILDHGT HD3HRSGS	21.34	21.34	21.34	21.34	21.34	21.34
SO BUILDWID HD3HRSGS	38.70	39.03	38.17	36.15	33.03	28.91
SO BUILDWID HD3HRSGS	23.91	18.18	11.90	18.18	23.91	28.91
SO BUILDWID HD3HRSGS	33.03	36.15	38.17	39.03	38.70	37.20
SO BUILDWID HD3HRSGS	38.70	39.03	38.17	36.15	33.03	28.91
SO BUILDWID HD3HRSGS	23.91	18.18	11.90	18.18	23.91	28.91
SO BUILDWID HD3HRSGS	33.03	36.15	38.17	39.03	38.70	37.20

SO BUILDHGT CL50T95N	21.34	21.34	21.34	21.34	21.34	21.34
SO BUILDHGT CL50T95N	21.34	21.34	21.34	21.34	21.34	21.34
SO BUILDHGT CL50T95N	21.34	21.34	.00	.00	.00	.00
SO BUILDHGT CL50T95N	.00	.00	.00	.00	21.34	21.34
SO BUILDHGT CL50T95N	21.34	21.34	21.34	21.34	21.34	21.34
SO BUILDHGT CL50T95N	21.34	21.34	.00	.00	.00	.00
SO BUILDWID CL50T95N	38.70	39.03	38.17	36.15	32.95	28.82
SO BUILDWID CL50T95N	23.81	18.08	11.80	18.08	23.81	28.82
SO BUILDWID CL50T95N	32.95	36.08	.00	.00	.00	.00
SO BUILDWID CL50T95N	.00	.00	.00	.00	32.95	28.82
SO BUILDWID CL50T95N	23.81	18.08	11.80	18.08	23.81	28.82
SO BUILDWID CL50T95N	32.95	36.08	.00	.00	.00	.00

SO BUILDHGT CL50T95S	.00	.00	.00	.00	21.34	21.34
SO BUILDHGT CL50T95S	21.34	21.34	21.34	21.34	21.34	21.34
SO BUILDHGT CL50T95S	21.34	21.34	21.34	21.34	21.34	.00
SO BUILDHGT CL50T95S	.00	.00	.00	.00	21.34	21.34
SO BUILDHGT CL50T95S	21.34	21.34	21.34	21.34	21.34	21.34
SO BUILDHGT CL50T95S	21.34	21.34	.00	.00	.00	.00
SO BUILDWID CL50T95S	.00	.00	.00	.00	33.03	28.91
SO BUILDWID CL50T95S	23.91	18.18	11.90	18.18	23.91	28.91
SO BUILDWID CL50T95S	33.03	36.15	38.12	38.99	38.68	.00
SO BUILDWID CL50T95S	.00	.00	.00	.00	33.03	28.91
SO BUILDWID CL50T95S	23.91	18.18	11.90	18.18	23.91	28.91
SO BUILDWID CL50T95S	33.03	36.15	.00	.00	.00	.00

DATE : 3/18/94

TIME : 15: 1:44

BPIP data for Seminole Electric buildings and stacks 2/1/94

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BPIP PROCESSING INFORMATION:

=====

The ST flag has been set for processing for an ISCST2 run.

The inputs units are in: METERS Multiplying METERS by a conversion
factor of 1.0000 will produce internal BPIP results 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 .00 degrees with respect to True North.

=====

INPUT SUMMARY:

=====

Number of buildings to be processed : 4

North HR has 1 tier(s) with a base elevation of .00 METERS

BUILDING NAME	TIER NUMBER	BLDG-TIER NUMBER	TIER HEIGHT	NO. OF CORNERS	CORNER X	COORDINATES Y
North HR	1	1	21.34	4		
					4.60	35.10 METERS
					4.60	46.90 METERS
					41.80	46.90 METERS
					41.80	35.10 METERS

South HR has 1 tier(s) with a base elevation of .00 METERS

BUILDING NAME	TIER NUMBER	BLDG-TIER NUMBER	TIER HEIGHT	NO. OF CORNERS	CORNER X	COORDINATES Y
South HR	1	5	21.34	4		
					4.60	-42.70 METERS
					4.60	-30.80 METERS
					41.80	-30.80 METERS
					41.80	-42.70 METERS

North Ai has 1 tier(s) with a base elevation of .00 METERS

BUILDING NAME	TIER NUMBER	BLDG-TIER NUMBER	TIER HEIGHT	NO. OF CORNERS	CORNER X	COORDINATES Y
North Ai	1	9	12.19	4		
					92.70	25.90 METERS
					92.70	38.10 METERS
					102.70	38.10 METERS
					102.70	25.90 METERS

South Ai has 1 tier(s) with a base elevation of .00 METERS

BUILDING NAME	TIER NUMBER	BLDG-TIER NUMBER	TIER HEIGHT	NO. OF CORNERS	CORNER X	COORDINATES Y
------------------	----------------	---------------------	----------------	-------------------	-------------	------------------

South A1 1 13 12.19 4

92.70 -60.00 METERS
92.70 -50.00 METERS
102.70 -50.00 METERS
102.70 -60.00 METERS

Number of stacks to be processed : 4

STACK NAME	STACK		STACK X	COORDINATES Y
	BASE	HEIGHT		
HD3HRSGN	.00	27.40	.00	39.30 METERS
HD3HRSGS	.00	27.40	.00	-39.30 METERS
CL50T95N	.00	22.90	60.70	39.30 METERS
CL50T95S	.00	22.90	60.70	-39.30 METERS

The number of stack-tier combinations entered, where each stack is at least 5L in from at least one of the edges of their respective tier roofs, is: 0

Overall GEP Summary Table
(Units: METERS)

StkNo: 1 Stk Name:HD3HRSGN Stk Ht: 27.40 Prelim. GEP Stk.Ht: 27.40
GEP: BH: 21.34 PBW: 21.45 *Eqn1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
No. of Tiers affecting Stk: 1 Direction occurred: 254.25
Bldg-Tier nos. contributing to GEP: 1

StkNo: 2 Stk Name:HD3HRSGS Stk Ht: 27.40 Prelim. GEP Stk.Ht: 27.40
GEP: BH: 21.34 PBW: 21.41 *Eqn1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
No. of Tiers affecting Stk: 1 Direction occurred: 254.50
Bldg-Tier nos. contributing to GEP: 5

StkNo: 3 Stk Name:CL50T95N Stk Ht: 22.90 Prelim. GEP Stk.Ht: 22.90
GEP: BH: 21.34 PBW: 21.45 *Eqn1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
No. of Tiers affecting Stk: 1 Direction occurred: 105.75
Bldg-Tier nos. contributing to GEP: 1

StkNo: 4 Stk Name:CL50T95S Stk Ht: 22.90 Prelim. GEP Stk.Ht: 22.90
GEP: BH: 21.34 PBW: 21.41 *Eqn1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
No. of Tiers affecting Stk: 1 Direction occurred: 105.50
Bldg-Tier nos. contributing to GEP: 5

Summary By Direction Table
(Units: METERS)

Dominate stand alone tiers:

Drtcn: 10.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 38.68 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 38.70 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 38.70 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 20.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 38.99 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 39.03 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 39.03 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 30.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 38.12 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 38.17 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 38.17 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 40.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 36.08 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:North HR TierNo: 1
StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 36.15 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1
StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: 21.34 PBW: 36.15 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1
StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 50.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 32.95 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:North HR TierNo: 1
StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 33.03 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1
StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: 21.34 PBW: 32.95 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:North HR TierNo: 1
StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: 21.34 PBW: 33.03 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 60.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 28.82 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:North HR TierNo: 1
StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 28.91 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1
StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: 21.34 PBW: 28.82 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

*with a Stack-Building elevation difference applied = .00

BldNo: 1 Bld Name:North HR TierNo: 1

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90

MAX: BH: 21.34 PBW: 28.91 *Wake Effect Ht: 53.35

GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

*with a Stack-Building elevation difference applied = .00

BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 70.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40

MAX: BH: 21.34 PBW: 23.81 *Wake Effect Ht: 53.35

GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

*with a Stack-Building elevation difference applied = .00

BldNo: 1 Bld Name:North HR TierNo: 1

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40

MAX: BH: 21.34 PBW: 23.91 *Wake Effect Ht: 53.35

GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

*with a Stack-Building elevation difference applied = .00

BldNo: 2 Bld Name:South HR TierNo: 1

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90

MAX: BH: 21.34 PBW: 23.81 *Wake Effect Ht: 53.35

GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

*with a Stack-Building elevation difference applied = .00

BldNo: 1 Bld Name:North HR TierNo: 1

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90

MAX: BH: 21.34 PBW: 23.91 *Wake Effect Ht: 53.35

GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

*with a Stack-Building elevation difference applied = .00

BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 80.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40

MAX: BH: 21.34 PBW: 18.08 *Wake Effect Ht: 48.46

GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

*with a Stack-Building elevation difference applied = .00

BldNo: 1 Bld Name:North HR TierNo: 1

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40

MAX: BH: 21.34 PBW: 18.18 *Wake Effect Ht: 48.61

GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

*with a Stack-Building elevation difference applied = .00

BldNo: 2 Bld Name:South HR TierNo: 1

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90

MAX: BH: 21.34 PBW: 18.08 *Wake Effect Ht: 48.46

GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

*with a Stack-Building elevation difference applied = .00

BldNo: 1 Bld Name:North HR TierNo: 1

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90

MAX: BH: 21.34 PBW: 18.18 *Wake Effect Ht: 48.61

GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

*with a Stack-Building elevation difference applied = .00

BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 90.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40

MAX: BH: 21.34 PBW: 11.80 *Wake Effect Ht: 39.04

GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

*with a Stack-Building elevation difference applied = .00

BldNo: 1 Bld Name:North HR TierNo: 1

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40

MAX: BH: 21.34 PBW: 11.90 *Wake Effect Ht: 39.19

GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

*with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1
 StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 11.80 *Wake Effect Ht: 39.04
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 11.90 *Wake Effect Ht: 39.19
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 100.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 18.08 *Wake Effect Ht: 48.46
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 18.18 *Wake Effect Ht: 48.61
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1
 StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 18.08 *Wake Effect Ht: 48.46
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 18.18 *Wake Effect Ht: 48.61
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 110.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 23.81 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 23.91 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1
 StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 23.81 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 23.91 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 120.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 28.82 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

*with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 28.91 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1
 StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 28.82 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 28.91 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 130.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 32.95 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 33.03 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1
 StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 32.95 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 33.03 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 140.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 36.08 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 36.15 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1
 StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 36.08 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 36.15 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 150.00

StkNo: 1	Stk Name:HD3HRSGN	Stack Ht:	27.40
	MAX: BH: 21.34 PBW: 38.12	*Wake Effect Ht:	53.35
	GEP: BH: 21.34 PBW: 21.45	*Equation 1 Ht:	53.35
	*with a Stack-Building elevation difference applied =		.00
	BldNo: 1 Bld Name:North HR	TierNo: 1	
StkNo: 2	Stk Name:HD3HRSGS	Stack Ht:	27.40
	MAX: BH: 21.34 PBW: 38.17	*Wake Effect Ht:	53.35
	GEP: BH: 21.34 PBW: 21.41	*Equation 1 Ht:	53.35
	*with a Stack-Building elevation difference applied =		.00
	BldNo: 2 Bld Name:South HR	TierNo: 1	
StkNo: 3	Stk Name:CL50T95N	Stack Ht:	22.90
	MAX: BH: .00 PBW: .00	*Wake Effect Ht:	.00
	GEP: BH: 21.34 PBW: 21.45	*Equation 1 Ht:	53.35
	*with a Stack-Building elevation difference applied =		.00
	BldNo: 1 Bld Name:North HR	TierNo: 1	
StkNo: 4	Stk Name:CL50T95S	Stack Ht:	22.90
	MAX: BH: 21.34 PBW: 38.12	*Wake Effect Ht:	53.35
	GEP: BH: 21.34 PBW: 21.41	*Equation 1 Ht:	53.35
	*with a Stack-Building elevation difference applied =		.00
	BldNo: 1 Bld Name:North HR	TierNo: 1	

Drtcn: 160.00

StkNo: 1	Stk Name:HD3HRSGN	Stack Ht:	27.40
	MAX: BH: 21.34 PBW: 38.99	*Wake Effect Ht:	53.35
	GEP: BH: 21.34 PBW: 21.45	*Equation 1 Ht:	53.35
	*with a Stack-Building elevation difference applied =		.00
	BldNo: 1 Bld Name:North HR	TierNo: 1	
StkNo: 2	Stk Name:HD3HRSGS	Stack Ht:	27.40
	MAX: BH: 21.34 PBW: 39.03	*Wake Effect Ht:	53.35
	GEP: BH: 21.34 PBW: 21.41	*Equation 1 Ht:	53.35
	*with a Stack-Building elevation difference applied =		.00
	BldNo: 2 Bld Name:South HR	TierNo: 1	
StkNo: 3	Stk Name:CL50T95N	Stack Ht:	22.90
	MAX: BH: .00 PBW: .00	*Wake Effect Ht:	.00
	GEP: BH: 21.34 PBW: 21.45	*Equation 1 Ht:	53.35
	*with a Stack-Building elevation difference applied =		.00
	BldNo: 1 Bld Name:North HR	TierNo: 1	
StkNo: 4	Stk Name:CL50T95S	Stack Ht:	22.90
	MAX: BH: 21.34 PBW: 38.99	*Wake Effect Ht:	53.35
	GEP: BH: 21.34 PBW: 21.41	*Equation 1 Ht:	53.35
	*with a Stack-Building elevation difference applied =		.00
	BldNo: 1 Bld Name:North HR	TierNo: 1	

Drtcn: 170.00

StkNo: 1	Stk Name:HD3HRSGN	Stack Ht:	27.40
	MAX: BH: 21.34 PBW: 38.68	*Wake Effect Ht:	53.35
	GEP: BH: 21.34 PBW: 21.45	*Equation 1 Ht:	53.35
	*with a Stack-Building elevation difference applied =		.00
	BldNo: 1 Bld Name:North HR	TierNo: 1	
StkNo: 2	Stk Name:HD3HRSGS	Stack Ht:	27.40
	MAX: BH: 21.34 PBW: 38.70	*Wake Effect Ht:	53.35
	GEP: BH: 21.34 PBW: 21.41	*Equation 1 Ht:	53.35
	*with a Stack-Building elevation difference applied =		.00
	BldNo: 2 Bld Name:South HR	TierNo: 1	
StkNo: 3	Stk Name:CL50T95N	Stack Ht:	22.90
	MAX: BH: .00 PBW: .00	*Wake Effect Ht:	.00
	GEP: BH: 21.34 PBW: 21.45	*Equation 1 Ht:	53.35
	*with a Stack-Building elevation difference applied =		.00
	BldNo: 1 Bld Name:North HR	TierNo: 1	
StkNo: 4	Stk Name:CL50T95S	Stack Ht:	22.90

MAX: BH: 21.34 PBW: 38.68 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:North HR TierNo: 1

Drtcn: 180.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 37.20 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:North HR TierNo: 1

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 37.20 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:North HR TierNo: 1

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:North HR TierNo: 1

Drtcn: 190.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 38.68 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:North HR TierNo: 1

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 38.70 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:North HR TierNo: 1

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:North HR TierNo: 1

Drtcn: 200.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 38.99 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:North HR TierNo: 1

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 39.03 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90

MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1

Drtcn: 210.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 38.12 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 38.17 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1
 StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1

Drtcn: 220.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 36.08 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 36.15 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1
 StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1

Drtcn: 230.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 32.95 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40

MAX: BH: 21.34 PBW: 33.03 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1
 StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 32.95 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 33.03 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 240.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 28.82 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 28.91 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1
 StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 28.82 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 28.91 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 250.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 23.81 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 23.91 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1
 StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 23.81 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 23.91 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 260.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40

MAX: BH: 21.34 PBW: 18.08 *Wake Effect Ht: 48.46
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 18.18 *Wake Effect Ht: 48.61
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1
 StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 18.08 *Wake Effect Ht: 48.46
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 18.18 *Wake Effect Ht: 48.61
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 270.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 11.80 *Wake Effect Ht: 39.04
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 11.90 *Wake Effect Ht: 39.19
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1
 StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 11.80 *Wake Effect Ht: 39.04
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 11.90 *Wake Effect Ht: 39.19
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 280.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 18.08 *Wake Effect Ht: 48.46
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 18.18 *Wake Effect Ht: 48.61
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1
 StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 18.08 *Wake Effect Ht: 48.46
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 18.18 *Wake Effect Ht: 48.61
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00

BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 290.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 23.81 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:North HR TierNo: 1
StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 23.91 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1
StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: 21.34 PBW: 23.81 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:North HR TierNo: 1
StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: 21.34 PBW: 23.91 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 300.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 28.82 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:North HR TierNo: 1
StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 28.91 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1
StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: 21.34 PBW: 28.82 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:North HR TierNo: 1
StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: 21.34 PBW: 28.91 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 310.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 32.95 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:North HR TierNo: 1
StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 33.03 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1
StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: 21.34 PBW: 32.95 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00

BldNo: 1 Bld Name:North HR TierNo: 1
StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: 21.34 PBW: 33.03 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 320.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 36.08 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:North HR TierNo: 1

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 36.15 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: 21.34 PBW: 36.08 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:North HR TierNo: 1

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: 21.34 PBW: 36.15 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 330.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 38.17 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 38.17 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:North HR TierNo: 1

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 340.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 39.03 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:South HR TierNo: 1

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 39.03 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
*with a Stack-Building elevation difference applied = .00

BldNo: 2 Bld Name:South HR TierNo: 1
 StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 350.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 38.70 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1
 StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 38.70 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1
 StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

Drtcn: 360.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 37.20 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1
 StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 37.20 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1
 StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:North HR TierNo: 1
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:South HR TierNo: 1

Dominate combined buildings:

Drtcn: 10.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40

	MAX:	BH:	21.34	PBW:	38.68	*Wake Effect Ht:	53.35
	GEP:	BH:	21.34	PBW:	21.45	*Equation 1 Ht:	53.35
No tiers affect this stack.							
StkNo: 2	Stk Name:	HD3HRSGS				Stack Ht:	27.40
	MAX:	BH:	21.34	PBW:	38.70	*Wake Effect Ht:	53.35
	GEP:	BH:	21.34	PBW:	21.41	*Equation 1 Ht:	53.35
No tiers affect this stack.							
StkNo: 3	Stk Name:	CL50T95N				Stack Ht:	22.90
	MAX:	BH:	21.34	PBW:	38.70	*Wake Effect Ht:	53.35
	GEP:	BH:	21.34	PBW:	21.45	*Equation 1 Ht:	53.35
No tiers affect this stack.							
StkNo: 4	Stk Name:	CL50T95S				Stack Ht:	22.90
	MAX:	BH:	.00	PBW:	.00	*Wake Effect Ht:	.00
	GEP:	BH:	21.34	PBW:	21.41	*Equation 1 Ht:	53.35
No tiers affect this stack.							

Drtcn: 20.00

StkNo: 1	Stk Name:	HD3HRSGN				Stack Ht:	27.40
	MAX:	BH:	21.34	PBW:	38.99	*Wake Effect Ht:	53.35
	GEP:	BH:	21.34	PBW:	21.45	*Equation 1 Ht:	53.35
No tiers affect this stack.							
StkNo: 2	Stk Name:	HD3HRSGS				Stack Ht:	27.40
	MAX:	BH:	21.34	PBW:	39.03	*Wake Effect Ht:	53.35
	GEP:	BH:	21.34	PBW:	21.41	*Equation 1 Ht:	53.35
No tiers affect this stack.							
StkNo: 3	Stk Name:	CL50T95N				Stack Ht:	22.90
	MAX:	BH:	21.34	PBW:	39.03	*Wake Effect Ht:	53.35
	GEP:	BH:	21.34	PBW:	21.45	*Equation 1 Ht:	53.35
No tiers affect this stack.							
StkNo: 4	Stk Name:	CL50T95S				Stack Ht:	22.90
	MAX:	BH:	.00	PBW:	.00	*Wake Effect Ht:	.00
	GEP:	BH:	21.34	PBW:	21.41	*Equation 1 Ht:	53.35
No tiers affect this stack.							

Drtcn: 30.00

StkNo: 1	Stk Name:	HD3HRSGN				Stack Ht:	27.40
	MAX:	BH:	21.34	PBW:	38.12	*Wake Effect Ht:	53.35
	GEP:	BH:	21.34	PBW:	21.45	*Equation 1 Ht:	53.35
No tiers affect this stack.							
StkNo: 2	Stk Name:	HD3HRSGS				Stack Ht:	27.40
	MAX:	BH:	21.34	PBW:	38.17	*Wake Effect Ht:	53.35
	GEP:	BH:	21.34	PBW:	21.41	*Equation 1 Ht:	53.35
No tiers affect this stack.							
StkNo: 3	Stk Name:	CL50T95N				Stack Ht:	22.90
	MAX:	BH:	21.34	PBW:	38.17	*Wake Effect Ht:	53.35
	GEP:	BH:	21.34	PBW:	21.45	*Equation 1 Ht:	53.35
No tiers affect this stack.							
StkNo: 4	Stk Name:	CL50T95S				Stack Ht:	22.90
	MAX:	BH:	.00	PBW:	.00	*Wake Effect Ht:	.00
	GEP:	BH:	21.34	PBW:	21.41	*Equation 1 Ht:	53.35
No tiers affect this stack.							

Drtcn: 40.00

StkNo: 1	Stk Name:	HD3HRSGN				Stack Ht:	27.40
	MAX:	BH:	21.34	PBW:	36.08	*Wake Effect Ht:	53.35
	GEP:	BH:	21.34	PBW:	21.45	*Equation 1 Ht:	53.35
No tiers affect this stack.							
StkNo: 2	Stk Name:	HD3HRSGS				Stack Ht:	27.40
	MAX:	BH:	21.34	PBW:	36.15	*Wake Effect Ht:	53.35
	GEP:	BH:	21.34	PBW:	21.41	*Equation 1 Ht:	53.35
No tiers affect this stack.							

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: 21.34 PBW: 36.15 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

No tiers affect this stack.

Drtcn: 50.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 32.95 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 33.03 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: 21.34 PBW: 32.95 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: 21.34 PBW: 33.03 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

No tiers affect this stack.

Drtcn: 60.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 28.82 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 28.91 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: 21.34 PBW: 28.82 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: 21.34 PBW: 28.91 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

No tiers affect this stack.

Drtcn: 70.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 23.81 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 23.91 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: 21.34 PBW: 23.81 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: 21.34 PBW: 23.91 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

No tiers affect this stack.

Drtcn: 80.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 18.08 *Wake Effect Ht: 48.46
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 18.18 *Wake Effect Ht: 48.61
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: 21.34 PBW: 18.08 *Wake Effect Ht: 48.46
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: 21.34 PBW: 18.18 *Wake Effect Ht: 48.61
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

No tiers affect this stack.

Drtcn: 90.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 11.80 *Wake Effect Ht: 39.04
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 11.90 *Wake Effect Ht: 39.19
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: 21.34 PBW: 11.80 *Wake Effect Ht: 39.04
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: 21.34 PBW: 11.90 *Wake Effect Ht: 39.19
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

No tiers affect this stack.

Drtcn: 100.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 18.08 *Wake Effect Ht: 48.46
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 18.18 *Wake Effect Ht: 48.61
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: 21.34 PBW: 18.08 *Wake Effect Ht: 48.46
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: 21.34 PBW: 18.18 *Wake Effect Ht: 48.61
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

No tiers affect this stack.

Drtcn: 110.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 23.81 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 2	Stk Name:HD3HRSGS	Stack Ht: 27.40
MAX: BH: 21.34	PBW: 23.91	*Wake Effect Ht: 53.35
GEP: BH: 21.34	PBW: 21.41	*Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 3	Stk Name:CL50T95N	Stack Ht: 22.90
MAX: BH: 21.34	PBW: 23.81	*Wake Effect Ht: 53.35
GEP: BH: 21.34	PBW: 21.45	*Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 4	Stk Name:CL50T95S	Stack Ht: 22.90
MAX: BH: 21.34	PBW: 23.91	*Wake Effect Ht: 53.35
GEP: BH: 21.34	PBW: 21.41	*Equation 1 Ht: 53.35

No tiers affect this stack.

Drtcn: 120.00

StkNo: 1	Stk Name:HD3HRSGN	Stack Ht: 27.40
MAX: BH: 21.34	PBW: 28.82	*Wake Effect Ht: 53.35
GEP: BH: 21.34	PBW: 21.45	*Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 2	Stk Name:HD3HRSGS	Stack Ht: 27.40
MAX: BH: 21.34	PBW: 28.91	*Wake Effect Ht: 53.35
GEP: BH: 21.34	PBW: 21.41	*Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 3	Stk Name:CL50T95N	Stack Ht: 22.90
MAX: BH: 21.34	PBW: 28.82	*Wake Effect Ht: 53.35
GEP: BH: 21.34	PBW: 21.45	*Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 4	Stk Name:CL50T95S	Stack Ht: 22.90
MAX: BH: 21.34	PBW: 28.91	*Wake Effect Ht: 53.35
GEP: BH: 21.34	PBW: 21.41	*Equation 1 Ht: 53.35

No tiers affect this stack.

Drtcn: 130.00

StkNo: 1	Stk Name:HD3HRSGN	Stack Ht: 27.40
MAX: BH: 21.34	PBW: 32.95	*Wake Effect Ht: 53.35
GEP: BH: 21.34	PBW: 21.45	*Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 2	Stk Name:HD3HRSGS	Stack Ht: 27.40
MAX: BH: 21.34	PBW: 33.03	*Wake Effect Ht: 53.35
GEP: BH: 21.34	PBW: 21.41	*Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 3	Stk Name:CL50T95N	Stack Ht: 22.90
MAX: BH: 21.34	PBW: 32.95	*Wake Effect Ht: 53.35
GEP: BH: 21.34	PBW: 21.45	*Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 4	Stk Name:CL50T95S	Stack Ht: 22.90
MAX: BH: 21.34	PBW: 33.03	*Wake Effect Ht: 53.35
GEP: BH: 21.34	PBW: 21.41	*Equation 1 Ht: 53.35

No tiers affect this stack.

Drtcn: 140.00

StkNo: 1	Stk Name:HD3HRSGN	Stack Ht: 27.40
MAX: BH: 21.34	PBW: 36.08	*Wake Effect Ht: 53.35
GEP: BH: 21.34	PBW: 21.45	*Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 2	Stk Name:HD3HRSGS	Stack Ht: 27.40
MAX: BH: 21.34	PBW: 36.15	*Wake Effect Ht: 53.35
GEP: BH: 21.34	PBW: 21.41	*Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 3	Stk Name:CL50T95N	Stack Ht: 22.90
MAX: BH: 21.34	PBW: 36.08	*Wake Effect Ht: 53.35

GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 No tiers affect this stack.
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 36.15 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 No tiers affect this stack.

Drtcn: 150.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 38.12 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 No tiers affect this stack.
 StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 38.17 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 No tiers affect this stack.
 StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 No tiers affect this stack.
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 38.12 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 No tiers affect this stack.

Drtcn: 160.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 38.99 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 No tiers affect this stack.
 StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 39.03 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 No tiers affect this stack.
 StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 No tiers affect this stack.
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 38.99 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 No tiers affect this stack.

Drtcn: 170.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 38.68 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 No tiers affect this stack.
 StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 38.70 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 No tiers affect this stack.
 StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 No tiers affect this stack.
 StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 38.68 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 No tiers affect this stack.

Drtcn: 180.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 37.20 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
No tiers affect this stack.
StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 37.20 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
No tiers affect this stack.
StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
No tiers affect this stack.
StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
No tiers affect this stack.

Drtcn: 190.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 38.68 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
No tiers affect this stack.
StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 38.70 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
No tiers affect this stack.
StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
No tiers affect this stack.
StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
No tiers affect this stack.

Drtcn: 200.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 38.99 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
No tiers affect this stack.
StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 39.03 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
No tiers affect this stack.
StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
No tiers affect this stack.
StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
No tiers affect this stack.

Drtcn: 210.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 38.12 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
No tiers affect this stack.
StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40

	MAX: BH: 21.34	PBW: 38.17	*Wake Effect Ht: 53.35
	GEP: BH: 21.34	PBW: 21.41	*Equation 1 Ht: 53.35
No tiers affect this stack.			
StkNo: 3	Stk Name:CL50T95N		Stack Ht: 22.90
	MAX: BH: .00	PBW: .00	*Wake Effect Ht: .00
	GEP: BH: 21.34	PBW: 21.45	*Equation 1 Ht: 53.35
No tiers affect this stack.			
StkNo: 4	Stk Name:CL50T95S		Stack Ht: 22.90
	MAX: BH: .00	PBW: .00	*Wake Effect Ht: .00
	GEP: BH: 21.34	PBW: 21.41	*Equation 1 Ht: 53.35
No tiers affect this stack.			

Drtcn: 220.00

StkNo: 1	Stk Name:HD3HRSGN		Stack Ht: 27.40
	MAX: BH: 21.34	PBW: 36.08	*Wake Effect Ht: 53.35
	GEP: BH: 21.34	PBW: 21.45	*Equation 1 Ht: 53.35
No tiers affect this stack.			
StkNo: 2	Stk Name:HD3HRSGS		Stack Ht: 27.40
	MAX: BH: 21.34	PBW: 36.15	*Wake Effect Ht: 53.35
	GEP: BH: 21.34	PBW: 21.41	*Equation 1 Ht: 53.35
No tiers affect this stack.			
StkNo: 3	Stk Name:CL50T95N		Stack Ht: 22.90
	MAX: BH: .00	PBW: .00	*Wake Effect Ht: .00
	GEP: BH: 21.34	PBW: 21.45	*Equation 1 Ht: 53.35
No tiers affect this stack.			
StkNo: 4	Stk Name:CL50T95S		Stack Ht: 22.90
	MAX: BH: .00	PBW: .00	*Wake Effect Ht: .00
	GEP: BH: 21.34	PBW: 21.41	*Equation 1 Ht: 53.35
No tiers affect this stack.			

Drtcn: 230.00

StkNo: 1	Stk Name:HD3HRSGN		Stack Ht: 27.40
	MAX: BH: 21.34	PBW: 32.95	*Wake Effect Ht: 53.35
	GEP: BH: 21.34	PBW: 21.45	*Equation 1 Ht: 53.35
No tiers affect this stack.			
StkNo: 2	Stk Name:HD3HRSGS		Stack Ht: 27.40
	MAX: BH: 21.34	PBW: 33.03	*Wake Effect Ht: 53.35
	GEP: BH: 21.34	PBW: 21.41	*Equation 1 Ht: 53.35
No tiers affect this stack.			
StkNo: 3	Stk Name:CL50T95N		Stack Ht: 22.90
	MAX: BH: 21.34	PBW: 32.95	*Wake Effect Ht: 53.35
	GEP: BH: 21.34	PBW: 21.45	*Equation 1 Ht: 53.35
No tiers affect this stack.			
StkNo: 4	Stk Name:CL50T95S		Stack Ht: 22.90
	MAX: BH: 21.34	PBW: 33.03	*Wake Effect Ht: 53.35
	GEP: BH: 21.34	PBW: 21.41	*Equation 1 Ht: 53.35
No tiers affect this stack.			

Drtcn: 240.00

StkNo: 1	Stk Name:HD3HRSGN		Stack Ht: 27.40
	MAX: BH: 21.34	PBW: 28.82	*Wake Effect Ht: 53.35
	GEP: BH: 21.34	PBW: 21.45	*Equation 1 Ht: 53.35
No tiers affect this stack.			
StkNo: 2	Stk Name:HD3HRSGS		Stack Ht: 27.40
	MAX: BH: 21.34	PBW: 28.91	*Wake Effect Ht: 53.35
	GEP: BH: 21.34	PBW: 21.41	*Equation 1 Ht: 53.35
No tiers affect this stack.			
StkNo: 3	Stk Name:CL50T95N		Stack Ht: 22.90
	MAX: BH: 21.34	PBW: 28.82	*Wake Effect Ht: 53.35
	GEP: BH: 21.34	PBW: 21.45	*Equation 1 Ht: 53.35
No tiers affect this stack.			

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: 21.34 PBW: 28.91 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
No tiers affect this stack.

Drtcn: 250.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 23.81 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
No tiers affect this stack.

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 23.91 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
No tiers affect this stack.

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: 21.34 PBW: 23.81 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
No tiers affect this stack.

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: 21.34 PBW: 23.91 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
No tiers affect this stack.

Drtcn: 260.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 18.08 *Wake Effect Ht: 48.46
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
No tiers affect this stack.

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 18.18 *Wake Effect Ht: 48.61
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
No tiers affect this stack.

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: 21.34 PBW: 18.08 *Wake Effect Ht: 48.46
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
No tiers affect this stack.

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: 21.34 PBW: 18.18 *Wake Effect Ht: 48.61
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
No tiers affect this stack.

Drtcn: 270.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 11.80 *Wake Effect Ht: 39.04
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
No tiers affect this stack.

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 11.90 *Wake Effect Ht: 39.19
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
No tiers affect this stack.

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: 21.34 PBW: 11.80 *Wake Effect Ht: 39.04
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
No tiers affect this stack.

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: 21.34 PBW: 11.90 *Wake Effect Ht: 39.19
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
No tiers affect this stack.

Drtcn: 280.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 18.08 *Wake Effect Ht: 48.46
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 No tiers affect this stack.

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 18.18 *Wake Effect Ht: 48.61
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 No tiers affect this stack.

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 18.08 *Wake Effect Ht: 48.46
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 No tiers affect this stack.

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 18.18 *Wake Effect Ht: 48.61
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 No tiers affect this stack.

Drtcn: 290.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 23.81 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 No tiers affect this stack.

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 23.91 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 No tiers affect this stack.

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 23.81 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 No tiers affect this stack.

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 23.91 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 No tiers affect this stack.

Drtcn: 300.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 28.82 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 No tiers affect this stack.

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 28.91 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 No tiers affect this stack.

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 28.82 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 No tiers affect this stack.

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
 MAX: BH: 21.34 PBW: 28.91 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
 No tiers affect this stack.

Drtcn: 310.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 32.95 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35
 No tiers affect this stack.

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
 MAX: BH: 21.34 PBW: 33.03 *Wake Effect Ht: 53.35
 GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 3	Stk Name:CL50T95N	Stack Ht:	22.90
MAX: BH:	21.34 PBW: 32.95	*Wake Effect Ht:	53.35
GEP: BH:	21.34 PBW: 21.45	*Equation 1 Ht:	53.35

No tiers affect this stack.

StkNo: 4	Stk Name:CL50T95S	Stack Ht:	22.90
MAX: BH:	21.34 PBW: 33.03	*Wake Effect Ht:	53.35
GEP: BH:	21.34 PBW: 21.41	*Equation 1 Ht:	53.35

No tiers affect this stack.

Drtcn: 320.00

StkNo: 1	Stk Name:HD3HRSGN	Stack Ht:	27.40
MAX: BH:	21.34 PBW: 36.08	*Wake Effect Ht:	53.35
GEP: BH:	21.34 PBW: 21.45	*Equation 1 Ht:	53.35

No tiers affect this stack.

StkNo: 2	Stk Name:HD3HRSGS	Stack Ht:	27.40
MAX: BH:	21.34 PBW: 36.15	*Wake Effect Ht:	53.35
GEP: BH:	21.34 PBW: 21.41	*Equation 1 Ht:	53.35

No tiers affect this stack.

StkNo: 3	Stk Name:CL50T95N	Stack Ht:	22.90
MAX: BH:	21.34 PBW: 36.08	*Wake Effect Ht:	53.35
GEP: BH:	21.34 PBW: 21.45	*Equation 1 Ht:	53.35

No tiers affect this stack.

StkNo: 4	Stk Name:CL50T95S	Stack Ht:	22.90
MAX: BH:	21.34 PBW: 36.15	*Wake Effect Ht:	53.35
GEP: BH:	21.34 PBW: 21.41	*Equation 1 Ht:	53.35

No tiers affect this stack.

Drtcn: 330.00

StkNo: 1	Stk Name:HD3HRSGN	Stack Ht:	27.40
MAX: BH:	21.34 PBW: 38.17	*Wake Effect Ht:	53.35
GEP: BH:	21.34 PBW: 21.45	*Equation 1 Ht:	53.35

No tiers affect this stack.

StkNo: 2	Stk Name:HD3HRSGS	Stack Ht:	27.40
MAX: BH:	21.34 PBW: 38.17	*Wake Effect Ht:	53.35
GEP: BH:	21.34 PBW: 21.41	*Equation 1 Ht:	53.35

No tiers affect this stack.

StkNo: 3	Stk Name:CL50T95N	Stack Ht:	22.90
MAX: BH:	.00 PBW: .00	*Wake Effect Ht:	.00
GEP: BH:	21.34 PBW: 21.45	*Equation 1 Ht:	53.35

No tiers affect this stack.

StkNo: 4	Stk Name:CL50T95S	Stack Ht:	22.90
MAX: BH:	.00 PBW: .00	*Wake Effect Ht:	.00
GEP: BH:	21.34 PBW: 21.41	*Equation 1 Ht:	53.35

No tiers affect this stack.

Drtcn: 340.00

StkNo: 1	Stk Name:HD3HRSGN	Stack Ht:	27.40
MAX: BH:	21.34 PBW: 39.03	*Wake Effect Ht:	53.35
GEP: BH:	21.34 PBW: 21.45	*Equation 1 Ht:	53.35

No tiers affect this stack.

StkNo: 2	Stk Name:HD3HRSGS	Stack Ht:	27.40
MAX: BH:	21.34 PBW: 39.03	*Wake Effect Ht:	53.35
GEP: BH:	21.34 PBW: 21.41	*Equation 1 Ht:	53.35

No tiers affect this stack.

StkNo: 3	Stk Name:CL50T95N	Stack Ht:	22.90
MAX: BH:	.00 PBW: .00	*Wake Effect Ht:	.00
GEP: BH:	21.34 PBW: 21.45	*Equation 1 Ht:	53.35

No tiers affect this stack.

StkNo: 4	Stk Name:CL50T95S	Stack Ht:	22.90
MAX: BH:	.00 PBW: .00	*Wake Effect Ht:	.00

GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35
No tiers affect this stack.

Drtcn: 350.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 38.70 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 38.70 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

No tiers affect this stack.

Drtcn: 360.00

StkNo: 1 Stk Name:HD3HRSGN Stack Ht: 27.40
MAX: BH: 21.34 PBW: 37.20 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 2 Stk Name:HD3HRSGS Stack Ht: 27.40
MAX: BH: 21.34 PBW: 37.20 *Wake Effect Ht: 53.35
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 3 Stk Name:CL50T95N Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 21.34 PBW: 21.45 *Equation 1 Ht: 53.35

No tiers affect this stack.

StkNo: 4 Stk Name:CL50T95S Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 21.34 PBW: 21.41 *Equation 1 Ht: 53.35

No tiers affect this stack.

'BPIP data for TPS Hardee buildings and stacks 4/10/94'

'ST'

'METERS' 1.00

'UTMN' 0.00

4

'Exist 1A HRSB bldg' 1 0.0

4 16.76

-178.100 -381.99

-178.100 -373.99

-157.900 -373.99

-157.900 -381.99

'Exist 1B HRSB bldg' 1 0.0

4 16.76

-178.100 -395.71

-178.100 -387.71

-157.900 -387.71

-157.900 -395.71

'Exist 2A HRSB bldg' 1 0.0

4 16.76

-178.100 -512.7

-178.100 -504.7

-157.900 -504.7

-157.900 -512.7

'Warehouse' 1 0.0

4 20.73

-138.7 -352.6

-105.8 -352.6

-105.8 -340.5

-138.7 -340.5

3

'EXIST1A' 0.0 27.4 -181.1 -378.0

'EXIST1B' 0.0 27.4 -181.1 -391.7

'EXIST2A' 0.0 22.9 -146.1 -508.7

0

DATE : 4/10/94
TIME : 13:28:54
BPIP data for TPS Hardee buildings and stacks 4/10/94

=====

BPIP PROCESSING INFORMATION:

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The ST flag has been set for processing for an ISCST2 run.

The inputs units are in: METERS Multiplying METERS by a conversion
factor of 1.0000 will produce internal BPIP results 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 .00 degrees with respect to True North.

=====

INPUT SUMMARY:

=====

Number of buildings to be processed : 4

Exist 1A has 1 tier(s) with a base elevation of .00 METERS

BUILDING NAME	TIER NUMBER	BLDG-TIER NUMBER	TIER HEIGHT	NO. OF CORNERS	CORNER X	COORDINATES Y
Exist 1A	1	1	16.76	4		
					-178.10	-381.99 METERS
					-178.10	-373.99 METERS
					-157.90	-373.99 METERS
					-157.90	-381.99 METERS

Exist 1B has 1 tier(s) with a base elevation of .00 METERS

BUILDING NAME	TIER NUMBER	BLDG-TIER NUMBER	TIER HEIGHT	NO. OF CORNERS	CORNER X	COORDINATES Y
Exist 1B	1	5	16.76	4		
					-178.10	-395.71 METERS
					-178.10	-387.71 METERS
					-157.90	-387.71 METERS
					-157.90	-395.71 METERS

Exist 2A has 1 tier(s) with a base elevation of .00 METERS

BUILDING NAME	TIER NUMBER	BLDG-TIER NUMBER	TIER HEIGHT	NO. OF CORNERS	CORNER X	COORDINATES Y
Exist 2A	1	9	16.76	4		
					-178.10	-512.70 METERS
					-178.10	-504.70 METERS
					-157.90	-504.70 METERS
					-157.90	-512.70 METERS

Warehous has 1 tier(s) with a base elevation of .00 METERS

BUILDING NAME	TIER NUMBER	BLDG-TIER NUMBER	TIER HEIGHT	NO. OF CORNERS	CORNER X	COORDINATES Y
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Warehous 1 13 20.73 4

-138.70 -352.60 METERS
-105.80 -352.60 METERS
-105.80 -340.50 METERS
-138.70 -340.50 METERS

Number of stacks to be processed : 3

STACK NAME	STACK		STACK X	COORDINATES Y
	BASE	HEIGHT		
EXIST1A	.00	27.40	-181.10	-378.00 METERS
EXIST1B	.00	27.40	-181.10	-391.70 METERS
EXIST2A	.00	22.90	-146.10	-508.70 METERS

The number of stack-tier combinations entered, where each stack is at least 5L
in from at least one of the edges of their respective tier roofs, is: 0

Overall GEP Summary Table
(Units: METERS)

StkNo: 1 Stk Name:EXIST1A Stk Ht: 27.40 Prelim. GEP Stk.Ht: 27.40
GEP: BH: 20.73 PBW: 22.03 *Eqn1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
No. of Tiers affecting Stk: 1 Direction occurred: 251.25
Bldg-Tier nos. contributing to GEP: 13

StkNo: 2 Stk Name:EXIST1B Stk Ht: 27.40 Prelim. GEP Stk.Ht: 27.40
GEP: BH: 20.73 PBW: 25.92 *Eqn1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
No. of Tiers affecting Stk: 1 Direction occurred: 242.50
Bldg-Tier nos. contributing to GEP: 13

StkNo: 3 Stk Name:EXIST2A Stk Ht: 22.90 Prelim. GEP Stk.Ht: 22.90
GEP: BH: 16.76 PBW: 14.00 *Eqn1 Ht: 37.75
*with a Stack-Building elevation difference applied = .00
No. of Tiers affecting Stk: 1 Direction occurred: 108.50
Bldg-Tier nos. contributing to GEP: 9

Summary By Direction Table
(Units: METERS)

Dominate stand alone tiers:

Drctn: 10.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.28 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:Exist 1A TierNo: 1
StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.28 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82

*with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 20.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.72 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.72 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 30.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.49 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.49 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 40.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 20.62 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 20.62 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 50.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 19.11 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 19.11 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:Exist 1B TierNo: 1
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 60.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 17.03 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 17.03 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:Exist 1B TierNo: 1
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 70.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 14.43 *Wake Effect Ht: 38.40
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 14.43 *Wake Effect Ht: 38.40
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 80.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 11.39 *Wake Effect Ht: 33.84
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 11.39 *Wake Effect Ht: 33.84
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 11.39 *Wake Effect Ht: 33.84
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
*with a Stack-Building elevation difference applied = .00
BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 90.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 8.00 *Wake Effect Ht: 28.76
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:Exist 1A TierNo: 1

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 8.00 *Wake Effect Ht: 28.76
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:Exist 1B TierNo: 1

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 8.00 *Wake Effect Ht: 28.76
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
*with a Stack-Building elevation difference applied = .00
BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 100.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 11.39 *Wake Effect Ht: 33.84
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:Exist 1A TierNo: 1

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 11.39 *Wake Effect Ht: 33.84
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:Exist 1B TierNo: 1

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 11.39 *Wake Effect Ht: 33.84
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
*with a Stack-Building elevation difference applied = .00
BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 110.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 14.43 *Wake Effect Ht: 38.40
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:Exist 1A TierNo: 1

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 14.43 *Wake Effect Ht: 38.40
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:Exist 1B TierNo: 1

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
*with a Stack-Building elevation difference applied = .00
BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 120.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 17.03 *Wake Effect Ht: 41.90

GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 17.03 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:Exist 1B TierNo: 1
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 130.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 19.11 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 19.11 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:Exist 1B TierNo: 1
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 140.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 20.62 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 20.62 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:Exist 1B TierNo: 1
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 150.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.49 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.49 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75

GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
*with a Stack-Building elevation difference applied = .00
BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 160.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.72 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:Exist 1A TierNo: 1
StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.72 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:Exist 1A TierNo: 1
StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
*with a Stack-Building elevation difference applied = .00
BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 170.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.28 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:Exist 1A TierNo: 1
StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.28 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:Exist 1A TierNo: 1
StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
*with a Stack-Building elevation difference applied = .00
BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 180.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 20.20 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:Exist 1A TierNo: 1
StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 20.20 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:Exist 1A TierNo: 1
StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
*with a Stack-Building elevation difference applied = .00
BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 190.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.28 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

BldNo: 2 Bld Name:Exist 1B TierNo: 1

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.28 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:Exist 1B TierNo: 1

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 200.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.72 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.72 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 210.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.49 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:Exist 1B TierNo: 1

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.49 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:Exist 1B TierNo: 1

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 220.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 20.73 PBW: 32.98 *Wake Effect Ht: 51.82
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 4 Bld Name:Warehous TierNo: 1

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 20.73 PBW: 32.98 *Wake Effect Ht: 51.82
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 4 Bld Name:Warehous TierNo: 1

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00

BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 230.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 20.73 PBW: 30.42 *Wake Effect Ht: 51.82
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 4 Bld Name:Warehous TierNo: 1
StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 20.73 PBW: 30.42 *Wake Effect Ht: 51.82
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 4 Bld Name:Warehous TierNo: 1
StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
*with a Stack-Building elevation difference applied = .00
BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 240.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 20.73 PBW: 26.93 *Wake Effect Ht: 51.82
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 4 Bld Name:Warehous TierNo: 1
StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 20.73 PBW: 26.93 *Wake Effect Ht: 51.82
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 4 Bld Name:Warehous TierNo: 1
StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
*with a Stack-Building elevation difference applied = .00
BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 250.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 20.73 PBW: 22.62 *Wake Effect Ht: 51.82
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 4 Bld Name:Warehous TierNo: 1
StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 14.43 *Wake Effect Ht: 38.40
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:Exist 1B TierNo: 1
StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
*with a Stack-Building elevation difference applied = .00
BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 260.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 11.39 *Wake Effect Ht: 33.84
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:Exist 1A TierNo: 1
StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40

MAX: BH: 16.76 PBW: 11.39 *Wake Effect Ht: 33.84
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 11.39 *Wake Effect Ht: 33.84
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 270.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 8.00 *Wake Effect Ht: 28.76
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 8.00 *Wake Effect Ht: 28.76
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:Exist 1B TierNo: 1
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 8.00 *Wake Effect Ht: 28.76
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 280.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 11.39 *Wake Effect Ht: 33.84
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 11.39 *Wake Effect Ht: 33.84
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:Exist 1B TierNo: 1
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 11.39 *Wake Effect Ht: 33.84
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 290.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 14.43 *Wake Effect Ht: 38.40
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:Exist 1B TierNo: 1
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 14.43 *Wake Effect Ht: 38.40
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 2 Bld Name:Exist 1B TierNo: 1
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 300.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 17.03 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:Exist 1A TierNo: 1

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 17.03 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:Exist 1B TierNo: 1

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
*with a Stack-Building elevation difference applied = .00
BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 310.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 19.11 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:Exist 1A TierNo: 1

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 19.11 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:Exist 1B TierNo: 1

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
*with a Stack-Building elevation difference applied = .00
BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 320.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 20.62 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:Exist 1A TierNo: 1

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 20.62 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 2 Bld Name:Exist 1B TierNo: 1

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
*with a Stack-Building elevation difference applied = .00
BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 330.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.49 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
BldNo: 1 Bld Name:Exist 1A TierNo: 1

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.49 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82

*with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 340.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.72 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.72 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 350.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.28 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.28 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Drtcn: 360.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 20.20 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 20.20 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 BldNo: 1 Bld Name:Exist 1A TierNo: 1
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 *with a Stack-Building elevation difference applied = .00
 BldNo: 3 Bld Name:Exist 2A TierNo: 1

Dominate combined buildings:

Drtcn: 10.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.28 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.28 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75

No tiers affect this stack.

Drtcn: 20.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.72 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.72 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75

No tiers affect this stack.

Drtcn: 30.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.49 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.49 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75

No tiers affect this stack.

Drtcn: 40.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 20.62 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 20.62 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 No tiers affect this stack.

Drtcn: 50.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 19.11 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 19.11 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 No tiers affect this stack.

Drtcn: 60.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 17.03 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 17.03 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 No tiers affect this stack.

Drtcn: 70.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 27.32 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 27.32 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5
StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
No tiers affect this stack.

Drtcn: 80.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 24.90 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 24.90 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 11.39 *Wake Effect Ht: 33.84
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
No tiers affect this stack.

Drtcn: 90.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.72 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.72 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 8.00 *Wake Effect Ht: 28.76
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
No tiers affect this stack.

Drtcn: 100.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 24.90 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 24.90 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 11.39 *Wake Effect Ht: 33.84
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
No tiers affect this stack.

Drtcn: 110.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 27.32 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 27.32 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75

No tiers affect this stack.

Drtcn: 120.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 17.03 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 17.03 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75

No tiers affect this stack.

Drtcn: 130.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 19.11 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 19.11 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75

No tiers affect this stack.

Drtcn: 140.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 20.62 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 20.62 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 No tiers affect this stack.

Drtcn: 150.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.49 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.49 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 No tiers affect this stack.

Drtcn: 160.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.72 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.72 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 No tiers affect this stack.

Drtcn: 170.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.28 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.28 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90

MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75

No tiers affect this stack.

Drtcn: 180.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 20.20 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 20.20 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75

No tiers affect this stack.

Drtcn: 190.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.28 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.28 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75

No tiers affect this stack.

Drtcn: 200.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.72 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.72 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2

Bldg-Tier nos. contributing to MAX: 1 5

StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75

No tiers affect this stack.

Drtcn: 210.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40

MAX: BH: 16.76 PBW: 21.49 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.49 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 No tiers affect this stack.

Drtcn: 220.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 20.73 PBW: 32.98 *Wake Effect Ht: 51.82
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 20.73 PBW: 32.98 *Wake Effect Ht: 51.82
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 No tiers affect this stack.

Drtcn: 230.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 20.73 PBW: 30.42 *Wake Effect Ht: 51.82
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 20.73 PBW: 30.42 *Wake Effect Ht: 51.82
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 No tiers affect this stack.

Drtcn: 240.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 20.73 PBW: 26.93 *Wake Effect Ht: 51.82
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 20.73 PBW: 26.93 *Wake Effect Ht: 51.82

GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 No tiers affect this stack.

Drtcn: 250.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 20.73 PBW: 22.62 *Wake Effect Ht: 51.82
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 27.32 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 No tiers affect this stack.

Drtcn: 260.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 24.90 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 24.90 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 11.39 *Wake Effect Ht: 33.84
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 No tiers affect this stack.

Drtcn: 270.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.72 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.72 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 8.00 *Wake Effect Ht: 28.76
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75

No tiers affect this stack.

Drtcn: 280.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 24.90 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
No. of Tiers affecting Stk: 2
Bldg-Tier nos. contributing to MAX: 1 5
StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 24.90 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
No. of Tiers affecting Stk: 2
Bldg-Tier nos. contributing to MAX: 1 5
StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 11.39 *Wake Effect Ht: 33.84
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
No tiers affect this stack.

Drtcn: 290.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 27.32 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
No. of Tiers affecting Stk: 2
Bldg-Tier nos. contributing to MAX: 1 5
StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 27.32 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
No. of Tiers affecting Stk: 2
Bldg-Tier nos. contributing to MAX: 1 5
StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
No tiers affect this stack.

Drtcn: 300.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 17.03 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
No. of Tiers affecting Stk: 2
Bldg-Tier nos. contributing to MAX: 1 5
StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 17.03 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00
No. of Tiers affecting Stk: 2
Bldg-Tier nos. contributing to MAX: 1 5
StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
No tiers affect this stack.

Drtcn: 310.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 19.11 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82

*with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 19.11 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 No tiers affect this stack.

Drtcn: 320.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 20.62 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 20.62 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 No tiers affect this stack.

Drtcn: 330.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.49 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.49 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
 MAX: BH: 16.76 PBW: 14.00 *Wake Effect Ht: 37.75
 GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
 No tiers affect this stack.

Drtcn: 340.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.72 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00
 No. of Tiers affecting Stk: 2
 Bldg-Tier nos. contributing to MAX: 1 5
 StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
 MAX: BH: 16.76 PBW: 21.72 *Wake Effect Ht: 41.90
 GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
 *with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2
Bldg-Tier nos. contributing to MAX: 1 5
StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
No tiers affect this stack.

Drtcn: 350.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.28 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2
Bldg-Tier nos. contributing to MAX: 1 5
StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 21.28 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2
Bldg-Tier nos. contributing to MAX: 1 5
StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
No tiers affect this stack.

Drtcn: 360.00

StkNo: 1 Stk Name:EXIST1A Stack Ht: 27.40
MAX: BH: 16.76 PBW: 20.20 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 22.03 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2
Bldg-Tier nos. contributing to MAX: 1 5
StkNo: 2 Stk Name:EXIST1B Stack Ht: 27.40
MAX: BH: 16.76 PBW: 20.20 *Wake Effect Ht: 41.90
GEP: BH: 20.73 PBW: 25.92 *Equation 1 Ht: 51.82
*with a Stack-Building elevation difference applied = .00

No. of Tiers affecting Stk: 2
Bldg-Tier nos. contributing to MAX: 1 5
StkNo: 3 Stk Name:EXIST2A Stack Ht: 22.90
MAX: BH: .00 PBW: .00 *Wake Effect Ht: .00
GEP: BH: 16.76 PBW: 14.00 *Equation 1 Ht: 37.75
No tiers affect this stack.

DATE : 4/10/94
TIME : 13:28:54
BPIP data for TPS Hardee buildings and stacks 4/10/94

=====

BPIP PROCESSING INFORMATION:

=====

The ST flag has been set for processing for an ISCST2 run.

The inputs units are in: METERS Multiplying METERS by a conversion
factor of 1.0000 will produce internal BPIP results 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 .00 degrees with respect to True North.
BPIP data for TPS Hardee buildings and stacks 4/10/94

PRELIMINARY* GEP STACK HEIGHT RESULTS TABLE
(Input Units: METERS)

Stack Name	Stack Height	GEP** EQN1	Preliminary* GEP Stack Height Value
EXIST1A	27.40	51.82	27.40
EXIST1B	27.40	51.82	27.40
EXIST2A	22.90	37.75	22.90

* Results based on Table 3.1 of the GEP Technical Support Document.

Consult Table 3.1 for any additional steps that may be required.

** Results using Equation 1, page 6 of GEP Technical Support Document.

DATE : 4/10/94
TIME : 13:28:54

BPIP data for TPS Hardee buildings and stacks 4/10/94

BPIP output in METERS

SO BUILDHGT EXIST1A	16.76	16.76	16.76	16.76	16.76	16.76
SO BUILDHGT EXIST1A	16.76	16.76	16.76	16.76	16.76	16.76
SO BUILDHGT EXIST1A	16.76	16.76	16.76	16.76	16.76	16.76
SO BUILDHGT EXIST1A	16.76	16.76	16.76	20.73	20.73	20.73
SO BUILDHGT EXIST1A	20.73	16.76	16.76	16.76	16.76	16.76
SO BUILDHGT EXIST1A	16.76	16.76	16.76	16.76	16.76	16.76
SO BUILDWID EXIST1A	21.28	21.72	21.49	20.62	19.11	17.03
SO BUILDWID EXIST1A	27.32	24.90	21.72	24.90	27.32	17.03
SO BUILDWID EXIST1A	19.11	20.62	21.49	21.72	21.28	20.20
SO BUILDWID EXIST1A	21.28	21.72	21.49	32.98	30.42	26.93
SO BUILDWID EXIST1A	22.62	24.90	21.72	24.90	27.32	17.03
SO BUILDWID EXIST1A	19.11	20.62	21.49	21.72	21.28	20.20

SO BUILDHGT EXIST1B	16.76	16.76	16.76	16.76	16.76	16.76
SO BUILDHGT EXIST1B	16.76	16.76	16.76	16.76	16.76	16.76
SO BUILDHGT EXIST1B	16.76	16.76	16.76	16.76	16.76	16.76
SO BUILDHGT EXIST1B	16.76	16.76	16.76	20.73	20.73	20.73
SO BUILDHGT EXIST1B	16.76	16.76	16.76	16.76	16.76	16.76
SO BUILDHGT EXIST1B	16.76	16.76	16.76	16.76	16.76	16.76
SO BUILDWID EXIST1B	21.28	21.72	21.49	20.62	19.11	17.03
SO BUILDWID EXIST1B	27.32	24.90	21.72	24.90	27.32	17.03
SO BUILDWID EXIST1B	19.11	20.62	21.49	21.72	21.28	20.20
SO BUILDWID EXIST1B	21.28	21.72	21.49	32.98	30.42	26.93
SO BUILDWID EXIST1B	27.32	24.90	21.72	24.90	27.32	17.03
SO BUILDWID EXIST1B	19.11	20.62	21.49	21.72	21.28	20.20

SO BUILDHGT EXIST2A	.00	.00	16.76	16.76	16.76	16.76
SO BUILDHGT EXIST2A	16.76	16.76	16.76	16.76	16.76	16.76
SO BUILDHGT EXIST2A	16.76	16.76	16.76	.00	.00	.00
SO BUILDHGT EXIST2A	.00	.00	16.76	16.76	16.76	16.76
SO BUILDHGT EXIST2A	16.76	16.76	16.76	16.76	16.76	16.76
SO BUILDHGT EXIST2A	16.76	16.76	16.76	.00	.00	.00
SO BUILDWID EXIST2A	.00	.00	14.00	14.00	14.00	14.00
SO BUILDWID EXIST2A	14.00	11.39	8.00	11.39	14.00	14.00
SO BUILDWID EXIST2A	14.00	14.00	14.00	.00	.00	.00
SO BUILDWID EXIST2A	.00	.00	14.00	14.00	14.00	14.00
SO BUILDWID EXIST2A	14.00	11.39	8.00	11.39	14.00	14.00
SO BUILDWID EXIST2A	14.00	14.00	14.00	.00	.00	.00

ATTACHMENT F

**GENERIC MAXIMUM IMPACTS (AT 10 G/S)
PREDICTED FOR THE PROPOSED HARDEE UNIT 3
IN THE AAQS AND PSD CLASS II AREAS**

ISCST2 OUTPUT FILE NUMBER 1 :hd3gencm.o82

ISCST2 OUTPUT FILE NUMBER 2 :hd3gencm.o83

ISCST2 OUTPUT FILE NUMBER 3 :hd3gencm.o84

ISCST2 OUTPUT FILE NUMBER 4 :hd3gencm.o85

ISCST2 OUTPUT FILE NUMBER 5 :hd3gencm.o86

First title for last output file is: 1982 SEMINOLE HARDEE 3 - DISTILLATE OIL- 3/12/94

Second title for last output file is: CT STACKS LOADS ANALYSIS GENERIC IMPACTS 10 g/s

AVERAGING TIME	YEAR	CONC (ug/m3)	DIR (deg) or X (m)	DIST (m) or Y (m)	PERIOD ENDING (YYMMDDHH)

SOURCE GROUP ID: CTBA32					
Annual	1982	0.00530	250.	300.	82-----
	1983	0.00643	240.	300.	83-----
	1984	0.00728	240.	300.	84-----
	1985	0.00656	240.	300.	85-----
	1986	0.00789	250.	270.	86-----
HIGH 24-Hour	1982	0.46662	120.	196.	82011424
	1983	0.20543	290.	44.	83022724
	1984	0.54973	130.	152.	84022824
	1985	0.10951	30.	2000.	85082424
	1986	0.12422	70.	2000.	86071624
HSR 24-Hour	1982	0.05166	80.	2000.	82061424
	1983	0.09564	250.	1500.	83052724
	1984	0.15160	120.	196.	84032924
	1985	0.06978	60.	2000.	85061724
	1986	0.09207	290.	1500.	86051124
HIGH 8-Hour	1982	1.39419	120.	196.	82011416
	1983	0.61629	290.	44.	83022716
	1984	1.26049	130.	152.	84022816
	1985	0.31485	30.	2000.	85082416
	1986	0.31942	70.	2000.	86071616
HSR 8-Hour	1982	0.15405	80.	2000.	82061416
	1983	0.21507	250.	1500.	83052716
	1984	0.41582	120.	196.	84022816
	1985	0.20658	60.	2000.	85060616
	1986	0.22242	280.	1500.	86051116
HIGH 3-Hour	1982	3.69989	120.	196.	82011415
	1983	1.51903	290.	44.	83022715
	1984	1.79726	130.	152.	84022812
	1985	0.83914	30.	2000.	85082415
	1986	0.65833	290.	1500.	86051115
HSR 3-Hour	1982	0.38969	80.	2000.	82061412
	1983	0.57351	250.	1500.	83052712
	1984	1.56389	130.	152.	84022815
	1985	0.51355	50.	2000.	85082415
	1986	0.59311	280.	1500.	86051115
HIGH 1-Hour	1982	8.39088	130.	152.	82011414
	1983	4.55707	290.	44.	83022713
	1984	4.13767	130.	152.	84022813
	1985	1.81812	50.	2000.	85060612
	1986	1.97500	290.	1500.	86051114
HSR 1-Hour	1982	4.09794	120.	196.	82011413
	1983	1.48032	260.	1500.	83052712
	1984	3.06923	130.	152.	84022811
	1985	1.50350	40.	2000.	85060612
	1986	1.77927	280.	1500.	86051114
SOURCE GROUP ID: CTBA95					
Annual	1982	0.00468	270.	300.	82-----
	1983	0.00569	250.	270.	83-----
	1984	0.00649	240.	300.	84-----
	1985	0.00552	240.	300.	85-----
	1986	0.00731	250.	270.	86-----
HIGH 24-Hour	1982	1.12201	120.	196.	82011424
	1983	0.56477	290.	44.	83022724
	1984	1.54093	130.	152.	84022824

SIMPLE CYCLE
FUEL OIL

BASE, 75%, 50%

32°F, 95°F

	1985	0.32796	120.	196.	85021224
	1986	0.13006	70.	2000.	86071624
HSB 24-Hour	1982	0.07260	210.	2000.	82090524
	1983	0.09772	240.	1500.	83071124
	1984	0.52207	120.	196.	84032924
	1985	0.10696	350.	1500.	85070424
	1986	0.09434	250.	1500.	86080624
HIGH 8-Hour	1982	3.31143	120.	196.	82011416
	1983	1.69432	290.	44.	83022716
	1984	3.15534	130.	152.	84022816
	1985	0.44320	120.	196.	85021224
	1986	0.33443	70.	2000.	86071616
HSB 8-Hour	1982	0.20872	210.	2000.	82090516
	1983	0.25759	240.	1500.	83061516
	1984	1.44732	130.	152.	84022808
	1985	0.40724	120.	196.	85021216
	1986	0.24486	260.	1500.	86082216
HIGH 3-Hour	1982	8.65561	120.	196.	82011415
	1983	4.10665	290.	44.	83022715
	1984	4.46289	130.	152.	84022812
	1985	1.18186	120.	196.	85021218
	1986	0.70188	260.	1500.	86080612
HSB 3-Hour	1982	0.55660	210.	2000.	82090515
	1983	1.12742	320.	100.	83022709
	1984	3.95079	130.	152.	84022815
	1985	1.01370	120.	196.	85021215
	1986	0.65296	260.	1500.	86082215
HIGH 1-Hour	1982	17.39275	130.	152.	82011414
	1983	12.31702	290.	44.	83022713
	1984	9.86674	130.	152.	84022813
	1985	3.54356	120.	196.	85021217
	1986	2.10563	260.	1500.	86080612
HSB 1-Hour	1982	9.59355	120.	196.	82011413
	1983	3.38227	320.	100.	83022709
	1984	7.37126	130.	152.	84022808
	1985	1.94249	340.	1500.	85042611
	1986	1.95889	260.	1500.	86082213
SOURCE GROUP ID:	CT7532				
Annual	1982	0.00581	120.	196.	82-----
	1983	0.00559	250.	270.	83-----
	1984	0.00922	130.	152.	84-----
	1985	0.00535	250.	270.	85-----
	1986	0.00721	250.	270.	86-----
HIGH 24-Hour	1982	1.97928	120.	196.	82011424
	1983	1.04865	290.	44.	83022724
	1984	3.00093	130.	152.	84022824
	1985	0.90167	120.	196.	85021224
	1986	0.19325	120.	196.	86012724
HSB 24-Hour	1982	0.10112	130.	1500.	82073024
	1983	0.13579	120.	196.	83032424
	1984	1.19317	120.	196.	84032924
	1985	0.11473	60.	1500.	85071024
	1986	0.10786	230.	1500.	86040324
HIGH 8-Hour	1982	5.73320	120.	196.	82011416
	1983	3.14594	290.	44.	83022716
	1984	5.55545	130.	152.	84022816
	1985	1.22823	120.	196.	85021216
	1986	0.57841	120.	196.	86012716
HSB 8-Hour	1982	0.22237	130.	1500.	82082416
	1983	0.28924	70.	1500.	83070316
	1984	3.35581	130.	152.	84022808
	1985	1.07802	120.	196.	85021224
	1986	0.27437	280.	1500.	86052916
HIGH 3-Hour	1982	14.62971	120.	196.	82011415
	1983	7.54221	290.	44.	83022715
	1984	7.81897	130.	152.	84022812
	1985	2.99973	120.	196.	85021215

HSH 3-Hour	1986	1.52954	120.	196.	86012715
	1982	1.20456	120.	196.	82011418
	1983	2.50217	320.	100.	83022709
	1984	6.99439	130.	152.	84022815
	1985	2.87444	120.	196.	85021218
	1986	0.68346	290.	1500.	86083115
HIGH 1-Hour	1982	27.07517	130.	152.	82011414
	1983	22.58241	290.	44.	83022713
	1984	16.63532	130.	152.	84022813
	1985	8.59221	120.	196.	85021217
	1986	4.58658	120.	196.	86012714
	HSH 1-Hour	1982	16.21455	120.	196.
1983		7.50652	320.	100.	83022709
1984		15.60612	130.	152.	84022808
1985		4.73503	120.	196.	85021215
1986		2.04229	290.	1500.	86083113
SOURCE GROUP ID: CT7595					
Annual	1982	0.00885	120.	196.	82-----
	1983	0.00496	290.	44.	83-----
	1984	0.01540	130.	152.	84-----
	1985	0.00576	120.	196.	85-----
	1986	0.00615	270.	2000.	86-----
	HIGH 24-Hour	1982	3.03050	120.	196.
1983		1.62995	290.	44.	83022724
1984		4.94651	130.	152.	84022824
1985		1.84632	120.	196.	85021224
1986		0.41544	120.	196.	86012724
HSH 24-Hour		1982	0.09974	130.	1500.
	1983	0.35444	120.	196.	83032424
	1984	2.21148	120.	196.	84022824
	1985	0.11614	60.	1500.	85071024
	1986	0.18670	70.	1500.	86080724
	HIGH 8-Hour	1982	8.58403	120.	196.
1983		4.88986	290.	44.	83022716
1984		8.35201	130.	152.	84022816
1985		2.64751	120.	196.	85021216
1986		1.24011	120.	196.	86012716
HSH 8-Hour		1982	0.50747	120.	196.
	1983	0.54075	120.	196.	83032424
	1984	6.23136	130.	152.	84022808
	1985	2.01854	120.	196.	85021224
	1986	0.51338	70.	1500.	86080716
	HIGH 3-Hour	1982	21.25210	120.	196.
1983		11.63464	290.	44.	83022715
1984		11.64995	130.	152.	84022812
1985		6.36553	120.	196.	85021215
1986		3.22891	120.	196.	86012715
HSH 3-Hour		1982	2.99188	120.	196.
	1983	4.38308	320.	100.	83022709
	1984	10.62013	130.	152.	84022815
	1985	5.37969	120.	196.	85021218
	1986	0.84416	70.	1500.	86080712
	HIGH 1-Hour	1982	37.93457	120.	196.
1983		34.63825	290.	44.	83022713
1984		26.19376	130.	152.	84022808
1985		15.94899	120.	196.	85021217
1986		9.66527	120.	196.	86012714
HSH 1-Hour		1982	23.54746	120.	196.
	1983	13.14925	320.	100.	83022709
	1984	23.98792	130.	152.	84022813
	1985	9.99871	120.	196.	85021215
	1986	2.44200	70.	1500.	86071611
	SOURCE GROUP ID: CT5032				
Annual	1982	0.01350	120.	196.	82-----
	1983	0.00825	120.	196.	83-----
	1984	0.02583	130.	152.	84-----
	1985	0.01148	120.	196.	85-----

HIGH 24-Hour	1986	0.00738	270.	2000.	86-----
	1982	4.63383	120.	196.	82011424
	1983	2.48475	290.	44.	83022724
	1984	8.00466	130.	152.	84022824
	1985	3.61737	120.	196.	85021224
HSH 24-Hour	1986	0.85696	120.	196.	86012724
	1982	0.20242	130.	152.	82080224
	1983	0.82426	120.	196.	83030124
	1984	3.94413	120.	196.	84022824
	1985	0.17078	240.	1500.	85090824
HIGH 8-Hour	1986	0.32750	130.	152.	86012724
	1982	12.74936	120.	196.	82011416
	1983	7.45421	290.	44.	83022716
	1984	12.26966	130.	152.	84022816
	1985	5.34922	120.	196.	85021216
HSH 8-Hour	1986	2.54448	120.	196.	86012716
	1982	1.15212	120.	196.	82011424
	1983	1.31116	120.	196.	83032416
	1984	11.11591	130.	152.	84022808
	1985	3.64984	120.	196.	85021224
HIGH 3-Hour	1986	0.97396	130.	152.	86012724
	1982	30.26917	120.	196.	82011415
	1983	17.63348	290.	44.	83022715
	1984	19.11202	120.	196.	84032912
	1985	12.65822	120.	196.	85021215
HSH 3-Hour	1986	6.41597	120.	196.	86012715
	1982	6.80146	120.	196.	82011418
	1983	7.37630	320.	100.	83022709
	1984	15.93551	130.	152.	84022815
	1985	9.71007	120.	196.	85021218
HIGH 1-Hour	1986	2.00893	130.	152.	86012718
	1982	53.95941	120.	196.	82011415
	1983	51.66220	290.	44.	83022713
	1984	41.60531	130.	152.	84022808
	1985	28.22336	120.	196.	85021217
HSH 1-Hour	1986	19.09071	120.	196.	86012714
	1982	33.52090	120.	196.	82011413
	1983	22.12891	320.	100.	83022709
	1984	33.43552	130.	152.	84022813
	1985	19.78699	120.	196.	85021215
SOURCE GROUP ID: CT5095 Annual	1986	5.93520	130.	152.	86012718
	1982	0.01731	120.	196.	82-----
	1983	0.01441	120.	196.	83-----
	1984	0.03626	130.	152.	84-----
	1985	0.01740	120.	196.	85-----
HIGH 24-Hour	1986	0.00808	270.	2000.	86-----
	1982	5.92769	120.	196.	82011424
	1983	3.16514	290.	44.	83022724
	1984	10.72715	130.	152.	84022824
	1985	5.30442	120.	196.	85021224
HSH 24-Hour	1986	1.62303	130.	152.	86030124
	1982	0.42796	130.	152.	82080224
	1983	1.20189	120.	196.	83030124
	1984	5.50723	120.	196.	84022824
	1985	0.29761	120.	196.	85010424
HIGH 8-Hour	1986	0.64520	130.	152.	86012724
	1982	15.96747	120.	196.	82011416
	1983	9.49524	290.	44.	83022716
	1984	16.62614	120.	196.	84032916
	1985	7.89417	120.	196.	85021216
HSH 8-Hour	1986	3.96563	130.	152.	86030116
	1982	1.81559	120.	196.	82011424
	1983	2.28842	120.	196.	83020316
	1984	15.48135	130.	152.	84022816
	1985	5.12515	120.	196.	85021224
	1986	1.91502	130.	152.	86012724

HIGH 3-Hour	1982	36.70625	120.	196.	82011415
	1983	22.41551	290.	44.	83022715
	1984	26.17896	120.	196.	84032912
	1985	18.48651	120.	196.	85021215
	1986	9.41951	120.	196.	86012715
HSH 3-Hour	1982	10.71523	120.	196.	82011418
	1983	9.83967	320.	100.	83022709
	1984	21.53573	120.	196.	84022809
	1985	13.59582	120.	196.	85021218
	1986	3.61001	130.	152.	86012718
HIGH 1-Hour	1982	65.40232	120.	196.	82011415
	1983	64.33028	290.	44.	83022713
	1984	54.10886	130.	152.	84022808
	1985	38.61280	120.	196.	85021217
	1986	27.77979	120.	196.	86012714
HSH 1-Hour	1982	40.63264	120.	196.	82011413
	1983	29.51900	320.	100.	83022709
	1984	40.42733	130.	152.	84022813
	1985	28.80984	120.	196.	85021215
	1986	10.51801	130.	152.	86012718
All receptor computations reported with respect to a user-specified origin					
GRID	0.00	0.00			
DISCRETE	0.00	0.00			

ISCST2 OUTPUT FILE NUMBER 1 :hd3genhm.o82

ISCST2 OUTPUT FILE NUMBER 2 :hd3genhm.o83

ISCST2 OUTPUT FILE NUMBER 3 :hd3genhm.o84

ISCST2 OUTPUT FILE NUMBER 4 :hd3genhm.o85

ISCST2 OUTPUT FILE NUMBER 5 :hd3genhm.o86

First title for last output file is: 1982 SEMINOLE HARDEE 3 - DISTILLATE OIL- 3/12/94

Second title for last output file is: HRS GS STACKS LOAD ANALYSIS GENERIC IMPACTS 10 g/s

AVERAGING TIME	YEAR	CONC (ug/m3)	DIR (deg) or X (m)	DIST (m) or Y (m)	PERIOD ENDING (YYMMDDHH)

SOURCE GROUP ID: HRBA32					
Annual	1982	0.04341	70.	2000.	82-----
	1983	0.03718	90.	2000.	83-----
	1984	0.04512	90.	2000.	84-----
	1985	0.05280	70.	2000.	85-----
	1986	0.06537	90.	2000.	86-----
HIGH 24-Hour	1982	1.64875	130.	200.	82011424
	1983	0.73066	290.	200.	83022724
	1984	3.02822	120.	196.	84022824
	1985	3.27140	360.	203.	85083124
	1986	0.75054	70.	1000.	86071624
HSR 24-Hour	1982	0.45864	360.	2000.	82082724
	1983	0.49591	50.	2000.	83082324
	1984	1.26500	130.	200.	84032924
	1985	0.52258	70.	2000.	85042624
	1986	0.60319	90.	2000.	86080124
HIGH 8-Hour	1982	4.69476	130.	200.	82011416
	1983	2.19199	290.	200.	83022716
	1984	6.79717	120.	196.	84022816
	1985	7.51347	360.	203.	85083116
	1986	1.92996	70.	1000.	86071616
HSR 8-Hour	1982	1.32201	60.	2000.	82071116
	1983	1.40079	50.	2000.	83082316
	1984	3.39885	140.	128.	84032916
	1985	2.24697	360.	203.	85083108
	1986	1.50091	90.	2000.	86080116
HIGH 3-Hour	1982	12.04586	130.	200.	82011415
	1983	4.73130	290.	200.	83022715
	1984	12.65428	120.	196.	84022812
	1985	9.01339	360.	203.	85083109
	1986	3.84300	10.	212.	86031412
HSR 3-Hour	1982	2.55101	60.	2000.	82042212
	1983	2.51663	30.	1500.	83081015
	1984	6.78287	140.	200.	84022815
	1985	7.28798	360.	203.	85083112
	1986	2.68532	90.	1000.	86071315
HIGH 1-Hour	1982	18.51274	130.	152.	82011415
	1983	14.13216	290.	200.	83022713
	1984	27.26331	210.	200.	84081704
	1985	26.89352	360.	203.	85083109
	1986	11.52901	10.	212.	86031412
HSR 1-Hour	1982	14.00486	130.	200.	82011415
	1983	5.58019	260.	1000.	83062611
	1984	15.03402	120.	196.	84022811
	1985	17.82910	360.	203.	85083106
	1986	4.95312	270.	1000.	86060316
SOURCE GROUP ID: HRBA95					
Annual	1982	0.05041	70.	2000.	82-----
	1983	0.04460	90.	2000.	83-----
	1984	0.05459	90.	2000.	84-----
	1985	0.06197	80.	2000.	85-----
	1986	0.07794	90.	2000.	86-----
HIGH 24-Hour	1982	3.01235	130.	200.	82011424
	1983	1.47372	280.	200.	83022724
	1984	6.14148	140.	128.	84022824

COMBINED CYCL
FUEL OIL

BASE, 75%, 50

32°F, 95°F

	1985	7.02815	360.	203.	85083124
	1986	1.11254	10.	212.	86031424
HSR 24-Hour	1982	0.60881	360.	2000.	82082724
	1983	0.56996	50.	1500.	83082324
	1984	3.10460	130.	200.	84032924
	1985	0.65759	80.	2000.	85060424
	1986	0.69644	90.	1500.	86080124
HIGH 8-Hour	1982	8.15612	130.	200.	82011416
	1983	4.42090	280.	200.	83022716
	1984	12.27576	120.	196.	84022816
	1985	16.01575	360.	203.	85083116
	1986	3.19840	10.	212.	86031416
HSR 8-Hour	1982	1.57159	60.	2000.	82071116
	1983	1.50089	50.	2000.	83082316
	1984	8.27910	140.	128.	84032916
	1985	4.58826	360.	203.	85083108
	1986	1.70257	70.	1000.	86080716
HIGH 3-Hour	1982	20.09505	130.	200.	82011415
	1983	8.48571	280.	100.	83022715
	1984	22.61999	120.	196.	84022812
	1985	16.47646	360.	203.	85083109
	1986	8.52908	10.	212.	86031412
HSR 3-Hour	1982	4.32376	130.	152.	82011418
	1983	3.95733	120.	196.	83121203
	1984	13.49985	140.	200.	84022815
	1985	16.06643	360.	203.	85083112
	1986	3.11715	90.	1000.	86071315
HIGH 1-Hour	1982	31.41720	130.	152.	82011415
	1983	24.74483	280.	100.	83022713
	1984	43.68443	210.	200.	84081704
	1985	47.62326	360.	203.	85083109
	1986	25.58723	10.	212.	86031412
HSR 1-Hour	1982	23.54003	130.	200.	82011415
	1983	9.83054	300.	300.	83022712
	1984	25.72452	120.	196.	84022813
	1985	34.90001	360.	203.	85083106
	1986	5.35447	270.	1000.	86062514
SOURCE GROUP ID:	HR7532				
Annual	1982	0.05687	70.	2000.	82-----
	1983	0.05090	90.	2000.	83-----
	1984	0.06266	90.	2000.	84-----
	1985	0.07094	70.	2000.	85-----
	1986	0.08834	90.	2000.	86-----
HIGH 24-Hour	1982	4.18885	130.	200.	82011424
	1983	2.12276	280.	200.	83022724
	1984	9.32961	140.	128.	84022824
	1985	10.73655	360.	203.	85083124
	1986	1.66310	10.	212.	86031424
HSR 24-Hour	1982	0.72846	360.	2000.	82082724
	1983	1.14602	120.	210.	83020324
	1984	5.07993	130.	200.	84032924
	1985	0.69175	80.	2000.	85081124
	1986	0.72420	90.	1500.	86080124
HIGH 8-Hour	1982	10.93609	130.	200.	82011416
	1983	6.36444	280.	200.	83022716
	1984	16.75722	120.	196.	84022816
	1985	23.91508	360.	203.	85083116
	1986	4.78141	10.	212.	86031416
HSR 8-Hour	1982	1.75614	60.	2000.	82071116
	1983	2.77149	120.	196.	83032424
	1984	13.20998	140.	128.	84032916
	1985	6.88332	360.	203.	85083108
	1986	1.95402	90.	2000.	86100516
HIGH 3-Hour	1982	26.11206	130.	200.	82011415
	1983	12.02379	280.	100.	83022715
	1984	30.54411	120.	196.	84022812
	1985	24.26398	360.	203.	85083112

	1986	12.75041	10.	212.	86031412
SHS 3-Hour	1982	7.97715	130.	152.	82011418
	1983	6.53060	120.	196.	83121203
	1984	19.54107	140.	200.	84022815
	1985	23.25939	360.	203.	85083109
	1986	3.42849	90.	1000.	86071315
HIGH 1-Hour	1982	41.19585	130.	152.	82011415
	1983	35.44115	350.	185.	83040212
	1984	55.58677	210.	200.	84081704
	1985	63.70060	360.	203.	85083109
	1986	38.25124	10.	212.	86031412
SHS 1-Hour	1982	30.70058	130.	200.	82011415
	1983	15.70753	120.	196.	83032417
	1984	34.21816	120.	196.	84022813
	1985	48.98897	360.	203.	85083106
	1986	5.66656	270.	1000.	86062514
SOURCE GROUP ID: HR7595					
Annual	1982	0.06301	70.	2000.	82-----
	1983	0.05689	90.	2000.	83-----
	1984	0.07004	90.	2000.	84-----
	1985	0.07913	70.	2000.	85-----
	1986	0.09683	90.	2000.	86-----
HIGH 24-Hour	1982	5.28293	130.	200.	82011424
	1983	2.75348	280.	200.	83022724
	1984	12.50017	140.	128.	84022824
	1985	14.55288	360.	203.	85083124
	1986	2.17590	10.	212.	86031424
SHS 24-Hour	1982	0.83943	360.	2000.	82082724
	1983	2.06051	120.	210.	83020324
	1984	7.18885	130.	200.	84032924
	1985	1.33875	140.	128.	85010424
	1986	0.91326	130.	200.	86030124
HIGH 8-Hour	1982	13.39502	130.	200.	82011416
	1983	8.24035	280.	200.	83022716
	1984	21.09843	140.	128.	84022816
	1985	31.48088	360.	203.	85083116
	1986	6.25571	10.	212.	86031416
SHS 8-Hour	1982	2.45376	130.	200.	82011424
	1983	4.08285	120.	196.	83032424
	1984	18.15698	140.	128.	84032916
	1985	9.34830	360.	203.	85083108
	1986	2.33873	130.	200.	86030116
HIGH 3-Hour	1982	31.16326	130.	200.	82011415
	1983	16.23818	350.	185.	83040212
	1984	37.44217	120.	196.	84022812
	1985	32.10814	360.	203.	85083112
	1986	16.68189	10.	212.	86031412
SHS 3-Hour	1982	11.97254	130.	152.	82011418
	1983	9.61866	130.	152.	83030106
	1984	25.41502	140.	200.	84022815
	1985	30.26276	360.	203.	85083109
	1986	3.94551	130.	200.	86030115
HIGH 1-Hour	1982	49.48452	130.	152.	82011415
	1983	48.71455	350.	185.	83040212
	1984	65.40144	210.	200.	84081704
	1985	77.46516	360.	203.	85083109
	1986	50.04566	10.	212.	86031412
SHS 1-Hour	1982	36.72737	130.	200.	82011415
	1983	21.89044	120.	196.	83032417
	1984	41.46001	120.	196.	84022813
	1985	61.46329	360.	203.	85083106
	1986	8.96664	140.	200.	86030115
SOURCE GROUP ID: HR5032					
Annual	1982	0.06638	70.	2000.	82-----
	1983	0.06072	90.	2000.	83-----
	1984	0.07468	90.	2000.	84-----
	1985	0.08408	70.	2000.	85-----

HIGH 24-Hour	1986	0.10267	90.	2000.	86-----
	1982	5.88888	130.	200.	82011424
	1983	3.11769	280.	200.	83022724
	1984	14.32215	140.	128.	84022824
	1985	16.80879	360.	203.	85083124
	1986	2.45725	10.	212.	86031424
HSH 24-Hour	1982	0.90423	360.	2000.	82082724
	1983	2.69520	120.	210.	83020324
	1984	8.45702	130.	200.	84032924
	1985	1.87610	140.	128.	85010424
	1986	1.24950	130.	200.	86030124
	HIGH 8-Hour	1982	14.71093	130.	200.
1983		9.31169	280.	200.	83022716
1984		23.52635	140.	128.	84022816
1985		35.70961	360.	203.	85083116
1986		7.06460	10.	212.	86031416
HSH 8-Hour		1982	2.95570	130.	200.
	1983	4.88667	120.	196.	83032424
	1984	20.99478	140.	128.	84032916
	1985	10.87026	360.	203.	85083108
	1986	3.18628	130.	200.	86030116
	HIGH 3-Hour	1982	33.77724	130.	200.
1983		18.73238	350.	185.	83040212
1984		41.08729	120.	196.	84022812
1985		36.48500	360.	203.	85083112
1986		18.83892	10.	212.	86031412
HSH 3-Hour		1982	14.40479	130.	152.
	1983	11.47278	130.	152.	83032418
	1984	28.78126	140.	200.	84022815
	1985	34.50554	360.	203.	85083109
	1986	5.24334	130.	200.	86030115
	HIGH 1-Hour	1982	53.80225	130.	152.
1983		56.19715	350.	185.	83040212
1984		70.42817	210.	200.	84081704
1985		84.66528	360.	203.	85083109
1986		56.51677	10.	212.	86031412
HSH 1-Hour		1982	39.85092	130.	200.
	1983	25.40549	120.	196.	83032417
	1984	45.23890	120.	196.	84022813
	1985	68.11073	360.	203.	85083106
	1986	11.69381	140.	200.	86030115
	SOURCE GROUP ID:	HR5095			
Annual	1982	0.07450	70.	2000.	82-----
	1983	0.06905	90.	2000.	83-----
	1984	0.10180	140.	128.	84-----
	1985	0.09482	70.	2000.	85-----
	1986	0.11523	90.	2000.	86-----
	HIGH 24-Hour	1982	7.12944	130.	200.
1983		4.30357	120.	196.	83020324
1984		18.16101	140.	128.	84022824
1985		21.69945	360.	203.	85083124
1986		3.17751	150.	113.	86030124
HSH 24-Hour		1982	1.05695	360.	2000.
	1983	3.91379	120.	196.	83032424
	1984	11.24649	130.	200.	84032924
	1985	3.33547	140.	128.	85010424
	1986	2.13658	130.	200.	86030124
	HIGH 8-Hour	1982	17.30500	130.	200.
1983		11.58660	280.	200.	83022716
1984		29.16397	130.	200.	84032916
1985		44.34903	360.	203.	85083116
1986		8.68898	10.	212.	86031416
HSH 8-Hour		1982	4.08288	130.	200.
	1983	6.72329	130.	152.	83032416
	1984	26.92397	140.	128.	84032916
	1985	14.33996	360.	203.	85083108
	1986	5.39117	130.	200.	86030116

HIGH 3-Hour	1982	38.77345	130.	200.	82011415
	1983	23.85139	350.	185.	83040212
	1984	48.17900	120.	196.	84022812
	1985	45.40738	360.	203.	85083112
	1986	23.17055	10.	212.	86031412
HSH 3-Hour	1982	19.85949	130.	152.	82011418
	1983	15.38550	130.	152.	83032418
	1984	35.89958	140.	200.	84022815
	1985	44.04725	360.	203.	85083109
	1986	8.53191	130.	200.	86030115
HIGH 1-Hour	1982	62.10972	130.	152.	82011415
	1983	71.55415	350.	185.	83040212
	1984	79.95133	210.	200.	84081704
	1985	98.54848	360.	203.	85083109
	1986	69.51166	10.	212.	86031412
HSH 1-Hour	1982	45.82896	130.	200.	82011415
	1983	32.67055	120.	196.	83032417
	1984	52.50950	120.	196.	84022813
	1985	81.97151	360.	203.	85083114
	1986	18.92893	150.	113.	86030114
All receptor computations reported with respect to a user-specified origin					
GRID	0.00	0.00			
DISCRETE	0.00	0.00			

ISCST2 OUTPUT FILE NUMBER 1 :genaugh.o82
 ISCST2 OUTPUT FILE NUMBER 2 :genaugh.o83
 ISCST2 OUTPUT FILE NUMBER 3 :genaugh.o84
 ISCST2 OUTPUT FILE NUMBER 4 :genaugh.o85
 ISCST2 OUTPUT FILE NUMBER 5 :genaugh.o86

First title for last output file is: 1982 SECI #3 PROPOSED HARDEE #3 NATURAL GAS 3/16/94

Second title for last output file is: MAXIMUM IMPACT & POWER AUG 80F & 95F SC,CC

AVERAGING TIME	YEAR	CONC (ug/m3)	DIR (deg) or X (m)	DIST (m) or Y (m)	PERIOD ENDING (YYMMDDHH)

SOURCE GROUP ID: 80COMB					
Annual					
	1982	0.11767	70.	2000.	82-----
	1983	0.10754	90.	2000.	83-----
	1984	0.13256	90.	2000.	84-----
	1985	0.15167	70.	2000.	85-----
	1986	0.18053	90.	2000.	86-----
HIGH 24-Hour					
	1982	6.51004	130.	200.	82011424
	1983	3.65948	280.	200.	83022724
	1984	15.14682	120.	196.	84022824
	1985	20.41336	360.	203.	85083124
	1986	2.92452	10.	212.	86031424
HSH 24-Hour					
	1982	1.65086	240.	2000.	82050324
	1983	3.36752	120.	210.	83032424
	1984	9.88680	130.	200.	84032924
	1985	2.07423	350.	185.	85090124
	1986	1.57113	130.	200.	86030124
HIGH 8-Hour					
	1982	16.13470	130.	200.	82011416
	1983	10.92014	280.	200.	83022716
	1984	26.28726	130.	200.	84032916
	1985	42.58060	360.	203.	85083116
	1986	8.40800	10.	212.	86031416
HSH 8-Hour					
	1982	3.87393	360.	2000.	82060616
	1983	5.81150	120.	196.	83032424
	1984	20.86016	140.	128.	84032916
	1985	13.27068	360.	203.	85083108
	1986	4.00742	130.	200.	86030116
HIGH 3-Hour					
	1982	36.72793	130.	200.	82011415
	1983	21.90579	350.	185.	83040212
	1984	46.57794	120.	196.	84022812
	1985	43.52716	360.	203.	85083112
	1986	22.42105	10.	212.	86031412
HSH 3-Hour					
	1982	15.35063	130.	200.	82011418
	1983	12.62014	120.	196.	83020315
	1984	32.50158	140.	200.	84022815
	1985	41.12191	360.	203.	85083109
	1986	6.64611	130.	200.	86030115
HIGH 1-Hour					
	1982	55.68156	140.	200.	82011414
	1983	65.71738	350.	185.	83040212
	1984	76.31068	210.	200.	84081704
	1985	96.33075	360.	203.	85083109
	1986	67.26316	10.	212.	86031412
HSH 1-Hour					

	1982	42.99879	130.	200.	82011415
	1983	29.31869	120.	196.	83032417
	1984	51.10233	120.	196.	84022813
	1985	79.13043	360.	203.	85083106
	1986	13.70058	140.	200.	86030115
SOURCE GROUP ID:	95COMB				
Annual					
	1982	0.11923	70.	2000.	82-----
	1983	0.10917	90.	2000.	83-----
	1984	0.13451	90.	2000.	84-----
	1985	0.15365	70.	2000.	85-----
	1986	0.18290	90.	2000.	86-----
HIGH 24-Hour					
	1982	6.69889	130.	200.	82011424
	1983	3.78337	280.	200.	83022724
	1984	15.64416	120.	196.	84022824
	1985	21.19911	360.	203.	85083124
	1986	3.01326	10.	212.	86031424
HSH 24-Hour					
	1982	1.68019	240.	2000.	82050324
	1983	3.56368	120.	196.	83032424
	1984	10.32145	130.	200.	84032924
	1985	2.25365	350.	185.	85090124
	1986	1.70823	130.	200.	86030124
HIGH 8-Hour					
	1982	16.53005	130.	200.	82011416
	1983	11.27912	280.	200.	83022716
	1984	27.29841	130.	200.	84032916
	1985	43.94297	360.	203.	85083116
	1986	8.66313	10.	212.	86031416
HSH 8-Hour					
	1982	3.91658	360.	2000.	82060616
	1983	6.09566	120.	196.	83032424
	1984	21.70868	140.	128.	84032916
	1985	13.83237	360.	203.	85083108
	1986	4.35136	130.	200.	86030116
HIGH 3-Hour					
	1982	37.48317	130.	200.	82011415
	1983	22.70639	350.	185.	83040212
	1984	47.67266	120.	196.	84022812
	1985	44.95676	20.	221.	85083121
	1986	23.10139	10.	212.	86031412
HSH 3-Hour					
	1982	16.10549	130.	200.	82011418
	1983	13.39494	120.	196.	83020315
	1984	33.59277	140.	200.	84022815
	1985	42.65548	360.	203.	85083109
	1986	7.16689	130.	200.	86030115
HIGH 1-Hour					
	1982	56.85577	140.	200.	82011414
	1983	68.11917	350.	185.	83040212
	1984	77.73208	210.	200.	84081704
	1985	98.43709	360.	203.	85083109
	1986	69.30415	10.	212.	86031412
HSH 1-Hour					
	1982	43.90231	130.	200.	82011415
	1983	30.45106	120.	196.	83032417
	1984	52.21728	120.	196.	84022813
	1985	81.52982	360.	203.	85083114
	1986	14.69678	140.	200.	86030115
SOURCE GROUP ID:	80SIMP				
Annual					
	1982	0.00566	140.	128.	82-----
	1983	0.00554	250.	300.	83-----

	1984	0.01504	140.	128.	84-----
	1985	0.00535	250.	300.	85-----
	1986	0.00730	250.	300.	86-----
HIGH 24-Hour					
	1982	1.94933	140.	128.	82011424
	1983	1.37164	320.	100.	83022724
	1984	3.68801	140.	128.	84022824
	1985	1.08274	360.	203.	85083124
	1986	0.13003	70.	2000.	86071624
HSH 24-Hour					
	1982	0.07440	220.	2000.	82090524
	1983	0.09422	250.	1500.	83052724
	1984	1.30512	140.	128.	84032924
	1985	0.11262	350.	1500.	85070424
	1986	0.10588	70.	1500.	86041524
HIGH 8-Hour					
	1982	5.65119	140.	128.	82011416
	1983	4.11491	320.	100.	83022716
	1984	8.52740	140.	128.	84022816
	1985	2.48802	360.	203.	85083116
	1986	0.33836	10.	212.	86031416
HSH 8-Hour					
	1982	0.21148	220.	2000.	82061516
	1983	0.25875	240.	1500.	83061516
	1984	3.90971	140.	128.	84032916
	1985	0.75639	360.	203.	85083108
	1986	0.27792	70.	1500.	86041516
HIGH 3-Hour					
	1982	14.98169	140.	128.	82011415
	1983	10.40286	320.	100.	83022715
	1984	17.05894	140.	128.	84022812
	1985	3.78516	360.	203.	85083109
	1986	0.90228	10.	212.	86031412
HSH 3-Hour					
	1982	0.61294	140.	128.	82011418
	1983	2.62962	310.	100.	83022709
	1984	6.28538	140.	128.	84032912
	1985	2.19967	360.	203.	85083112
	1986	0.64077	260.	1500.	86082215
HIGH 1-Hour					
	1982	24.81108	140.	128.	82011413
	1983	31.13858	320.	100.	83022713
	1984	28.57964	140.	128.	84022810
	1985	11.35337	360.	203.	85083109
	1986	2.70685	10.	212.	86031412
HSH 1-Hour					
	1982	14.63755	140.	128.	82011414
	1983	7.88887	310.	100.	83022709
	1984	16.00076	140.	128.	84022811
	1985	6.05815	360.	203.	85083110
	1986	1.92231	260.	1500.	86082213
SOURCE GROUP ID: 95SIMP					
Annual					
	1982	0.00649	140.	128.	82-----
	1983	0.00554	250.	300.	83-----
	1984	0.01802	140.	128.	84-----
	1985	0.00534	250.	300.	85-----
	1986	0.00729	250.	300.	86-----
HIGH 24-Hour					
	1982	2.23713	140.	128.	82011424
	1983	1.60916	310.	100.	83022724
	1984	4.37664	140.	128.	84022824
	1985	1.34021	360.	203.	85083124
	1986	0.15258	10.	212.	86031424

HSH 24-Hour					
	1982	0.10142	130.	1500.	82073024
	1983	0.09503	250.	1500.	83052724
	1984	1.60715	140.	128.	84032924
	1985	0.11312	350.	1500.	85070424
	1986	0.10633	70.	1500.	86041524
HIGH 8-Hour					
	1982	6.43885	140.	128.	82011416
	1983	4.82746	310.	100.	83022716
	1984	9.94926	140.	128.	84022816
	1985	3.07678	360.	203.	85083116
	1986	0.43797	10.	212.	86031416
HSH 8-Hour					
	1982	0.27255	140.	128.	82011424
	1983	0.25987	240.	1500.	83061516
	1984	4.81119	140.	128.	84032916
	1985	0.93842	360.	203.	85083108
	1986	0.27911	70.	1500.	86041516
HIGH 3-Hour					
	1982	17.04822	140.	128.	82011415
	1983	11.90962	320.	100.	83022715
	1984	19.78829	140.	128.	84022812
	1985	4.53864	360.	203.	85083109
	1986	1.16792	10.	212.	86031412
HSH 3-Hour					
	1982	0.84884	140.	128.	82011418
	1983	3.18443	310.	100.	83022709
	1984	7.50566	140.	128.	84032912
	1985	2.76815	360.	203.	85083112
	1986	0.64447	260.	1500.	86082215
HIGH 1-Hour					
	1982	28.24280	140.	128.	82011413
	1983	35.60113	320.	100.	83022713
	1984	32.52365	140.	128.	84022810
	1985	13.61121	360.	203.	85083109
	1986	3.50376	10.	212.	86031412
HSH 1-Hour					
	1982	16.65187	140.	128.	82011414
	1983	9.55328	310.	100.	83022709
	1984	18.63564	140.	128.	84022811
	1985	7.51154	360.	203.	85083110
	1986	1.93342	260.	1500.	86082213

All receptor computations reported with respect to a user-specified origin

GRID	0.00	0.00
DISCRETE	0.00	0.00

ATTACHMENT G

**GENERIC MAXIMUM IMPACTS (AT 10 G/S)
PREDICTED FOR THE PROPOSED HARDEE UNIT 3
IN THE PSD CLASS I AREA**

ISCST2 OUTPUT FILE NUMBER 1 :SGENCL1D.082

ISCST2 OUTPUT FILE NUMBER 2 :SGENCL1D.083

ISCST2 OUTPUT FILE NUMBER 3 :SGENCL1D.084

ISCST2 OUTPUT FILE NUMBER 4 :SGENCL1D.085

ISCST2 OUTPUT FILE NUMBER 5 :SGENCL1D.086

First title for last output file is: 1982 SEMINOLE HARDEE 3 - DISTILLATE OIL- CLASS I 2/1/94

Second title for last output file is: HRSQS STACKS LOADS ANALYSIS GENERIC IMPACTS 10G/S (GROUP)

AVERAGING TIME	YEAR	CONC (ug/m3)	DIR (deg) or X (m)	DIST (m) or Y (m)	PERIOD ENDING (YYMMDDHH)

SOURCE GROUP ID: HRBA32					
Annual					
	1982	0.00381	340300.	3165700.	82-----
	1983	0.00339	340700.	3171900.	83-----
	1984	0.00223	340700.	3171900.	84-----
	1985	0.00416	340300.	3165700.	85-----
	1986	0.00474	340300.	3165700.	86-----
HIGH 24-Hour					
	1982	0.09197	340300.	3169800.	82061024
	1983	0.10348	340700.	3171900.	83050324
	1984	0.05461	343700.	3178300.	84080524
	1985	0.10824	342000.	3174000.	85113024
	1986	0.12052	340300.	3165700.	86072424
HSH 24-Hour					
	1982	0.06083	340700.	3171900.	82121124
	1983	0.08775	340700.	3171900.	83090424
	1984	0.04998	343700.	3178300.	84063024
	1985	0.07709	340300.	3167700.	85113024
	1986	0.09851	340300.	3165700.	86020524
HIGH 8-Hour					
	1982	0.30218	340300.	3169800.	82061008
	1983	0.37943	340700.	3171900.	83050308
	1984	0.18325	343700.	3178300.	84063024
	1985	0.27032	342000.	3174000.	85113008
	1986	0.32712	340300.	3165700.	86072408
HSH 8-Hour					
	1982	0.17161	340700.	3171900.	82010808
	1983	0.17297	343000.	3176200.	83070708
	1984	0.16383	343700.	3178300.	84080508
	1985	0.20302	340300.	3167700.	85103024
	1986	0.29553	340300.	3165700.	86020508
HIGH 3-Hour					
	1982	0.70509	340300.	3169800.	82061003
	1983	0.47628	340700.	3171900.	83050306
	1984	0.43587	340700.	3171900.	84070103
	1985	0.55838	343000.	3176200.	85113003
	1986	0.76324	340300.	3165700.	86072403
HSH 3-Hour					
	1982	0.40783	340700.	3171900.	82122903
	1983	0.34109	342000.	3174000.	83070706
	1984	0.37410	340300.	3169800.	84070103
	1985	0.36397	340300.	3165700.	85012003
	1986	0.52147	343000.	3176200.	86071203
HIGH 1-Hour					
	1982	1.12594	340300.	3169800.	82061003
	1983	1.03779	343000.	3176200.	83070706
	1984	1.12975	340300.	3169800.	84050505
	1985	1.09190	340300.	3165700.	85010707

COMBINED CYCLE
FUEL OIL

BASE, 75, 50%

32°F, 95°F

HSB 1-Hour	1986	1.14424	340300.	3165700.	86072402
	1982	0.99064	340300.	3169800.	82072822
	1983	0.92131	342000.	3174000.	83062323
	1984	0.90863	340300.	3169800.	84042804
	1985	1.09190	340300.	3165700.	85012001
	1986	1.14424	340300.	3165700.	86072403
SOURCE GROUP ID:	HRBA95				
Annual					
	1982	0.00405	340300.	3165700.	82-----
	1983	0.00358	340700.	3171900.	83-----
	1984	0.00243	340700.	3171900.	84-----
	1985	0.00439	340300.	3165700.	85-----
	1986	0.00521	340300.	3165700.	86-----
HIGH 24-Hour					
	1982	0.10045	340300.	3169800.	82061024
	1983	0.12678	340700.	3171900.	83050324
	1984	0.05837	340700.	3171900.	84070124
	1985	0.11465	342000.	3174000.	85113024
	1986	0.13035	340300.	3165700.	86072424
HSB 24-Hour					
	1982	0.06246	340700.	3171900.	82121124
	1983	0.09215	340700.	3171900.	83090424
	1984	0.05319	343700.	3178300.	84063024
	1985	0.08239	340300.	3167700.	85113024
	1986	0.11070	340300.	3165700.	86020524
HIGH 8-Hour					
	1982	0.33005	340300.	3169800.	82061008
	1983	0.46485	340700.	3171900.	83050308
	1984	0.19504	343700.	3178300.	84063024
	1985	0.28805	342000.	3174000.	85113008
	1986	0.35380	340300.	3165700.	86072408
HSB 8-Hour					
	1982	0.18570	340700.	3171900.	82010808
	1983	0.18685	343000.	3176200.	83070708
	1984	0.17013	343700.	3178300.	84080508
	1985	0.21698	340300.	3167700.	85103024
	1986	0.32358	340300.	3165700.	86020508
HIGH 3-Hour					
	1982	0.77012	340300.	3169800.	82061003
	1983	0.51202	340700.	3171900.	83050306
	1984	0.46694	340700.	3171900.	84070103
	1985	0.59204	343000.	3176200.	85113003
	1986	0.82548	340300.	3165700.	86072403
HSB 3-Hour					
	1982	0.44961	340700.	3171900.	82122903
	1983	0.36856	342000.	3174000.	83070706
	1984	0.39841	340300.	3169800.	84070103
	1985	0.39473	340300.	3165700.	85012003
	1986	0.57409	343000.	3176200.	86071203
HIGH 1-Hour					
	1982	1.21704	340300.	3169800.	82061003
	1983	1.12107	343000.	3176200.	83070706
	1984	1.22092	340300.	3169800.	84050505
	1985	1.18420	340300.	3165700.	85010707
	1986	1.23754	340300.	3165700.	86072402
HSB 1-Hour					
	1982	1.09494	340300.	3169800.	82072822
	1983	0.99177	340700.	3171900.	83062323
	1984	1.00846	340300.	3169800.	84042804
	1985	1.18420	340300.	3165700.	85012001
	1986	1.23754	340300.	3165700.	86072403

SOURCE GROUP ID: HR7532

Annual

1982	0.00418	340300.	3165700.	82-----
1983	0.00371	340700.	3171900.	83-----
1984	0.00250	340700.	3171900.	84-----
1985	0.00458	340300.	3165700.	85-----
1986	0.00547	340300.	3165700.	86-----

HIGH 24-Hour

1982	0.10576	340300.	3169800.	82061024
1983	0.13351	340700.	3171900.	83050324
1984	0.06105	340700.	3171900.	84070124
1985	0.12195	342000.	3174000.	85113024
1986	0.13740	340300.	3165700.	86072424

HSH 24-Hour

1982	0.06356	340700.	3171900.	82121124
1983	0.09513	340700.	3171900.	83090424
1984	0.05542	343700.	3178300.	84063024
1985	0.09381	340300.	3167700.	85113024
1986	0.11755	340300.	3165700.	86020524

HIGH 8-Hour

1982	0.34749	340300.	3169800.	82061008
1983	0.48955	340700.	3171900.	83050308
1984	0.20321	343700.	3178300.	84063024
1985	0.30400	342000.	3174000.	85113008
1986	0.37294	340300.	3165700.	86072408

HSH 8-Hour

1982	0.19581	340700.	3171900.	82010808
1983	0.19679	343000.	3176200.	83070708
1984	0.17447	343700.	3178300.	84080508
1985	0.22747	340300.	3167700.	85103024
1986	0.34414	340300.	3165700.	86020508

HIGH 3-Hour

1982	0.81080	340300.	3169800.	82061003
1983	0.53859	340700.	3171900.	83050306
1984	0.48837	340700.	3171900.	84070103
1985	0.62457	343000.	3176200.	85113003
1986	0.87014	340300.	3165700.	86072403

HSH 3-Hour

1982	0.47877	340700.	3171900.	82122903
1983	0.38825	342000.	3174000.	83070706
1984	0.41529	340300.	3169800.	84070103
1985	0.41688	340300.	3165700.	85012003
1986	0.60551	343000.	3176200.	86071203

HIGH 1-Hour

1982	1.28236	340300.	3169800.	82061003
1983	1.18075	343000.	3176200.	83070706
1984	1.28627	340300.	3169800.	84050505
1985	1.25063	340300.	3165700.	85010707
1986	1.30449	340300.	3165700.	86072402

HSH 1-Hour

1982	1.15152	340300.	3169800.	82072822
1983	1.01623	340700.	3171900.	83062323
1984	1.08210	340300.	3169800.	84042804
1985	1.25063	340300.	3165700.	85012001
1986	1.30449	340300.	3165700.	86072403

SOURCE GROUP ID: HR7575

Annual

1982	0.00427	340300.	3165700.	82-----
1983	0.00380	340700.	3171900.	83-----
1984	0.00256	340700.	3171900.	84-----
1985	0.00475	340300.	3165700.	85-----
1986	0.00568	340300.	3165700.	86-----

HIGH 24-Hour

1982	0.11156	340300.	3169800.	82061024
1983	0.13920	340700.	3171900.	83050324
1984	0.06323	340700.	3171900.	84070124
1985	0.12577	342000.	3174000.	85113024
1986	0.14345	340300.	3165700.	86072424

HSH 24-Hour

1982	0.06457	340700.	3171900.	82010824
1983	0.09757	340700.	3171900.	83090424
1984	0.05723	343700.	3178300.	84063024
1985	0.09698	340300.	3167700.	85113024
1986	0.12332	340300.	3165700.	86020524

HIGH 8-Hour

1982	0.36655	340300.	3169800.	82061008
1983	0.51039	340700.	3171900.	83050308
1984	0.20986	343700.	3178300.	84063024
1985	0.31466	342000.	3174000.	85113008
1986	0.38935	340300.	3165700.	86072408

HSH 8-Hour

1982	0.20473	340300.	3169800.	82072824
1983	0.20531	343000.	3176200.	83070708
1984	0.17806	343700.	3178300.	84080508
1985	0.23987	340300.	3165700.	85082008
1986	0.36144	340300.	3165700.	86020508

HIGH 3-Hour

1982	0.85529	340300.	3169800.	82061003
1983	0.56138	340700.	3171900.	83050306
1984	0.50584	340700.	3171900.	84070103
1985	0.64483	343000.	3176200.	85113003
1986	0.90842	340300.	3165700.	86072403

HSH 3-Hour

1982	0.50277	340700.	3171900.	82122903
1983	0.40512	342000.	3174000.	83070706
1984	0.42903	340300.	3169800.	84070103
1985	0.43590	340300.	3165700.	85012003
1986	0.63957	343000.	3176200.	86071203

HIGH 1-Hour

1982	1.33833	340300.	3169800.	82061003
1983	1.23185	343000.	3176200.	83070706
1984	1.34225	340300.	3169800.	84050505
1985	1.30770	340300.	3165700.	85010707
1986	1.36188	340300.	3165700.	86072402

HSH 1-Hour

1982	1.22840	340300.	3169800.	82072822
1983	1.06923	340700.	3171900.	83051605
1984	1.14309	340300.	3169800.	84042804
1985	1.30770	340300.	3165700.	85012001
1986	1.36188	340300.	3165700.	86072403

SOURCE GROUP ID: HR5032

Annual

1982	0.00442	340300.	3165700.	82-----
1983	0.00390	340700.	3171900.	83-----
1984	0.00259	340700.	3171900.	84-----
1985	0.00492	340300.	3165700.	85-----
1986	0.00576	340300.	3165700.	86-----

HIGH 24-Hour

1982	0.11471	340300.	3169800.	82061024
1983	0.14215	340700.	3171900.	83050324
1984	0.06436	340700.	3171900.	84070124
1985	0.12779	342000.	3174000.	85113024
1986	0.14668	340300.	3165700.	86072424

HSH 24-Hour

	1982	0.06604	340700.	3171900.	82010824
	1983	0.09883	340700.	3171900.	83090424
	1984	0.05817	343700.	3178300.	84063024
	1985	0.09864	340300.	3167700.	85113024
	1986	0.12632	340300.	3165700.	86020524
HIGH 8-Hour	1982	0.37691	340300.	3169800.	82061008
	1983	0.52123	340700.	3171900.	83050308
	1984	0.21328	343700.	3178300.	84063024
	1985	0.32029	342000.	3174000.	85113008
	1986	0.39812	340300.	3165700.	86072408
HSH 8-Hour	1982	0.21182	340300.	3169800.	82072824
	1983	0.20986	343000.	3176200.	83070708
	1984	0.17993	343700.	3178300.	84080508
	1985	0.24656	340300.	3165700.	85082008
	1986	0.37044	340300.	3165700.	86020508
HIGH 3-Hour	1982	0.87946	340300.	3169800.	82061003
	1983	0.57320	340700.	3171900.	83050306
	1984	0.51484	340700.	3171900.	84070103
	1985	0.65560	343000.	3176200.	85113003
	1986	0.92890	340300.	3165700.	86072403
HSH 3-Hour	1982	0.51523	340700.	3171900.	82122903
	1983	0.41414	342000.	3174000.	83070706
	1984	0.43611	340300.	3169800.	84070103
	1985	0.45611	340300.	3165700.	85012003
	1986	0.65797	343000.	3176200.	86071203
HIGH 1-Hour	1982	1.36825	340300.	3169800.	82061003
	1983	1.25916	343000.	3176200.	83070706
	1984	1.37218	340300.	3169800.	84050505
	1985	1.36832	340300.	3165700.	85010707
	1986	1.39257	340300.	3165700.	86072402
HSH 1-Hour	1982	1.27092	340300.	3169800.	82072822
	1983	1.09876	340700.	3171900.	83051605
	1984	1.17487	340300.	3169800.	84042804
	1985	1.36832	340300.	3165700.	85012001
	1986	1.39257	340300.	3165700.	86072403
SOURCE GROUP ID: HR5095					
Annual	1982	0.00458	340300.	3165700.	82-----
	1983	0.00402	340700.	3171900.	83-----
	1984	0.00267	340700.	3171900.	84-----
	1985	0.00517	340300.	3165700.	85-----
	1986	0.00606	340300.	3165700.	86-----
HIGH 24-Hour	1982	0.12305	340300.	3169800.	82061024
	1983	0.14789	340700.	3171900.	83050324
	1984	0.06653	340700.	3171900.	84070124
	1985	0.13391	342000.	3174000.	85113024
	1986	0.16432	340300.	3165700.	86072424
HSH 24-Hour	1982	0.08337	340300.	3169800.	82121124
	1983	0.10128	340700.	3171900.	83090424
	1984	0.05996	343700.	3178300.	84063024
	1985	0.10229	340300.	3167700.	85113024
	1986	0.13216	340300.	3165700.	86020524
HIGH 8-Hour	1982	0.40430	340300.	3169800.	82061008

	1983	0.54228	340700.	3171900.	83050308
	1984	0.21986	343700.	3178300.	84063024
	1985	0.33748	342000.	3174000.	85113008
	1986	0.44601	340300.	3165700.	86072408
HSH 8-Hour					
	1982	0.22575	340300.	3169800.	82072824
	1983	0.22647	343000.	3176200.	83070708
	1984	0.18359	343700.	3178300.	84080508
	1985	0.25959	340300.	3165700.	85082008
	1986	0.38796	340300.	3165700.	86020508
HIGH 3-Hour					
	1982	0.94338	340300.	3169800.	82061003
	1983	0.59614	340700.	3171900.	83050306
	1984	0.53221	340700.	3171900.	84070103
	1985	0.69350	343000.	3176200.	85113003
	1986	1.00196	340300.	3165700.	86072403
HSH 3-Hour					
	1982	0.53938	340700.	3171900.	82122903
	1983	0.44686	342000.	3174000.	83070706
	1984	0.44974	340300.	3169800.	84070103
	1985	0.47982	340300.	3165700.	85012003
	1986	0.69391	343000.	3176200.	86071203
HIGH 1-Hour					
	1982	1.47628	340300.	3169800.	82061003
	1983	1.35884	343000.	3176200.	83070706
	1984	1.48078	340300.	3169800.	84050505
	1985	1.43945	340300.	3165700.	85010707
	1986	1.50214	340300.	3165700.	86072402
HSH 1-Hour					
	1982	1.35452	340300.	3169800.	82072822
	1983	1.16252	342000.	3174000.	83013023
	1984	1.23673	340300.	3169800.	84042804
	1985	1.43945	340300.	3165700.	85012001
	1986	1.50214	340300.	3165700.	86072403

All receptor computations reported with respect to a user-specified origin

GRID	0.00	0.00
DISCRETE	0.00	0.00

ATTACHMENT H

**SOURCE CONTRIBUTION TO THE REFINED IMPACTS
FOR THE AAQS AND PSD CLASS II ANALYSES**

*** ISCEV2 - VERSION 92273 ***

*** 1982 SEMINOLE HARDEE 3 - DISTILLATE OIL- AAQS 4/10/94

*** 04/28

*** SO2 3 HOUR REFINED FOR PROPOSED IS SIGNIFICANT

*** 20:27

*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

PAGE

*** SOURCE CONTRIBUTIONS FOR EVENT: TH030045 ***

---* AVE. PER.: 3 HRS; END DATE: 82011418; LOCATION (XR,YR,ZELEV,ZFLAG): 108.50 -97.69 0.00 0.00 (

GROUP ID: ALL OF SOURCES: @ZERO , L50T95N , L50T95S , HRDEX01 , HRDEX02 , HRDEX03 , CGRIV04 , CGRIV05 , CGRIV06 , CGRIV55 , CGRIVAA , CGBRT21 , CGBRTC3 , CFBON05 , CFBON06 , CFBONAA , CFBONAB , CFBONAC , CONMN20 , CONMNC2 , FARMLO5 , FPCBTC2A , FPCBT03 , FPCBT04 , FPCBTC3B , FPCHGC2 , FPCHG03 , FPCHGC3 , FPCHG07 , FPCINC6 , FPCIN07 , .

*** GROUP VALUE = 99.60750 ***

SOURCE ID	CONTRIBUTION	SOURCE ID	CONTRIBUTION	SOURCE ID	CONTRIBUTION
@ZERO	0.00000	L50T95N	0.00057	L50T95S	27.43960
HRDEX01	0.00000	HRDEX02	0.00000	HRDEX03	0.00000
CGRIV04	0.63380	CGRIV05	0.71903	CGRIV06	0.91703
CGRIV41	0.00272	CGRIV55	0.01347	CGRIVAA	0.02688
CGBRT21	0.00000	CGBRTC3	0.00000	CFBON05	0.00000
CFBON06	0.00000	CFBONAA	0.00000	CFBONAB	0.00000
CFBONAC	0.00000	CONMN20	0.00000	CONMNC2	0.00000
FARMLC2	0.00000	FARMLO5	0.00000	FPCBTC2A	2.65735
FPCBT03	2.05684	FPCBT04	0.00865	FPCBTC3B	0.66295
FPCHGC2	2.24771	FPCHG03	1.10769	FPCHGC3	0.05277
FPCHG07	0.07082	FPCINC6	0.00000	FPCIN07	0.00000
FPCIN08	0.00000	FPCPKC2	0.00000	FPLMNC2	0.00000
GARDN01	0.00000	GLEAD01	0.00061	IANIC05	0.00000
IANIC12	0.00000	IANIC15	0.00000	IANIC16	0.00000
IAWALC2	0.00000	IAWAL09	0.00000	IAWAL13	0.00000
IAWAL27	0.00000	IAWAL44	0.00000	IAWAL45	0.00000
IAWAL46	0.00000	IANOR01	0.00000	IANOR02	0.00000
IASOU01	0.00000	IASOUC2	0.00000	IASOU10	0.00000
IMPRLO1	0.00000	IMPRLO2	0.00000	LAFRG29	2.44603
LAKLR01	0.00000	LAKLRC3	0.00000	LAKLRC2	0.00000
LAKLRAA	0.00000	LAKMC01	0.00000	LAKMCC2	0.00000
LAKMC04	0.00000	LAKMC05	0.00000	LAKMC06	0.00000
MBNICC2	0.00000	MBNIC04	0.00000	MBL#401	0.00000
MBL#4AA	0.00000	MULCNAA	0.00000	MULCNAB	0.00000
MLPHS02	0.00000	MLPHS05	0.00000	MLPHS09	0.00000
TECBBC2A	19.01671	TECB803	11.88357	TECB804	3.07051
TECBBC2B	0.66978	TECB807	0.11214	TECGNC2	4.82017
TECGN03	3.01587	TECGN04	3.61893	TECGN05	4.26565
TECGN06	6.79736	TECGN07	0.11368	TECHKC2A	0.24969
TECHKC2B	0.34199	TECHK05	0.25101	TECHK06	0.31591
TECPKAA	0.00000	TECPKAB	0.00000	TECPKAC	0.00000
UAFTM06	0.00000	UAFTMC2	0.00000		

*** ISCEV2 - VERSION 92273 ***

*** 1984 SEMINOLE HARDEE 3 - DISTILLATE OIL- AAQS 4/10/94

04/30/9

*** SQ2 3 HOUR REFINED FOR PROPOSED IS SIGNIFICANT

09:33:0

*** MODELING OPTIONS USED: CONC

RURAL FLAT

DEFAULT

PAGE 8

*** SOURCE CONTRIBUTIONS FOR EVENT: TH030079 ***

---> AVE. PER.: 3 HRS; END DATE: 84032915; LOCATION (XR,YR,ZELEV,ZFLAG): 88.33 -98.10 0.00 0.00 (M)

GROUP ID: ALL OF SOURCES: @ZERO , L50T95N , L50T95S , HRDEX01 , HRDEX02 , HRDEX03 , CGRIV04 , CGRIV05 , CGRIV06 , CGRIV55 , CGRIVAA , CGBRT21 , CGBRTC3 , CFBON05 , CFBON06 , CFBONAA , CFBONAB , CFBONAC , CONMN20 , CONMNC2 , FARML05 , FPCBTC2A , FPCBT03 , FPCBT04 , FPCBTC3B , FPCHGC2 , FPCHG03 , FPCHGC3 , FPCHG07 , FPCINC6 , FPCIN07 , . .

*** GROUP VALUE = 141.29024 ***

SOURCE ID	CONTRIBUTION	SOURCE ID	CONTRIBUTION	SOURCE ID	CONTRIBUTION
@ZERO	0.00000	L50T95N	0.00001	L50T95S	41.14930
HRDEX01	0.00000	HRDEX02	0.00000	HRDEX03	0.00000
CGRIV04	0.50386	CGRIV05	0.57195	CGRIV06	0.73017
CGRIV41	0.00216	CGRIV55	0.01070	CGRIVAA	0.02136
CGBRT21	0.00000	CGBRTC3	0.00000	CFBON05	0.00000
CFBON06	0.00000	CFBONAA	0.00000	CFBONAB	0.00000
CFBONAC	0.00000	CONMN20	0.00000	CONMNC2	0.00000
FARMLC2	0.00000	FARML05	0.00000	FPCBTC2A	2.82622
FPCBT03	2.19890	FPCBT04	0.00911	FPCBTC3B	0.73331
FPCHGC2	1.78459	FPCHG03	0.87883	FPCHGC3	0.03993
FPCHG07	0.05350	FPCINC6	0.00000	FPCIN07	0.00000
FPCIN08	0.00000	FPCPKC2	0.00000	FPLMNC2	0.00000
GARDN01	0.00000	GLEAD01	0.00975	IANIC05	0.00000
IANIC12	0.00000	IANIC15	0.00000	IANIC16	0.00000
IAWALC2	0.00000	IAWAL09	0.00000	IAWAL13	0.00000
IAWAL27	0.00000	IAWAL44	0.00000	IAWAL45	0.00000
IAWAL46	0.00000	IANOR01	0.00000	IANOR02	0.00000
IASOU01	0.00000	IASOUC2	0.00000	IASOU10	0.00000
IMPRLO1	0.00000	IMPRLO2	0.00000	LAFRG29	7.35009
LAKLRO1	0.00000	LAKLRC3	0.00000	LAKLRC2	0.00000
LAKLRAA	0.00000	LAKMC01	0.00000	LAKMCC2	0.00000
LAKMC04	0.00000	LAKMC05	0.00000	LAKMC06	0.00000
MBNICC2	0.00000	MBNIC04	0.00000	MBL#401	0.00000
MBL#4AA	0.00000	MULCNAA	0.00000	MULCNAB	0.00000
MLPHS02	0.00000	MLPHS05	0.00000	MLPHS09	0.00000
TECBBC2A	16.61605	TECBB03	9.99158	TECBB04	2.57762
TECBBC2B	0.53812	TECBB07	0.08904	TECGNC2	10.32469
TECGN03	6.47016	TECGN04	7.74401	TECGN05	9.16577
TECGN06	14.71838	TECGN07	0.24206	TECHKC2A	0.84782
TECHKC2B	1.16191	TECHK05	0.85353	TECHK06	1.07573
TECPKAA	0.00000	TECPKAB	0.00000	TECPKAC	0.00000
UAFTM06	0.00000	UAFTMC2	0.00000		

*** ISCEV2 - VERSION 92273 ***

*** 1985 SEMINOLE HARDEE 3 - DISTILLATE OIL- AAQS 4/10/94

*** 04/2

*** SO2 3 HOUR REFINED FOR PROPOSED IS SIGNIFICANT

*** 20:2

*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

PAGE

*** SOURCE CONTRIBUTIONS FOR EVENT: TH030017 ***

---& AVE. PER.: 3 HRS; END DATE: 85083121; LOCATION (XR,YR,ZELEV,ZFLAG): 59.81 208.59 0.00 0.00 (

GROUP ID: ALL OF SOURCES: @ZERO , L50T95N , L50T95S , HRDEX01 , HRDEX02 , HRDEX03 , CGRIV04 , CGRIV05 , CGRIV06 , CGRIV55 , CGRIVAA , CGBRT21 , CGBRTC3 , CFBON05 , CFBON06 , CFBONAA , CFBONAB , CFBONAC , CONMN20 , CONMNC2 , FARMLO5 , FPCBTC2A , FPCBTC3B , FPCBTC38 , FPCBTC04 , FPCBTC3B , FPCHGC2 , FPCHGC3 , FPCHGC07 , FPCINC6 , FPCINC07 ,

*** GROUP VALUE = 149.98862 ***

SOURCE ID	CONTRIBUTION	SOURCE ID	CONTRIBUTION	SOURCE ID	CONTRIBUTION
@ZERO	0.00000	L50T95N	37.41078	L50T95S	21.21025
HRDEX01	45.66288	HRDEX02	45.70472	HRDEX03	0.00001
CGRIV04	0.00000	CGRIV05	0.00000	CGRIV06	0.00000
CGRIV41	0.00000	CGRIV55	0.00000	CGRIVAA	0.00000
CGBRT21	0.00000	CGBRTC3	0.00000	CFBON05	0.00000
CFBON06	0.00000	CFBONAA	0.00000	CFBONAB	0.00000
CFBONAC	0.00000	CONMN20	0.00000	CONMNC2	0.00000
FARMLC2	0.00000	FARML05	0.00000	FPCBTC2A	0.00000
FPCBTC03	0.00000	FPCBTC04	0.00000	FPCBTC38	0.00000
FPCHGC2	0.00000	FPCHGC03	0.00000	FPCHGC3	0.00000
FPCHGC07	0.00000	FPCINC6	0.00000	FPCINC07	0.00000
FPCINC08	0.00000	FPCPKC2	0.00000	FPLMNC2	0.00000
GARDN01	0.00000	GLEAD01	0.00000	IANIC05	0.00000
IANIC12	0.00000	IANIC15	0.00000	IANIC16	0.00000
IAWALC2	0.00000	IAWAL09	0.00000	IAWAL13	0.00000
IAWAL27	0.00000	IAWAL44	0.00000	IAWAL45	0.00000
IAWAL46	0.00000	IANOR01	0.00000	IANOR02	0.00000
IASOU01	0.00000	IASOUC2	0.00000	IASOU10	0.00000
IMPRLO1	0.00000	IMPRLO2	0.00000	LAFRG29	0.00000
LAKLR01	0.00000	LAKLRC3	0.00000	LAKLRC2	0.00000
LAKLRAA	0.00000	LAKMC01	0.00000	LAKMCC2	0.00000
LAKMC04	0.00000	LAKMC05	0.00000	LAKMC06	0.00000
MBNICC2	0.00000	MBNIC04	0.00000	MBL#401	0.00000
MBL#4AA	0.00000	MULCNAA	0.00000	MULCNAB	0.00000
MLPHS02	0.00000	MLPHS05	0.00000	MLPHS09	0.00000
TECBBC2A	0.00000	TECBB03	0.00000	TECBB04	0.00000
TECBBC2B	0.00000	TECBB07	0.00000	TECGNC2	0.00000
TECGN03	0.00000	TECGN04	0.00000	TECGN05	0.00000
TECGN06	0.00000	TECGN07	0.00000	TECHKC2A	0.00000
TECHKC2B	0.00000	TECHK05	0.00000	TECHK06	0.00000
TECPKAA	0.00000	TECPKAB	0.00000	TECPKAC	0.00000
UAFTM06	0.00000	UAFTMC2	0.00000		

*** ISCEV2 - VERSION 92273 ***

*** 1983 SEMINOLE HARDEE 3 - DISTILLATE OIL- AAQS 4/10/94

*** 04/2

*** SO2 24 HOUR REFINED FOR PROPOSED IS SIGNIFICANT

*** 20:2

*** MODELING OPTIONS USED: CONC RURAL FLAT DEFAULT

PAGE

*** SOURCE CONTRIBUTIONS FOR EVENT: TH240005 ***

---* AVE. PER.: 24 HRS; END DATE: 83020324; LOCATION (XR,YR,ZELEV,ZFLAG): 145.08 -97.86 0.00 0.00 (

GROUP ID: ALL OF SOURCES: @ZERO , L50T95N , L50T95S , HRDEX01 , HRDEX02 , HRDEX03 , CGRIV04 , CGRIV05 , CGRIV06 , CGRIV55 , CGRIVAA , CGBRT21 , CGBRTC3 , CFBON05 , CFBON06 , CFBONAA , CFBONAB , CFBONAC , CONMN20 , CONMNC2 , FARMLO5 , FPCBTC2A , FPCBT03 , FPCBT04 , FPCBTC3B , FPCHGC2 , FPCHG03 , FPCHGC3 , FPCHG07 , FPCINC6 , FPCIN07 , .

*** GROUP VALUE = 75.08363 ***

SOURCE ID	CONTRIBUTION	SOURCE ID	CONTRIBUTION	SOURCE ID	CONTRIBUTION
@ZERO	0.00000	L50T95N	0.48250	L50T95S	5.73337
HRDEX01	0.00000	HRDEX02	0.00000	HRDEX03	0.00000
CGRIV04	0.25424	CGRIV05	0.28800	CGRIV06	0.36588
CGRIV41	0.00115	CGRIV55	0.00544	CGRIVAA	0.01086
CGBRT21	0.00000	CGBRTC3	0.00000	CFBON05	0.00000
CFBON06	0.00000	CFBONAA	0.00000	CFBONAB	0.00000
CFBONAC	0.00000	CONMN20	0.00000	CONMNC2	0.00000
FARMLC2	0.00000	FARMLO5	0.00000	FPCBTC2A	2.87238
FPCBT03	2.22619	FPCBT04	0.00934	FPCBTC3B	0.71797
FPCHGC2	0.87063	FPCHG03	0.43174	FPCHGC3	0.01184
FPCHG07	0.01582	FPCINC6	0.00000	FPCIN07	0.00000
FPCIN08	0.00000	FPCPKC2	0.00000	FPLMNC2	1.34261
GARDN01	0.00000	GLEAD01	0.29715	IANIC05	0.00000
IANIC12	0.00000	IANIC15	0.00000	IANIC16	0.00000
IAWALC2	0.00002	IAWAL09	0.00000	IAWAL13	0.00001
IAWAL27	0.00000	IAWAL44	0.00000	IAWAL45	0.00000
IAWAL46	0.00000	IANOR01	0.00000	IANOR02	0.00000
IASOU01	0.00000	IASOUC2	0.00000	IASOU10	0.00000
IMPRL01	0.00000	IMPRL02	0.00000	LAFRG29	4.67875
LAKLR01	0.00000	LAKLRC3	0.00000	LAKLRC2	0.00000
LAKLRAA	0.00000	LAKMC01	0.00000	LAKMCC2	0.00000
LAKMC04	0.00000	LAKMC05	0.00000	LAKMC06	0.00000
MBNICC2	0.00000	MBNIC04	0.00000	MBL#401	0.10502
MBL#4AA	0.00503	MULCNAA	0.00000	MULCNAB	0.00000
MLPHS02	0.00000	MLPHS05	0.00000	MLPHS09	0.00000
TECBBC2A	17.27783	TECB803	10.70617	TECB804	2.78307
TECBBC2B	0.59456	TECB807	0.09924	TECGNC2	4.48469
TECGN03	2.73730	TECGN04	3.39240	TECGN05	3.81958
TECGN06	5.76580	TECGN07	0.15321	TECHKC2A	0.57089
TECHKC2B	0.76311	TECHK05	0.54224	TECHK06	0.66759
TECPKAA	0.00000	TECPKAB	0.00000	TECPKAC	0.00000
UAFTM06	0.00000	UAFTMC2	0.00000		

*** ISCEV2 - VERSION 92273 ***

*** 1984 SEMINOLE HARDEE 3 - DISTILLATE OIL- AAQS 4/10/94

*** 04/2

*** SO2 24 HOUR REFINED FOR PROPOSED IS SIGNIFICANT

*** 20:2

*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

PAGE

*** SOURCE CONTRIBUTIONS FOR EVENT: TH240088 ***

---* AVE. PER.: 24 HRS; END DATE: 84032924; LOCATION (XR,YR,ZELEV,ZFLAG): 94.47 -97.83 0.00 0.00 (

GROUP ID: ALL OF SOURCES: @ZERO , L50T95N , L50T95S , HRDEX01 , HRDEX02 , HRDEX03 , CGRIV04 , CGRIV05 , CGRIV06 , CGRIV55 , CGRIVAA , CGBRT21 , CGBRTC3 , CFBON05 , CFBON06 , CFBONAA , CFBONAB , CFBONAC , CONMN20 , CONMNC2 , FA FARMLO5 , FPCBTC2A , FPCBTC3 , FPCBTC3B , FPCHGC2 , FPCHGC3 , FPCHGC07 , FPCINC6 , FPCIN07 , .

*** GROUP VALUE = 87.87694 ***

SOURCE ID	CONTRIBUTION	SOURCE ID	CONTRIBUTION	SOURCE ID	CONTRIBUTION
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@ZERO	0.00000	L50T95N	0.00005	L50T95S	16.78380
HRDEX01	0.00000	HRDEX02	0.00000	HRDEX03	0.00000
CGRIV04	0.49230	CGRIV05	0.55851	CGRIV06	0.71211
CGRIV41	0.00212	CGRIV55	0.01047	CGRIVAA	0.02089
CGBRT21	0.00000	CGBRTC3	0.00000	CFBON05	0.00000
CFBON06	0.00000	CFBONAA	0.00000	CFBONAB	0.00000
CFBONAC	0.00000	CONMN20	0.00000	CONMNC2	0.00000
FARMLC2	0.00000	FARMLO5	0.00000	FPCBTC2A	2.72250
FPCBTC03	2.11010	FPCBTC04	0.00885	FPCBTC3B	0.68002
FPCHGC2	1.76452	FPCHGC03	0.87051	FPCHGC3	0.03232
FPCHGC07	0.04324	FPCINC6	0.00000	FPCIN07	0.00000
FPCIN08	0.00000	FPCPKC2	0.00000	FPLMNC2	0.34115
GARDN01	0.00000	GLEAD01	0.14660	IANIC05	0.00000
IANIC12	0.00000	IANIC15	0.00000	IANIC16	0.00000
IAWALC2	0.00000	IAWAL09	0.00000	IAWAL13	0.00000
IAWAL27	0.00000	IAWAL44	0.00000	IAWAL45	0.00000
IAWAL46	0.00000	IANOR01	0.00000	IANOR02	0.00000
IASOU01	0.00000	IASOUC2	0.00000	IASOU10	0.00000
IMPRLO1	0.00000	IMPRLO2	0.00000	LAFRG29	3.69178
LAKLR01	0.00000	LAKLRC3	0.00000	LAKLRC2	0.00000
LAKLRAA	0.00000	LAKMC01	0.00000	LAKMCC2	0.00000
LAKMC04	0.00000	LAKMC05	0.00000	LAKMC06	0.00000
MBNICC2	0.00000	MBNIC04	0.00000	MBL#401	0.00287
MBL#4AA	0.00014	MULCNAA	0.00000	MULCNAB	0.00000
MLPHS02	0.00000	MLPHS05	0.00000	MLPHS09	0.00000
TECBBC2A	16.16795	TECBB03	10.01231	TECBB04	2.61173
TECBBC2B	0.55651	TECBB07	0.09300	TECGNC2	5.44303
TECGN03	3.39331	TECGN04	4.08782	TECGN05	4.79088
TECGN06	7.56891	TECGN07	0.12912	TECHKC2A	0.43884
TECHKC2B	0.59951	TECHK05	0.43847	TECHK06	0.55069
TECPKAA	0.00000	TECPKAB	0.00000	TECPKAC	0.00000
UAFTM06	0.00000	UAFTMC2	0.00000		

*** ISCEV2 - VERSION 92273 ***

*** 1985 SEMINOLE HARDEE 3 - DISTILLATE OIL- AAQS 4/10/94

*** 04/2

*** SO2 24 HOUR REFINED FOR PROPOSED IS SIGNIFICANT

*** 20:2

*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

PAGE

*** SOURCE CONTRIBUTIONS FOR EVENT: TH240013 ***

---c AVE. PER.: 24 HRS; END DATE: 85021224; LOCATION (XR,YR,ZELEV,ZFLAG): 169.74 -98.00 0.00 0.00 (

GROUP ID: ALL OF SOURCES: @ZERO , L50T95N , L50T95S , HRDEX01 , HRDEX02 , HRDEX03 , CGRIV04 , CGRIV05 , CGRIV06 , CGRIV55 , CGRIVAA , CGBRT21 , CGBRTC3 , CFBON05 , CFBON06 , CFBONAA , CFBONAB , CFBONAC , CONMN20 , CONMNC2 , FARMLO5 , FPCBTC2A , FPCBT03 , FPCBT04 , FPCBTC3B , FPCCHG2 , FPCCHG3 , FPCCHG07 , FPCINC6 , FPCIN07 , .

*** GROUP VALUE = 88.31908 ***

SOURCE ID	CONTRIBUTION	SOURCE ID	CONTRIBUTION	SOURCE ID	CONTRIBUTION
-----	-----	-----	-----	-----	-----
@ZERO	0.00000	L50T95N	4.26531	L50T95S	7.17339
HRDEX01	0.00000	HRDEX02	0.00000	HRDEX03	0.00000
CGRIV04	0.50078	CGRIV05	0.56785	CGRIV06	0.72327
CGRIV41	0.00216	CGRIV55	0.01065	CGRIVAA	0.02125
CGBRT21	0.00000	CGBRTC3	0.00000	CFBON05	0.00000
CFBON06	0.00000	CFBONAA	0.00000	CFBONAB	0.00000
CFBONAC	0.00000	CONMN20	0.00000	CONMNC2	0.00000
FARMLC2	0.00000	FARMLO5	0.00000	FPCBTC2A	2.65372
FPCBT03	2.05740	FPCBT04	0.00862	FPCBTC3B	0.67210
FPCCHG2	1.80757	FPCCHG03	0.89300	FPCCHG3	0.02858
FPCCHG07	0.03821	FPCINC6	0.00000	FPCIN07	0.00000
FPCIN08	0.00000	FPCPKC2	0.00000	FPLMNC2	0.00000
GARDN01	0.00000	GLEAD01	0.24404	IANIC05	0.00000
IANIC12	0.00000	IANIC15	0.00000	IANIC16	0.00000
IAWALC2	0.00000	IAWAL09	0.00000	IAWAL13	0.00000
IAWAL27	0.00000	IAWAL44	0.00000	IAWAL45	0.00000
IAWAL46	0.00000	IANOR01	0.00000	IANOR02	0.00000
IASOU01	0.00000	IASOUC2	0.00000	IASOU10	0.00000
IMPRL01	0.00000	IMPRL02	0.00000	LAFRG29	5.09592
LAKLR01	0.00000	LAKLRC3	0.00000	LAKLRC2	0.00000
LAKLRAA	0.00000	LAKMC01	0.00000	LAKMCC2	0.00000
LAKMC04	0.00000	LAKMC05	0.00000	LAKMC06	0.00000
MBNICC2	0.00000	MBNIC04	0.00000	MBL#401	0.06926
MBL#4AA	0.00328	MULCNAA	0.00000	MULCNAB	0.00000
MLPHS02	0.00000	MLPHS05	0.00000	MLPHS09	0.00000
TECBBC2A	15.46774	TECB803	9.52994	TECB804	2.45061
TECBBC2B	0.52638	TECB807	0.08757	TECGNC2	6.57735
TECGN03	4.07755	TECGN04	4.94836	TECGN05	5.73526
TECGN06	8.90660	TECGN07	0.15803	TECHKC2A	0.65566
TECHKC2B	0.89383	TECHK05	0.65162	TECHK06	0.81626
TECPKAA	0.00000	TECPKAB	0.00000	TECPKAC	0.00000
UAFTM06	0.00000	UAFTMC2	0.00000		

*** ISCEV2 - VERSION 92273 ***

*** 1985 PROPOSED SECI HARDEE UNIT PSD CLASS II 4/28/94

*** 04/28/

*** S02 REFINED ANALYSIS 24 HOUR PROPOSED SIGNIFICANT

*** 11:32:

*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

PAGE

*** SOURCE CONTRIBUTIONS FOR EVENT: TH240028 ***

---> AVE. PER.: 24 HRS; END DATE: 85083124; LOCATION (XR,YR,ZELEV,ZFLAG): 0.00 203.00 0.00 0.00 (M)

GROUP ID: ALL OF SOURCES: @ZERO , L50T95N , L50T95S , HRDEX01 , HRDEX02 , HRDEX03 , BORDHIL , CGRIV06 , CGRIV456 , CGRIV8 , CGRIV9B , CGBRTC3 , CGBRT12 , CGBRT3A , CGBRTDRY , CFBON05 , CFBON06 , CFBONAB , CFBONAC , CFBON1 , CFBON3 , CFBON4 , CFBON56 , DOLIMEDR , DOLIMEBL , ESTDRY1 , ESTDRY2 , ESTSAP , FARMLC2 , FARML05 , FARML12 , . .

*** GROUP VALUE = 45.40391 ***

SOURCE ID	CONTRIBUTION	SOURCE ID	CONTRIBUTION	SOURCE ID	CONTRIBUTION
@ZERO	0.00000	L50T95N	15.31581	L50T95S	12.45949
HRDEX01	9.16134	HRDEX02	8.46727	HRDEX03	0.00000
BORDHIL	0.00000	CGRIV06	0.00000	CGRIV456	0.00000
CGRIV7	0.00000	CGRIV8	0.00000	CGRIV9B	0.00000
CGBRTC3	0.00000	CGBRT12	0.00000	CGBRT3A	0.00000
CGBRTDRY	0.00000	CFBON05	0.00000	CFBON06	0.00000
CFBONAB	0.00000	CFBONAC	0.00000	CFBON1	0.00000
CFBON2	0.00000	CFBON3	0.00000	CFBON4	0.00000
CFBON56	0.00000	DOLIMEDR	0.00000	DOLIMEBL	0.00000
ESTDRY1	0.00000	ESTDRY2	0.00000	ESTSAP	0.00000
FARMLC2	0.00000	FARML05	0.00000	FARML12	0.00000
FPCIN07	0.00000	FPCIN08	0.00000	FPCPKC2	0.00000
IANIC05	0.00000	IANIC	0.00000	IANICDRY	0.00000
IAWALC2	0.00000	IAWAL27	0.00000	IAWAL44	0.00000
IAWAL46	0.00000	IAWALDRY	0.00000	IAWAL	0.00000
IAPRC12	0.00000	IAPRC34	0.00000	IASOUC2	0.00000
IASOU10	0.00000	IASOUB	0.00000	IMPR LX	0.00000
LAKLRAA	0.00000	LAKMC06	0.00000	MOBELE1	0.00000
MOBELE2	0.00000	MOBELE3	0.00000	MOBELE4	0.00000
MOBELE5	0.00000	MOBELE6	0.00000	MBNIC04	0.00000
MBNIC1	0.00000	MBNIC2	0.00000	MBL#401	0.00000
MBL#4AA	0.00000	MULCNAA	0.00000	MULCNAB	0.00000
MLPHS02	0.00000	MLPHS1	0.00000	TECB804	0.00000
TECB83X	0.00000	TECB812X	0.00000	TECPKAA	0.00000
TECPKAB	0.00000	TECPKAC	0.00000	UAGBAR1	0.00000
UAGBAR2	0.00000	UAFTMC2	0.00000	UAFTMX	0.00000
UAFTMGT	0.00000				

*** ISCEV2 - VERSION 92273 ***

*** 1985 PROPOSED SECI HARDEE UNIT PSD CLASS II 4/28/94

*** 04/28/94

*** S02 REFINED ANALYSIS 3 HOUR PROPOSED SIGNIFICANT

*** 11:36:32

*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

PAGE 2

*** SOURCE CONTRIBUTIONS FOR EVENT: TH030017 ***

----> AVE. PER.: 3 HRS; END DATE: 85083121; LOCATION (XR,YR,ZELEV,ZFLAG): 59.81 208.59 0.00 0.00 (M)

GROUP ID: ALL OF SOURCES: @ZERO , L50T95N , L50T95S , HRDEX01 , HRDEX02 , HRDEX03 , BORDHIL , CGRIV06 , CGRIV456 , CGRIV8 , CGRIV9B , CGBRTC3 , CGBRT12 , CGBRT3A , CGBRTDRY , CFBON05 , CFBON06 , CFBONAB , CFBONAC , CFBON1 , CFBON3 , CFBON4 , CFBON56 , DOLIMEDR , DOLIMEBL , ESTDRY1 , ESTDRY2 , ESTSAP , FARMLC2 , FARML05 , FARML12 , . .

*** GROUP VALUE = 149.98862 ***

SOURCE ID	CONTRIBUTION	SOURCE ID	CONTRIBUTION	SOURCE ID	CONTRIBUTION
@ZERO	0.00000	L50T95N	37.41078	L50T95S	21.21025
HRDEX01	45.66288	HRDEX02	45.70472	HRDEX03	0.00001
BORDHIL	0.00000	CGRIV06	0.00000	CGRIV456	0.00000
CGRIV7	0.00000	CGRIV8	0.00000	CGRIV9B	0.00000
CGBRTC3	0.00000	CGBRT12	0.00000	CGBRT3A	0.00000
CGBRTDRY	0.00000	CFBON05	0.00000	CFBON06	0.00000
CFBONAB	0.00000	CFBONAC	0.00000	CFBON1	0.00000
CFBON2	0.00000	CFBON3	0.00000	CFBON4	0.00000
CFBON56	0.00000	DOLIMEDR	0.00000	DOLIMEBL	0.00000
ESTDRY1	0.00000	ESTDRY2	0.00000	ESTSAP	0.00000
FARMLC2	0.00000	FARML05	0.00000	FARML12	0.00000
FPCIN07	0.00000	FPCIN08	0.00000	FPCPKC2	0.00000
IANIC05	0.00000	IANIC	0.00000	IANICDRY	0.00000
IAWALC2	0.00000	IAWAL27	0.00000	IAWAL44	0.00000
IAWAL46	0.00000	IAWALDRY	0.00000	IAWAL	0.00000
IAPRC12	0.00000	IAPRC34	0.00000	IASOUC2	0.00000
IASOU10	0.00000	IASOUB	0.00000	IMPR LX	0.00000
LAKLRAB	0.00000	LAKMC06	0.00000	MOBELE1	0.00000
MOBELE2	0.00000	MOBELE3	0.00000	MOBELE4	0.00000
MOBELE5	0.00000	MOBELE6	0.00000	MBNIC04	0.00000
MBNIC1	0.00000	MBNIC2	0.00000	MBL#401	0.00000
MBL#4AA	0.00000	MULCNAA	0.00000	MULCNAB	0.00000
MLPHS02	0.00000	MLPHS1	0.00000	TECBB04	0.00000
TECBB3X	0.00000	TECBB12X	0.00000	TECPKAA	0.00000
TECPKAB	0.00000	TECPKAC	0.00000	UAGBAR1	0.00000
UAGBAR2	0.00000	UAFTMC2	0.00000	UAFTMX	0.00000
UAFTMGT	0.00000				

APPENDIX 10.1.6

COASTAL ZONE MANAGEMENT CERTIFICATION

COASTAL ZONE MANAGEMENT CERTIFICATIONS

The Coastal Management Act of 1978 (Section 380.21-380.25, Florida Statutes) requires that the Coastal Zone Management Section of Florida Department of Environmental Protection (FDEP) be responsible for certification of consistency with the Florida Coastal Management Program (FCMP) for all federal licenses, permits, activities, and projects listed in Section 380.23(3)(C), Florida Statutes, when such activities are subject to federal consistency review and affect land or water use, are seaward of the jurisdiction of state, or there is no state agency with sole jurisdiction for such consistency review.

In accordance with FCMP consistency evaluation procedures, copies of the following documents are included in Section 10.1 of this Site Certification Application:

- Combined applications for construction in, and discharge of dredge or fill materials to, waters of the United States Section 404 of the Water Pollution Control Act of 1972, as amended);
- Notice of Proposed Construction or Alteration (required by Part 77 of the Federal Aviation Regulations (14 CFR Part 77) pursuant to Section 1011 of the Federal Aviation Act or 1958, amended).

Federal Consistency Evaluation Procedures (15 CFR 930.50) require these permit applications and the FAA Notice to be accompanied by a consistency certification attachment which includes:

- A written and pictorial description of the project, and
- An assessment of probable impacts relevant to applicable FCMP statutes.

Each application included with this Site Certification Application is accompanied by such consistency certification.

DESCRIPTION OF THE PROJECT

SECI is proposing to own and operate a new 440-MW combined cycle power plant [the Hardee Power Station Unit 3 (Hardee Unit 3) Project]. This facility will be constructed under a turnkey construction contract with Westinghouse Electric Corporation and Black & Veatch Construction, Inc. The Hardee Unit 3 Project will be located on the existing HPS site and will represent an incremental increase in the ultimate power-generating capacity of the HPS site from 660 MW to

880 MW. The HPS site was selected as the preferred location for the Hardee Unit 3 Project because this site has been previously certified for 660 MW of combined cycle power generation (Certification Number PA89-25) (TPS/SECI, 1989). Furthermore, the HPS site has adequate area to accommodate the proposed expansion from 660 MW to 880 MW. Locating the Hardee Unit 3 Project at the HPS site takes advantage of the existing infrastructure and onsite facilities, and minimizes potential environmental impacts that might otherwise be associated with the construction of a combined cycle power plant at a previously undeveloped site.

The Hardee Unit 3 Project will be located on the 526-hectare (ha) (1,300-acre) HPS site in Hardee and Polk counties approximately 14 kilometers (km) (9 miles) northwest of Wauchula, 26 km (16 miles) south-southwest of Bartow, and 64 km (40 miles) east of Tampa Bay (Figures 1.3.2-1 and 1.3.2-2). The entire HPS site is owned by the Acuera Corporation, Inc., a subsidiary of SECI. The HPS site is bordered on the east by County Road (CR) 663, a CSX right-of-way, and CF Industries' Hardee Complex. IMC-Agrico properties surround the remaining portions of the site. Payne Creek flows along the southern and western boundary of the HPS site. The Hardee Unit 3 facility will occupy approximately 20 ha (50 acres) of the HPS site.

ASSESSMENT OF PROBABLE PROJECT IMPACTS

As part of the Federal Consistency Evaluation Procedures, an assessment of the probable impacts of the project on the coastal zone were determined in relation to FCMP statutes.

Flood Zones--All Hardee Unit 3 facilities will be at or above the 100-year flood evaluation. In addition, all Hardee Unit 3 facilities are designed to comply with all applicable Southwest Florida Water Management District (SWFWMD) and FDEP requirements regarding flood protection control. Installation and operation of the Hardee Unit 3 facility is expected to have no adverse impact on the 100-year flood elevations or flood flows in Payne Creek. Since the plant will be entirely above the limits of the 100-year flood, adjacent property owners will not be adversely affected.

Air and Water Impacts--These concerns will be addressed by obtaining the appropriate facility operation and discharge permits and using pollution control measures to abate impacts from facility construction and operation. All construction and operation permits will be obtained

through the Power Plant Siting Act process in accordance with requirements established in the prevention of significant deterioration (PSD) air quality regulations and the air quality regulations governing new sources. No additional water allocation is being pursued for this project.

A stormwater detention basin will be used to collect runoff waters from the site. The discharge from these basins will comply with all FDEP and SWFWMD requirements for protection of surface water and groundwater.

Archaeological and Historical Resources Impacts--An evaluation of archaeological and historical resources within the Hardee Unit 3 site has been conducted with the conclusion that no archaeological or historical resources occur onsite.

Water Resources Impacts--SWFWMD will review the project for water resources impacts. No additional consumptive use of water is anticipated; therefore, permits for such use will not be obtained from SWFWMD. Stormwater management practices will be employed to mitigate impacts to water resources from runoff.

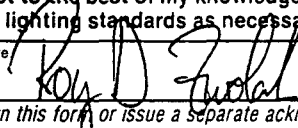
Power Plant Siting Act--An application is being filed with FDEP under the Power Plant Siting Act. This application will present information discussing the conditions resulting from construction, and the anticipated impacts from facility operation, in order to provide assurance that all applicable state, regional, and local regulations are met and that the project will be consistent with the FCMP.

CONSISTENCY DETERMINATION

The proposed project complies with Florida's approved coastal management program and will be conducted in a manner consistent with that program.

APPENDIX 10.1.7

**NOTICE OF PROPOSED CONSTRUCTION OR ALTERATION
(FAA FORM 7460-1)**

 U.S. Department of Transportation Federal Aviation Administration		Notice of Proposed Construction or Alteration		Aeronautical Study Number	
1. Nature of Proposal			2. Complete Description of Structure		
A. Type ☒ New Construction ☐ Alteration *		B. Class ☒ Permanent ☐ Temporary (Duration _____ months)		C. Work Schedule Dates Beginning <u>1/97</u> End <u>12/98</u>	
* If Alteration, provide previous FAA Aeronautical Study Number, if available:					
3A. Name, address, and telephone number of individual, company corporation, etc. proposing the construction or alteration. (Number, Street, City, State, and Zip Code) Seminole Electric Cooperative, Inc. P.O. Box 272000 Tampa, Florida 33688 (813) <u>963-0994</u> Area Code Telephone Number			Please describe, on a separate sheet of paper if necessary, the proposed construction or alteration. A. For proposals involving transmitting stations, include effective radiated power (ERP) and assigned frequency of all proposed or modified transmitters on the structure. (If not known, give frequency band and maximum ERP). B. For proposals involving overhead wire, transmission lines, etc., include the size and the configuration of the wires and their supporting structures. C. For all proposals, include site orientation, dimensions, and construction materials of the proposed or altered structure. D. Optional — Describe the type of obstruction marking and lighting system desired for your structure. The FAA will recommend appropriate marking and lighting for the structure in accordance with the standards of Advisory Circular AC 70/7460-1. An FAA marking and lighting recommendation will reflect the minimum acceptable level of conspicuity necessary to warn pilots of the presence of an object. However, the FAA, under certain circumstances, will not object to the use of a system (such as a medium intensity flashing white light system or a dual lighting system) other than the recommended standard.		
3B. Name, address and telephone number of proponent's representative, if different than 3A. above. KBN Engineering and Applied Sciences, Inc 5405 West Cypress Street, Suite 215 Tampa, FL 33607 (813) <u>287-1717</u> Area Code Telephone Number					
4. Location Of Structure			5. Height and Elevation (to nearest foot)		
A. Coordinates (to hundredths of seconds, if known) Latitude 0' 27" 38" 27" Longitude 0' 81" 57" 46"		B. Nearest City or Town and State Bowling Green		C. Nearest public or military airport, heliport, flightpark, or seaplane base Wauchula Muni	
4D. Source of coordinate information for item 4A. above. ☒ USGS 7.5' Quad Chart ☐ Survey ☐ Other Specify		(1). Distance to 4B 7.5 NM		(1). Distance from structure to nearest point of nearest runway 10.5 NM	
Indicate the reference datum of the coordinates, if known. ☐ NAD 27 ☐ NAD 83 ☐ Other Specify		(2). Direction to 4B E		(2). Direction from structure to airport SSE	
		4E. Describe, on a separate sheet of paper, the location of the site with respect to highways, streets, airports, prominent terrain features, existing structures, etc. Attach a copy of a U.S. Geological Survey quadrangle map 7.5 minute series (or equivalent) showing the construction site. If available, attach a copy of a documented site survey with the surveyor's certification.		A. Elevation of site above mean sea level. 129	
				B. Height of structure including all appurtenances and lighting above ground or water. 90	
				C. Overall height above mean sea level (A + B) 219	
FAILURE TO PROVIDE ALL REQUESTED INFORMATION MAY DELAY PROCESSING OF YOUR NOTICE Notice is required by Part 77 of the Federal Aviation Regulations (14 C.F.R. Part 77) pursuant to Section 1101 of the Federal Aviation Act of 1958, as amended (49 U.S.C. app. § 1501). Persons who knowingly and willfully violate the Notice requirements of Part 77 are subject to a civil penalty of \$1,000 per day until the notice is received, pursuant to Section 901(a) of the Federal Aviation Act of 1958, as amended (49 U.S.C. app. § 1471(a)) as well as the fine (criminal penalty) of not more than \$500 for the first offense and not more than \$2,000 for subsequent offenses, pursuant to Section 902(a) of the Federal Aviation Act of 1958, as amended (49 U.S.C. app. § 1472(a)).					
I HEREBY CERTIFY that all of the above statements made by me are true, complete, and correct to the best of my knowledge. In addition, I agree to obstruction mark and/or light the structure in accordance with established marking & lighting standards as necessary.					
Date 3/16/94		Typed or Printed Name and Title of Person Filing Notice Roy D. Zwolak, Project Planner		Signature 	
FOR FAA USE ONLY					
The Proposal: ☐ Does not require a notice to FAA. ☐ is not identified as an obstruction under any standard of FAR, Part 77, Subpart C, and would not be a hazard to navigation. ☐ is identified as an obstruction under the standards of FAR, Part 77, Subpart C, but would not be a hazard to navigation. ☐ Should be obstruction ☐ marked ☐ lighted per FAA Advisory Circular 70/7460-1, Chapters _____ ☐ Obstruction marking and lighting are not necessary.			Supplemental Notice of Construction, FAA Form 7460-2, is required any time the project is abandoned, or ☐ At least 48 hours before the start of construction. ☐ Within five days after the construction reaches its greatest height. This determination expires on _____, unless: (a) extended, revised or terminated by the issuing office; (b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit is made to the FCC on or before the above expiration date. In such cases the determination expires on the date prescribed by the FCC for completion of construction, or on the date the FCC denies the application. NOTE: Request for extension of the effective period of this determination must be postmarked or delivered to the issuing office at least 15 days prior to the expiration date. If the structure is subject to the licensing authority of the FCC, a copy of this determination will be sent to that agency.		
Remarks					
NAD 83 Coordinates (Use these coordinates for any future correspondence with the FAA)		Latitude		Longitude	
Issued in		Signature		Date	

2. DESCRIPTION OF STRUCTURE

Seminole Electric Cooperative Incorporated (SECI), is proposing to construct and operate a 440-megawatt (MW) combined cycle power plant and ancillary facilities on a 50-acre parcel within an existing 1,300-acre site that has been previously developed for an existing power plant facility. The proposed facilities will include two 90-foot (ft) above ground level (AGL) stacks associated with the Heat Recovery Steam Generators (HRSG) (See Figure 2-1, No. 6) constructed of either concrete or prefabricated steel. These two stacks will be the tallest facilities on-site. In addition to the HRSG stacks, two bypass stacks will be constructed as part of the facility. The bypass stacks will be 75 ft AGL (See Figure 2-1, No.5).

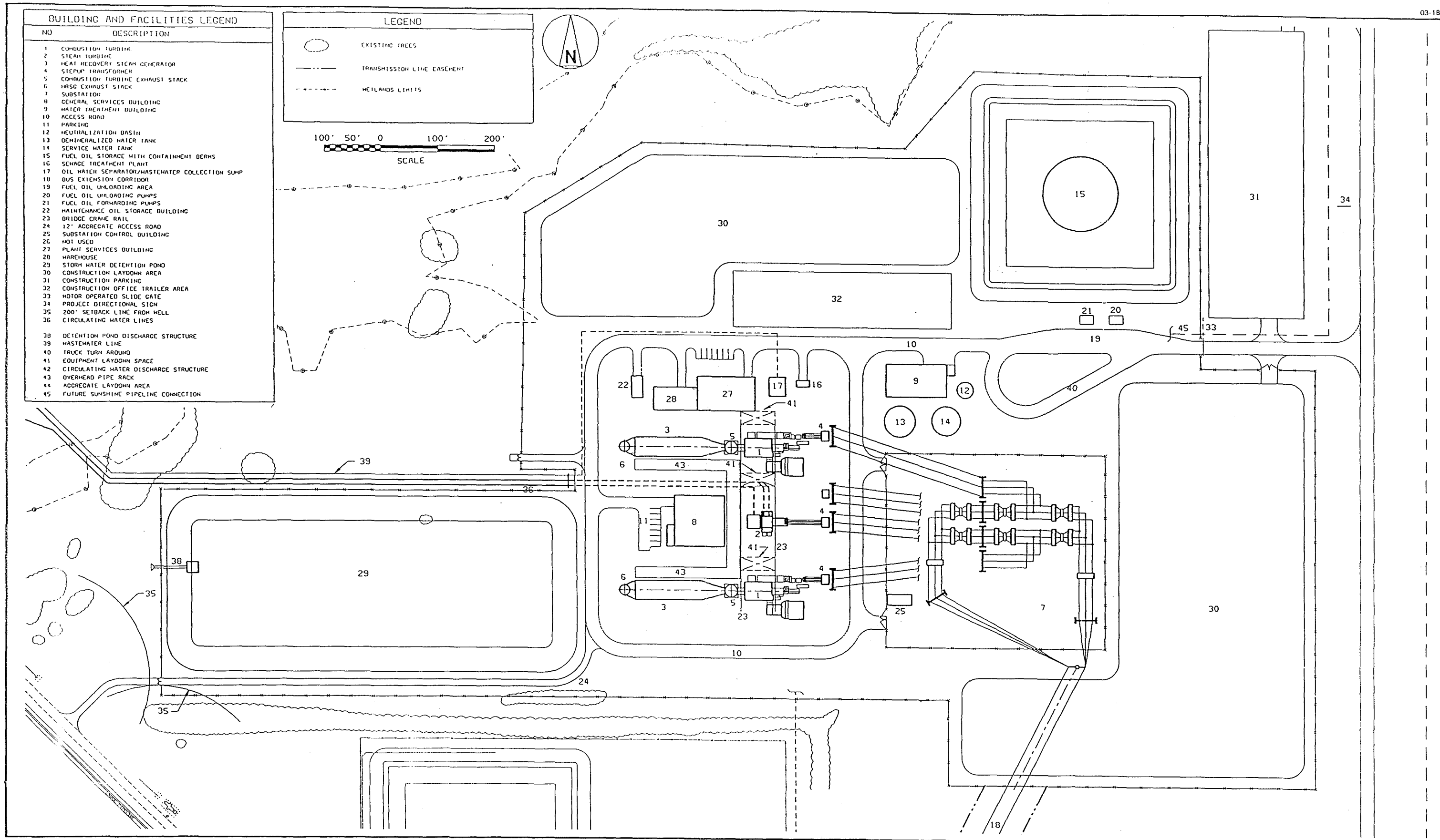


Figure 2-1
Hardec Unit 3 Plot Plan

Source: Black & Veatch, 1994.



4E. LOCATION OF PROPOSED FACILITIES

The proposed power plant facilities will be located on a 1,300-acre site in Hardee and Polk counties, approximately 7 miles west of Bowling Green, 9 miles northwest of Wauchula, 16 miles south-southwest of Bartow, and 40 miles east of Tampa Bay (See Figures 4E-1 and 4E-2). The site is bordered on the east by County Road 663, a CSX Railroad right-of-way, and a phosphate mining complex (CF Industries', Hardee Complex) is located southeast of the site. Existing phosphate mining and mining reclamation activities surround the site. The terrain around the site is relatively flat mined over phosphate lands.

Located 2,000 ft southwest of the proposed facility is an existing power plant and associated facilities. The type and dimensions of the proposed structures will be very similar in arrangement and composition of the existing facility.

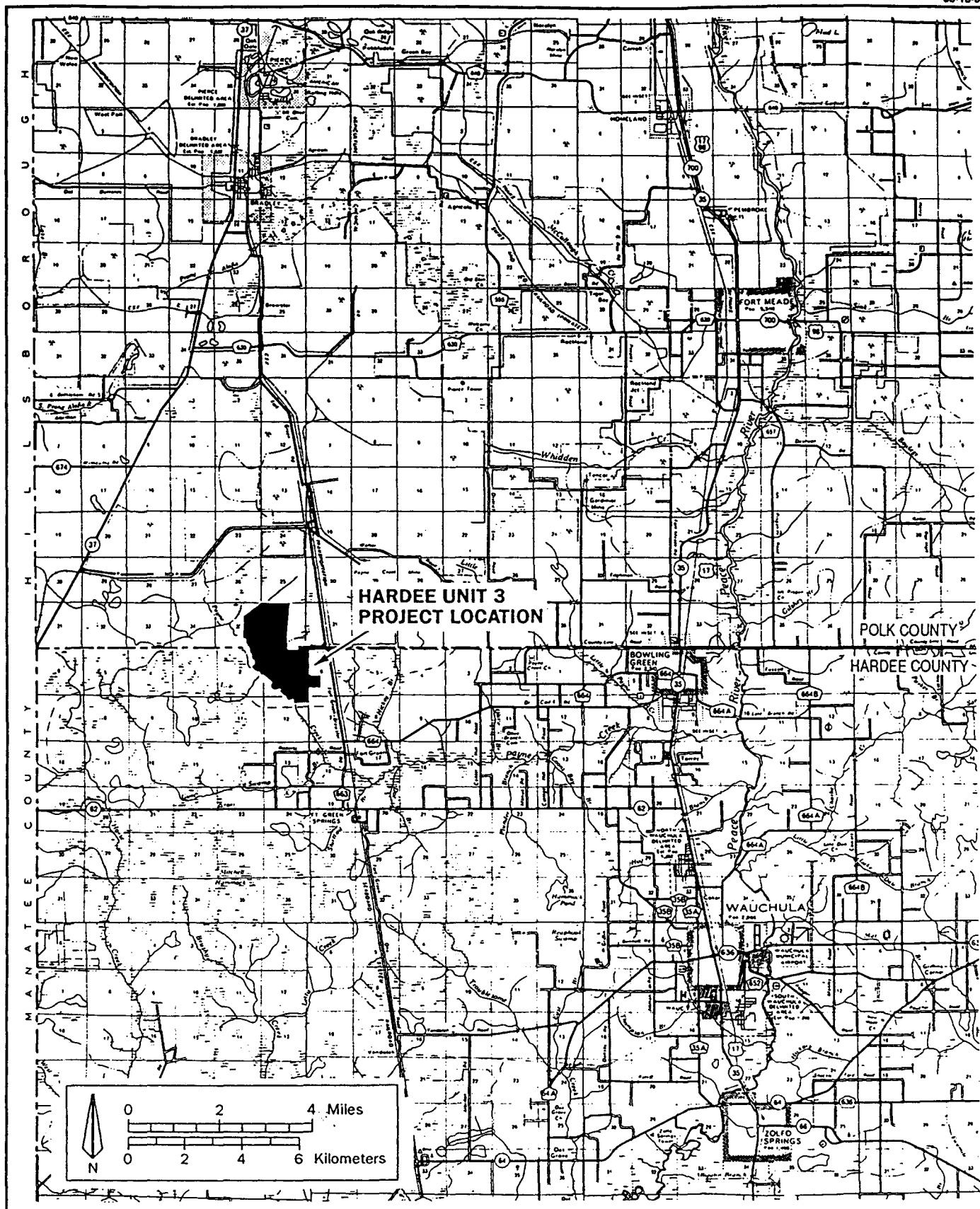


Figure 4E-1
Location of Hardee Unit 3 Project

Sources: FDOT, 1990; 1992; KBN, 1994.



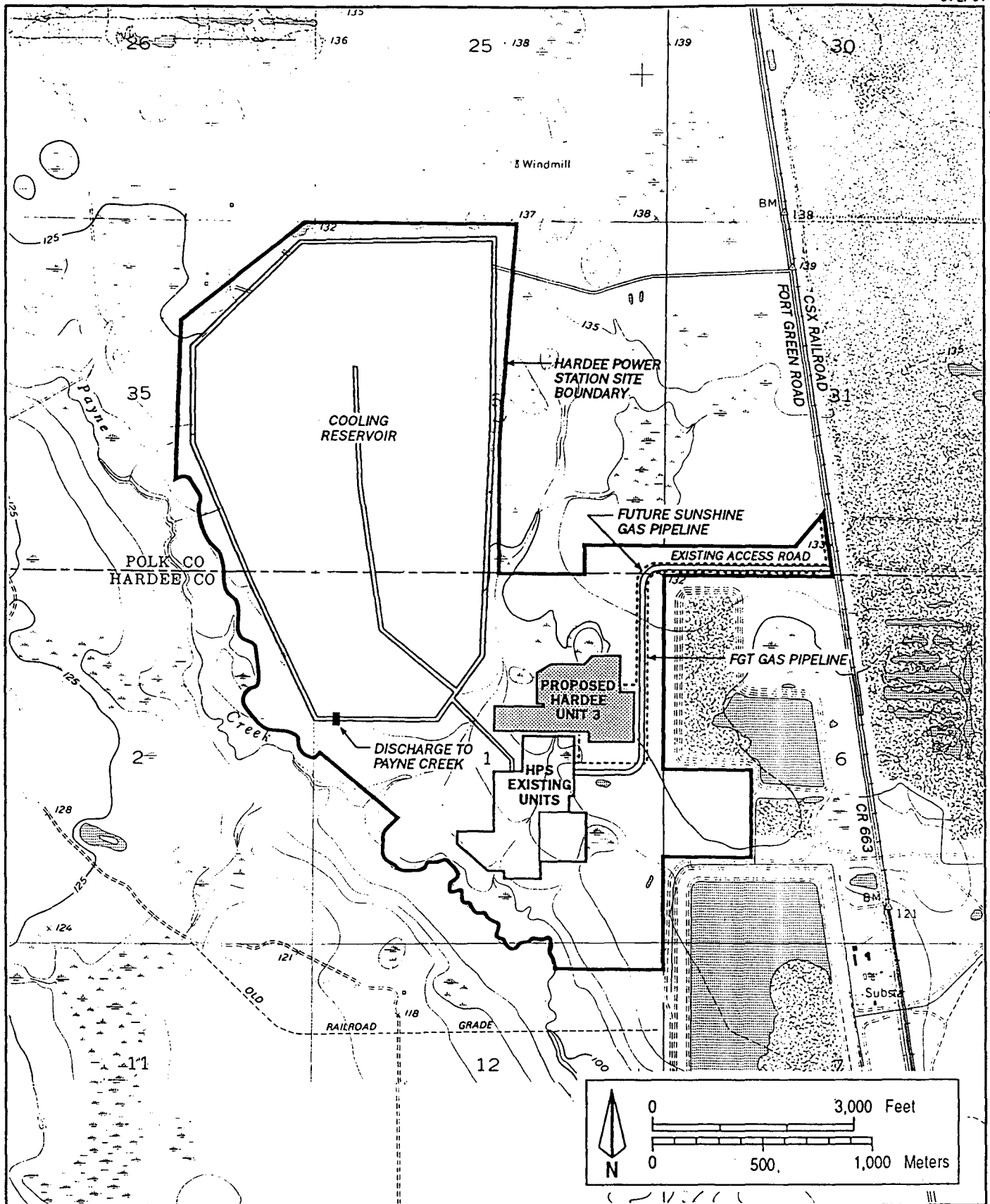


Figure 4E-2
Hardee Unit 3 Site Boundary and Adjacent Properties

Sources: USGS, 1987; KBN, 1994.



APPENDIX 10.1.8

SPILL PREVENTION CONTROL AND COUNTERMEASURE (SPCC) PLAN

**SPILL PREVENTION, CONTROL
AND COUNTERMEASURE (SPCC)
PLAN FOR THE HARDEE UNIT 3
FACILITY**

Prepared For:

**Seminole Electric Cooperative
P.O. Box 272000
Tampa, Florida 33688-2000**

Prepared By:

**KBN Engineering and Applied Sciences, Inc.
1034 NW 57th Street
Gainesville, Florida 32605**

**April 1994
13225D7**

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SPILL PREVENTION, CONTROL, AND
COUNTERMEASURE (SPCC) PLAN

Seminole Electric Cooperative Incorporated
Hardee Unit 3
P.O. Box 272000
Tampa, Florida 33688-2000

(813) 963-0994
Jim Duran

MANAGEMENT APPROVAL:

Signature

Name

Title

CERTIFICATION:

Engineer

Signature

License Number

State: Florida
(Seal)

Date

**SPILL PREVENTION, CONTROL, AND COUNTERMEASURE
(SPCC) PLAN FOR SEMINOLE ELECTRIC COOPERATIVE, INC. (SECI),
HARDEE UNIT 3 FACILITY**

1.0 INTRODUCTION

This Spill Prevention, Control, and Countermeasure (SPCC) Plan has been developed in compliance with the requirements of 40 Code of Federal Regulations (CFR) 112 and is designed in accordance with good engineering practices to prevent discharges of oil to waters of the United States. All sections of 40 CFR 112.7 are addressed in this plan.

Not addressed in this plan are oil spill contingency and response planning requirements of the Oil Pollution Act of 1990 (OPA 90). Detailed oil spill response procedures developed in the oil spill contingency plan for the Hardee Unit 3 facility will provide supplementary information for use with this SPCC plan.

1.1 NOTIFICATION AND REPORTING REQUIREMENTS (40 CFR 112.4)

The SPCC Plan must be kept on file at the facility. If a spill event of more than 1,000 gallons of oil, or if a discharge of oil in harmful quantities occurs within a 12 month period, the SPCC plan must be submitted to the EPA Regional Administrator and the State of Florida within 60 days of eligibility.

In the event of a spill, the spill-response and notification summaries, Tables 1 and 2 should be reviewed to determine appropriate actions. These tables summarize the actions, notifications, or responses required of different individuals during a spill. Additional generalized spill response information is provided in Attachment A.

1.2 SECI GENERAL INFORMATION

Information about the Seminole Electric Cooperative, Inc. (SECI) Hardee Unit 3 and its operations is given below. A site location map is presented in Figure 1.

TABLE 1
SPILL RESPONSE SUMMARY

<u>Person/Position</u>	<u>Response</u>
Anyone discovering a spill must:	• Stop the flow if practicable • Notify immediate supervisor
Immediate Supervisor must:	• Notify the oil spill coordinator
Oil Spill Coordinator must:	• Assess the spill event and determine if it is reportable • Make appropriate notifications • Mobilize response personnel to contain spill • Supervise activities of the response team

TABLE 2
OIL SPILL EMERGENCY NOTIFICATION TELEPHONE NUMBERS FOR
SECI HARDEE UNIT 3 PLANT

<u>Initial SECI Personnel for Plant to Contact</u>	<u>Telephone Numbers</u>
1. Plant General Manager	To be appointed
2. Environmental Affairs Department	(813) 963-0994
<u>Agencies Required to be Notified</u>	
(Environmental Affairs will make notification unless unable to contact)	
3. National Response Center (NRC) ^a	1-800-424-8802 (24 hrs)
4. State Emergency Response Commission (SERC) ^b State Warning Point	(904) 488-1320 (24 hrs)
5. Florida Department of Environmental Protection (FDEP)	(904) 488-0190
<u>Additional Agencies for Plant to Contact (If Needed)</u>	
6. Hardee County Public Safety	(813) 773-6373
7. Fire Department	911
8. Emergency Response Contractor	To be appointed

^a Notify if spill to navigable water or adjoining shoreline.

^b Notify if spill to land (pervious surface).

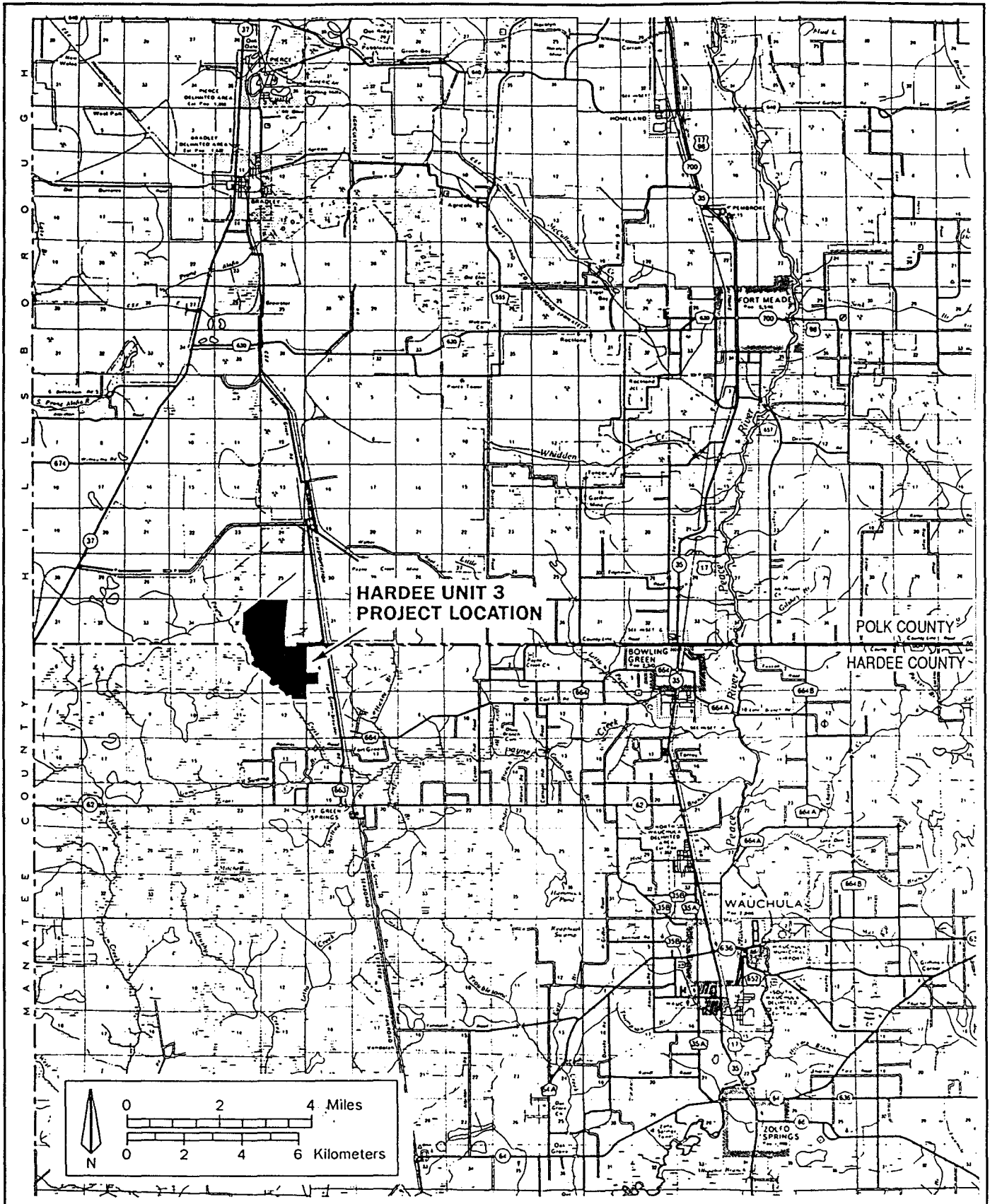


Figure 1
Location of Hardee Unit 3 Project

Sources: FDOT, 1990; 1992; KBN, 1994.



1.2.1 Facility Name and Responsible Parties

Facility Name: Seminole Electric Cooperative, Inc.
Hardee Unit 3

Type of Facility: The Hardee Unit 3 facility is a 440-MW combined cycle generating facility burning natural gas as the primary fuel and No. 2 oil as a backup fuel.

Location of Facility: Hardee County, Florida

Facility Address: 3.5 Miles North of SR 62 on CR 663

Facility Mailing Address: CR 663
Fort Green, Florida 33834

Name and Address of Owner or Operator: Seminole Electric Cooperative, Inc.
P.O. Box 272000
Tampa, Florida 33688-2000

1.2.3 SECI Commitment to Manpower and Equipment [40 CFR 112.7(d)(2)]

The designated facility representative responsible for oil spill prevention is the plant manager. The onsite coordination will be designated by the plant manager to follow through SECI's commitments for manpower, equipment, and material in the event of a spill.

1.3 GENERAL SITE DESCRIPTION

The Hardee Unit 3 facility consists of the following components:

- Base Plant and Buildings,
- Fuel Oil Storage/Handling,
- Switchyard,
- Switchyard Interconnect,
- Water/Wastewater Treatment,
- Site Runoff Detention Pond,
- Miscellaneous (e.g., site roads), and
- Cooling Reservoir.

Figure 2 presents a site plan indicating the locations of the above facility components.

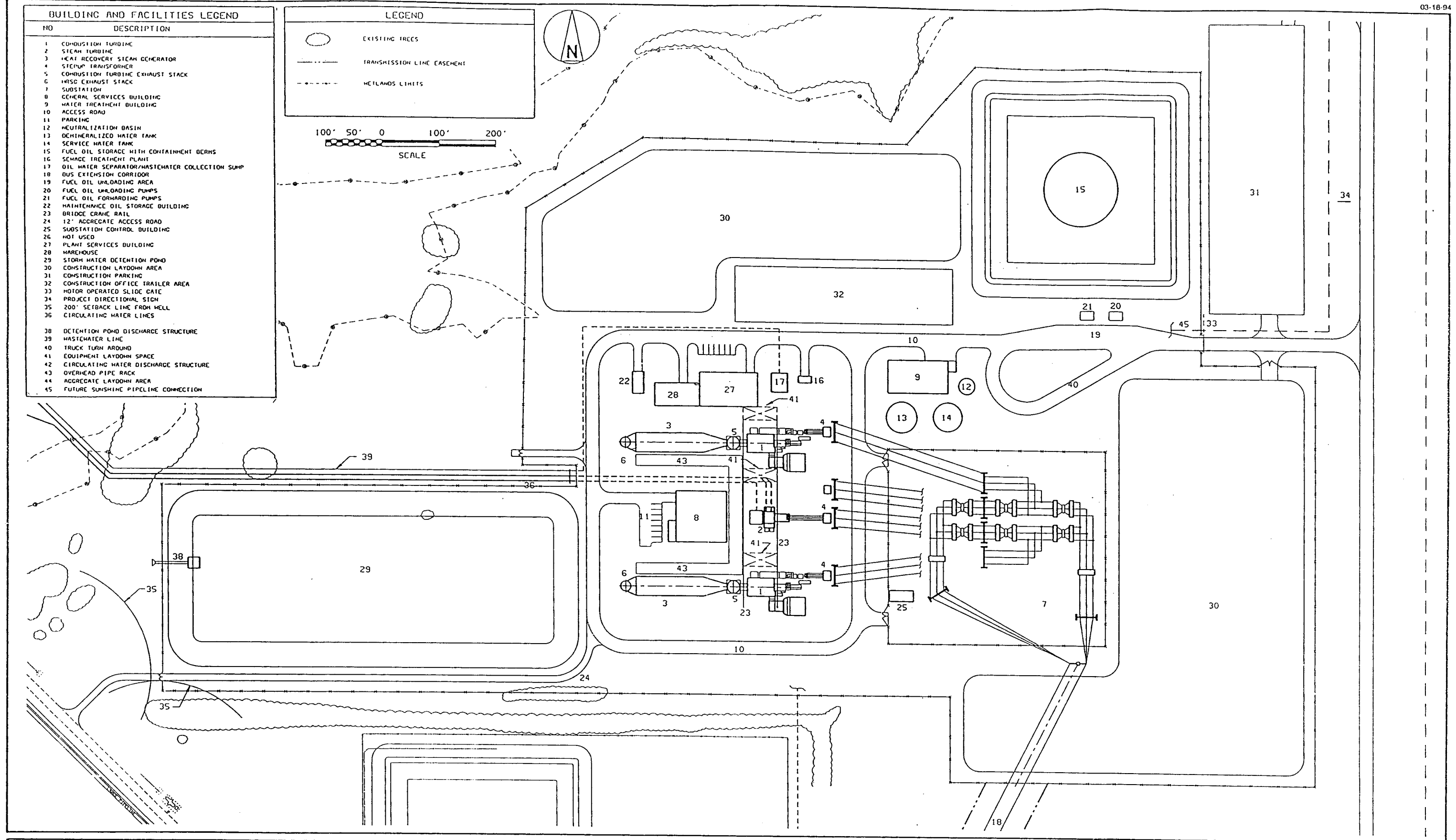


Figure 2
Hardee Unit 3 Plot Plan

Source: Black & Veatch, 1994.



2.0 OPERATIONAL HISTORY

2.1 SPILL HISTORY [40 CFR 112.7(a)]

The proposed Hardee Unit 3 has not experienced a reportable spill 12 months prior to the effective date of CFR 40 Part 112, January 10, 1974. Should the plant experience an oil spill, a spill report form will be prepared, according to the format presented in Attachment B. The spill report will provide a description of the incident including date, time, and cause of the spill. The report will also address corrective actions taken as well as measures necessary to prevent a recurrence.

2.2 POTENTIAL FOR EQUIPMENT FAILURE AND PREVENTIVE MEASURES [40 CFR 112.7(b) and (c)]

Hardee Unit 3 stores significant quantities of oil, which creates a potential for a release if equipment fails (i.e., tank overflow, rupture, or leakage). Table 3 lists storage tanks, other oil storage areas, and on-site oil-containing equipment; and identifies their capacities and the types of oil normally stored. This table also identifies the type of secondary containment structures. All oil storage tanks and equipment are provided with secondary containment structures to prevent, in the event of equipment failure, the spill from reaching Waters of the United States.

The Hardee Unit 3 facility will employ the following containment and diversionary structures to prevent discharged oil from reaching Waters of the United States:

- Containment dikes or curbing around all oil storage areas, tanks, and oil-containing equipment; and
- Sorbent materials.

3.0 GENERAL FACILITY DRAINAGE [40 CFR 112.7(e)(1)]

The Hardee Unit 3 facility lies within the Peace River drainage basin. The facility is adjacent to an unnamed tributary that is connected to Payne Creek, which leads to the Peace River. Normal, uncontaminated stormwater accumulated in secondary containment structures will be directed to the on-site oil/water separator treatment system. Wastewater will then be routed to the wastewater collection sump and recycled to the cooling water reservoir. Drainage from noncontact areas of the facility will be routed to the on-site stormwater retention basin.

TABLE 3
OIL STORAGE FACILITIES

Oil Storage Area, Tank, or Equipment	Oil and Type	Total Capacity (gallons)	Secondary Containment Structure
Fuel Oil Storage Tank	No. 2 Fuel Oil	4.4 million	Earthen Dike
Generator Step-Up Transformer No. 1	Transformer Oil < 1 ppm PCB)	15,000	Concrete containment basin
Generator Step-Up Transformer No. 2	Transformer Oil < 1 ppm PCB)	15,000	Concrete containment basin
Generator Step-Up Transformer No. 3	Transformer Oil < 1 ppm PCB)	15,000	Concrete containment basin
Combustion Turbine Oil Reservoir No. 1	Lube Oil	4,150	Enclosure with drain to oil/ water separator
Combustion Turbine Oil Reservoir No. 2	Lube Oil	4,150	Enclosure with drain to oil/ water separator
Steam Turbine Oil Reservoir	Lube Oil	4,150	Enclosure with drain to oil/ water separator
Boiler Feed Pump No. 1	Lube Oil	50	Enclosure with drain to oil/ water separator
Boiler Feed Pump No. 2	Lube Oil	50	Enclosure with drain to oil/ water separator
Boiler Feed Pump No. 3	Lube Oil	50	Enclosure with drain to oil/ water separator
Boiler Feed Pump No. 4	Lube Oil	50	Enclosure with drain to oil/ water separator
Steam Turbine Lube Oil Storage Tank	Lube Oil	4,500	Concrete containment basin
Steam Turbine Dirty Lube Oil Storage Tank	Lube Oil	4,500	Concrete containment basin

Open-and-closed-type valves will be used to drain collected stormwater in containment areas. Accumulated stormwater from containment units will be discharged only after sufficient visual inspection to determine the presence and amount of observable oil in the water to be discharged. If indications of hydrocarbon products are observed in accumulated water in excess of the oil/water separator treatment capacity, the contaminated water will not be discharged but will be removed for proper disposal by a licensed contractor. An investigation of the cause of the oil discharge will then be implemented. The drainage valves will normally be kept in a closed position. Records of drainage events will be kept on-site.

4.0 BULK STORAGE TANKS [40 CFR 112.7(e)(2)]

The bulk storage tank containing No. 2 fuel oil will be constructed using quality materials in accordance with American Petroleum Institute (API) specification 650-D. The tank will be constructed of carbon steel and field erected in accordance with API requirements.

Secondary containment structures around the bulk storage tank will be sufficiently impervious and of adequate capacity to retain the contents of the largest tank plus 10 percent for accumulation of precipitation.

No underground or mobile oil storage tanks will be constructed for the Hardee Unit 3 facility.

Fail-safe engineering practices to be employed to prevent overfilling of the tank will include high liquid level pump cutoff devices and/or alarms on the bulk storage tank that will sound in the control center to alert operations personnel when the level inside the tank reaches a predetermined level.

5.0 FACILITY TRANSFER OPERATIONS [40 CFR 112.7(e)(3)]

Fuel oil transfer operations at the Hardee Unit 3 facility will be implemented mainly through aboveground piping. The piping will be coated and wrapped for corrosion protection. The small amount of belowgrade piping will consist of a guarded system.

Piping supports will be provided for the abovegrade oil supply piping from the unloading pump to the tank and from the transfer pumps to the combustion turbines. Supports will be designed to minimize abrasion and corrosion.

Pipelines will be scheduled to be inspected routinely for the following items:

- Flange joints,
- Expansion joints,
- Valve glands and bodies,
- Pipeline supports,
- Exposed metal surfaces, and
- Oil leaks of any type.

Measures to prevent spills during transfer operations will include:

- Operator inspection of valves,
- Verbal and visual warning to all vehicular traffic operating in pipeline areas, and
- Utilization of trained personnel authorized for the transfer operations.

6.0 FACILITY TANK TRUCK UNLOADING [40 CFR 112.7(e)(4)]

The tank truck unloading procedures for Hardee Unit 3 will meet the requirements and regulations established by the Department of Transportation.

No. 2 fuel oil will be delivered by tank truck at Hardee Unit 3. The fuel will be pumped into the fuel oil storage tank by trained operations personnel. In the unlikely event of an oil release, the curbing surrounding the unloading area will provide containment.

The oil-water separator for the unloading facility will have sufficient emergency spill capacity for 100 percent of the volume of the largest single compartment of a tank truck.

7.0 INSPECTIONS AND RECORDS [40 CFR 112.7(e)(8)]

A strict inventory control of the petroleum product in all tanks will be maintained. During each shift, an operator will inspect the pipeline and all oil-storage facilities. Secondary containment and oil transfer areas will also be inspected for leaks or accumulated oil. Containment outlet valves will be periodically inspected to assure that they remain closed.

Inspections of oil storage and transfer facilities will be conducted as a part of the regular plant inspection program. These inspections will follow written guidelines and will be documented in plant inspection logs. Proposed inspection procedures and recording forms are presented in

Attachment B. These inspection records will be maintained at the facility for a minimum of 3 years.

In general, inspections will include the following items:

- Tank exteriors for paint condition and corrosion;
- Joints, seams, valves, and flowlines for leaks;
- Supports and foundations for deterioration or corrosion that would affect structural strength;
- Containment structures for integrity, and to ensure that discharge valves are in the closed position;
- The floor of the containment structure for visual observation of leaks; and
- Aboveground pipes and valves for assessment of condition and evidence of leaks.

If warranted, pressure testing will be performed to confirm the condition of the pipelines and valves. Any evidence of poor condition or leakage will be immediately reported and corrective actions implemented.

8.0 SECURITY [40 CFR 112.7(e)(9)]

The objectives of the Hardee Unit 3 facility security program are to minimize and prevent unknowing entry to the facility, maximize the personal protection of employees operating the facility, and prevent the accidental spill of any oil. Security provisions at the Hardee Unit 3 facility will include:

- Drain valves on tanks will be locked in the closed position when in nonoperating status.
- A chain-link security fence will surround the project area to meet safety and security requirements. All material and installation will conform to accepted standards for such fencing.
- A controlled access entrance gate will be monitored.
- Starter controls on all oil pumps are locked in "off" position and accessible only to authorized personnel.
- Unloading connections of oil pipelines will be capped when not in service.
- Adequate night lighting will be provided to permit surveillance of the facility.

9.0 PERSONNEL TRAINING [40 CFR 112.7(e)(10)]

The Hardee Unit 3 facility will maintain a routine program of personnel training for its employees. This program will include a review of safety training, environmental regulations, company policies, and proper maintenance and housekeeping procedures. Records of training will be maintained and will include subject matter and names of personnel in attendance. In addition, new personnel will be trained promptly upon being hired.

Appropriate plant employees will be trained in the following plant rules and procedures:

- Brief overview of applicable federal regulations,
- Spill prevention measures,
- Spill containment and recovery procedures,
- Spill reporting procedures,
- A review of previous spills, and
- Equipment maintenance and inspection procedures.

Personnel responsible for operation and maintenance of oil storage and transfer facilities will be properly trained in proper spill prevention measures, oil containment and cleanup procedures, equipment maintenance, discussion of any past spill events, regulatory requirements, and the SPCC plan. These training and briefing sessions will on a periodic basis for applicable personnel. New personnel will be trained prior to assuming any related responsibilities.

A designated person in a supervisory position will be assigned the responsibility of carrying out the intent of this plan, including knowledge of current regulatory amendments and requirements, inspections, recordkeeping, spill reporting, and spill response initiation.

Specific spill control and cleanup procedures for the facility will be developed in the oil spill contingency plan as required by OPA 90 and readily available to personnel. A clear chain of command in the event of a spill will be established and readily accessible.

ATTACHMENT A
OIL SPILL REPORTING GUIDANCE



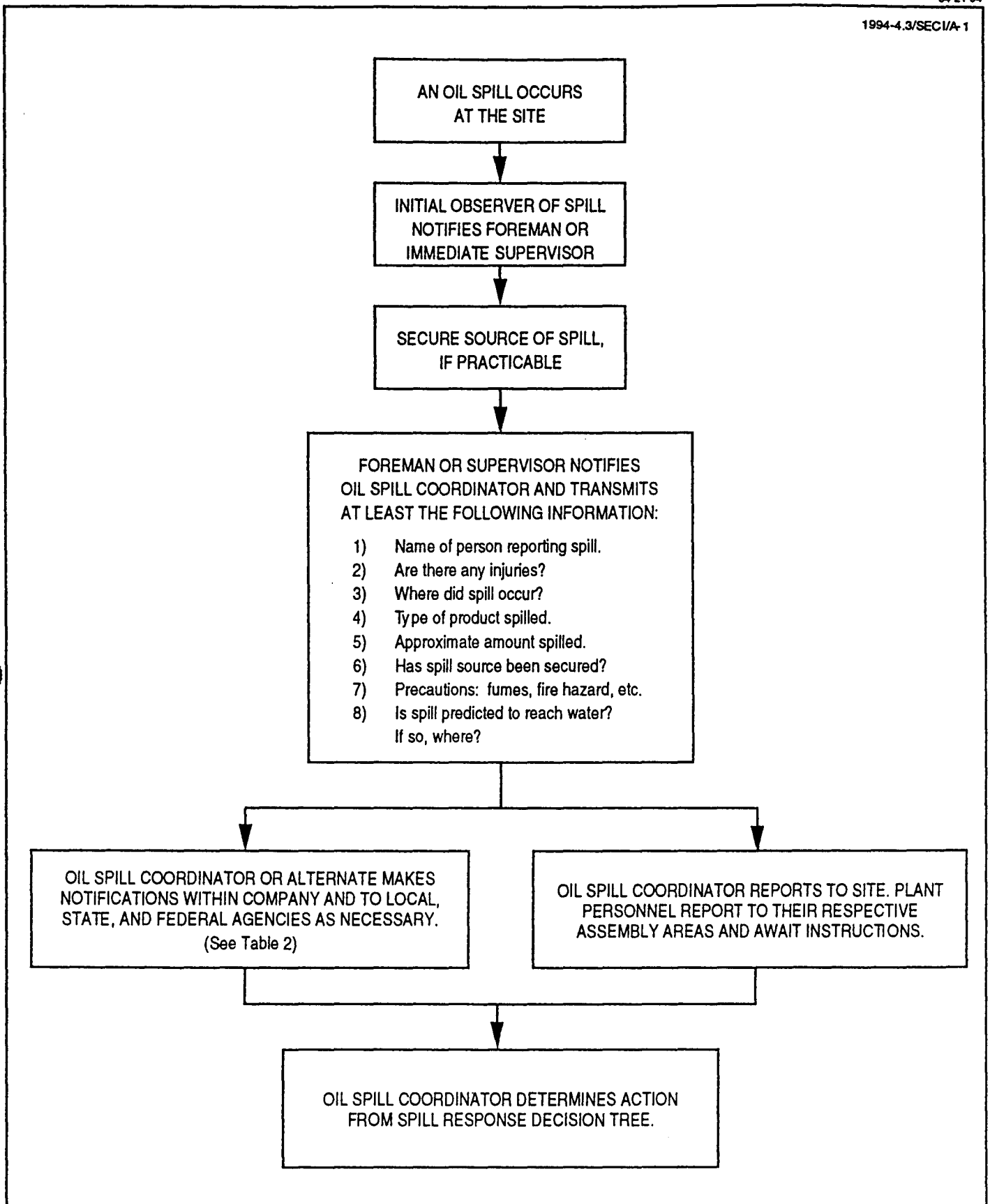


Figure A-1
Flow Chart of Initial Discovery, Notification,
and Evaluation of Spill



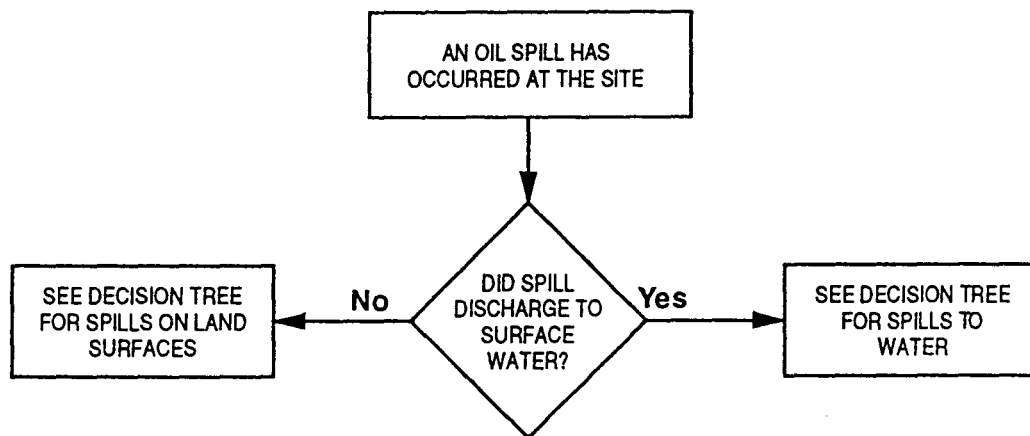


Figure A-2
Oil Spill Response Decision Tree



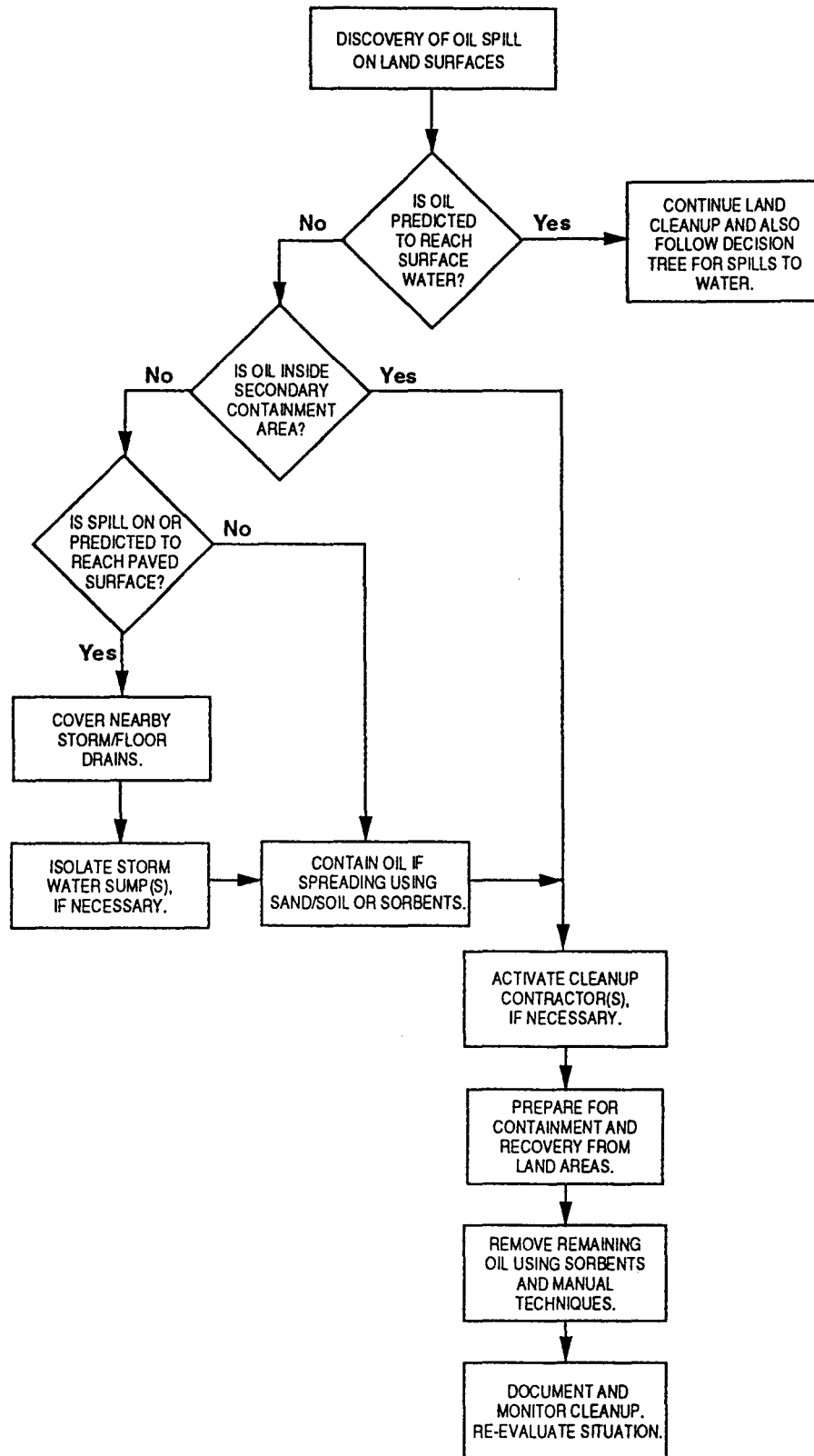


Figure A-3
Decision Tree for Spills on Land Surfaces



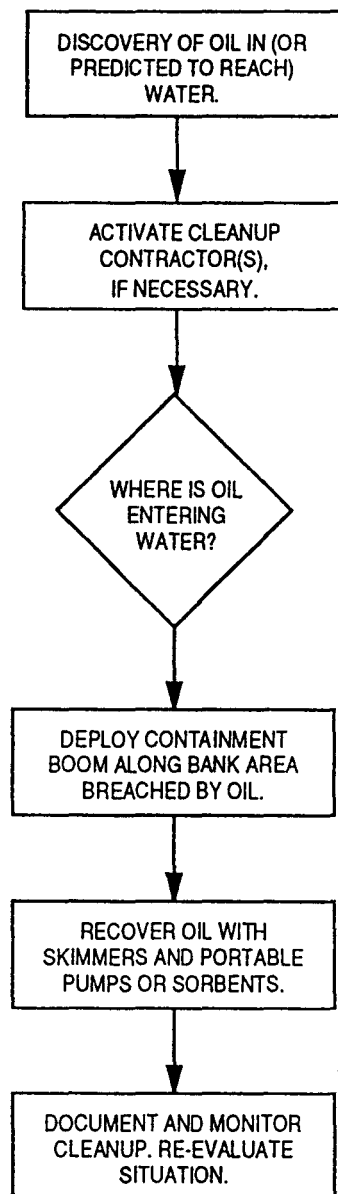


Figure A-4
Decision Tree for Spills to Water



ATTACHMENT B
INSPECTION FORMS

CONTAINER INSPECTION REPORTS

The largest volume of petroleum products used at the Hardee Unit 3 Plant is received in bulk and stored in large-capacity, aboveground storage tanks. Other oils, additives, solvents, and lubricants are typically received in 5-gallon drums or smaller containers. As part of the Spill Prevention, Control, and Countermeasures (SPCC) requirements, scheduled inspection of all containers is important to prevent a potential spill. Therefore, the following inspection procedures have been formulated:

- When a full drum of oil is trucked, unloaded, and moved to the storage site (drum rack) inside the plant, it shall be inspected for leaks and shipment damage (dents) by all employees who handle it.
- Special attention shall be given to ensure that drum taps are properly threaded and installed in accordance with manufacturers' guidelines. A small sample shall be obtained to be certain the dispenser is functioning as designed (without leaks).
- A visual inspection of all drum storage areas and drum racks shall be conducted. Braces and supports shall be inspected for cracks or failures. The surrounding areas shall also be inspected to verify that no drums are slowly leaking and that any spilled oil has been cleaned up. A record of such inspections shall be maintained at the site. A sample inspection log follows.

INSPECTION RECORD FROM _____ TO _____

[illegible]

STORAGE TANK AND PIPING INSPECTION PROCEDURE

All storage tanks, piping, joints, valve glands and bodies, pipeline supports, metal surfaces, and other aboveground equipment and facilities for transporting or holding oil will be visually checked by each employee during the daily work schedule. Any and all discrepancies will be reported immediately to the appropriate supervisor. Additionally, an entry will be made on the discrepancy report and corrective action will be taken.

A detailed and specific visual check of oil containing equipment (as indicated above) will be made monthly. Records of these inspections will be maintained.

STORAGE TANK AND PIPING INSPECTION RECORD

DISCREPANCY REPORT				
DATE	LOCATION	DESCRIPTION	CORRECTION/DATE	SUPERVISOR

MONTHLY INSPECTION REPORT					
DATE	INSPECTOR	DATE	INSPECTOR	DATE	INSPECTOR

DIKE DRAINAGE INSPECTION PROCEDURE

All diked areas and the catchment basin will be inspected weekly for water collection and after each rainfall event. Collection of water at the drain pipe inlet or diked area low point of a depth greater than 1 foot will necessitate drainage. Prior to drainage, the water will be carefully inspected for an oil sheen, which is defined as an iridescent appearance on the surface. If a sheen is observed, it will be reported to the oil spill coordinator for appropriate action prior to drainage. Action taken by the coordinator will be noted in the record. If there is not a sheen, the valve will be fully opened or the pump started. The area will be checked periodically during the time it takes to drain. When empty, the valve will be immediately closed or the pump stopped. Appropriate record entries will be completed as shown on the example form of the next page.

LIQUID LEVEL SENSING DEVICES INSPECTION

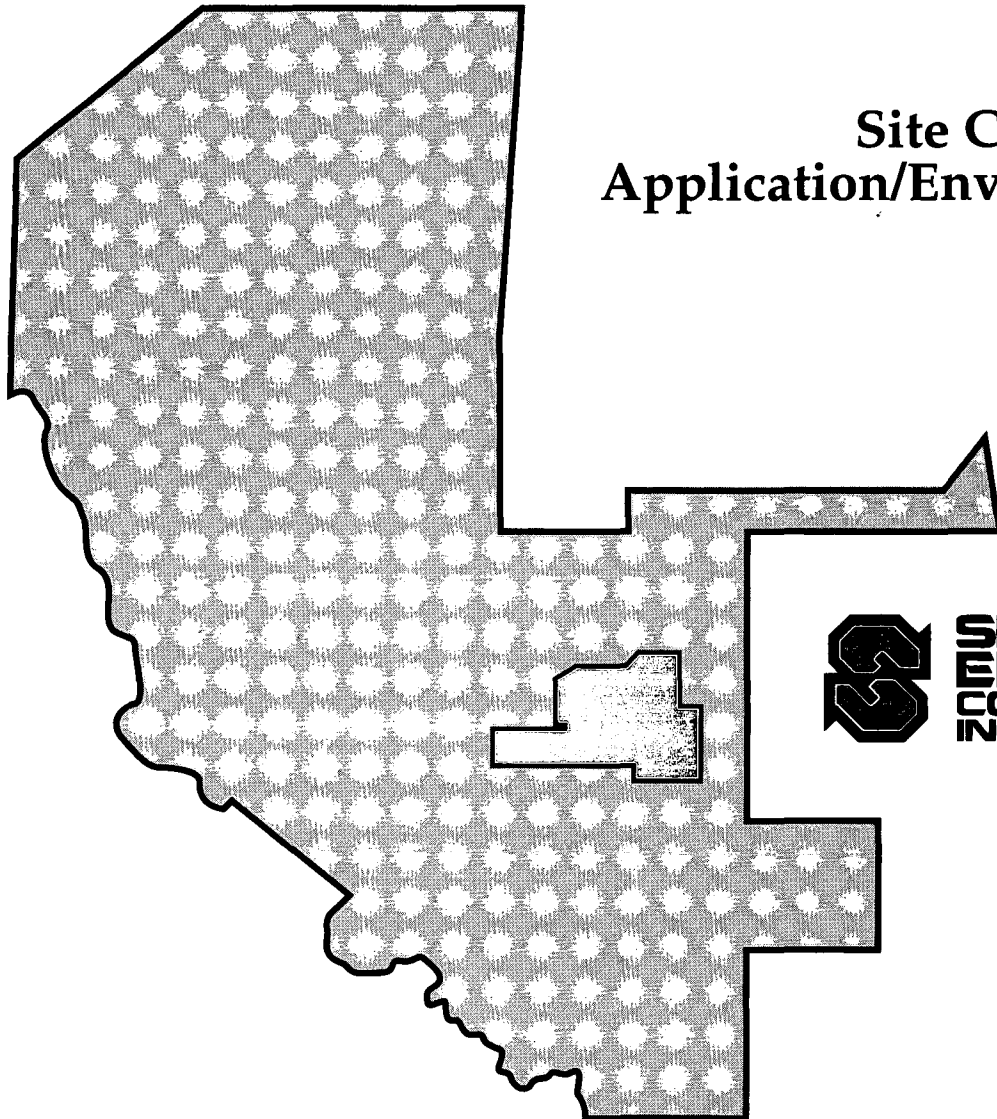
The following inspection log will be completed to document that any liquid level sensing devices utilized for measurements of oil in storage tanks are operable.

INSPECTION RECORD

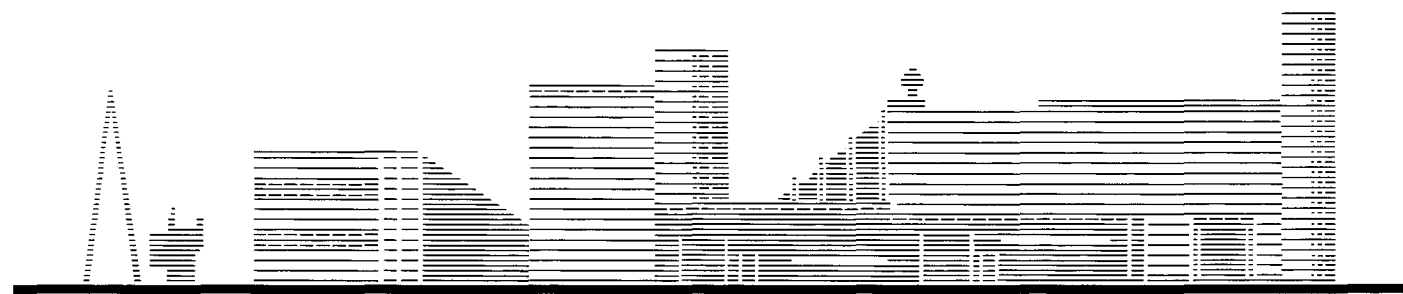
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HARDEE UNIT 3

Site Certification
Application/Environmental
Analysis



Appendix 10.2



APPENDIX 10.2
ZONING DESCRIPTIONS

APPENDIX 10.2.1

HARDEE COUNTY ZONING DESCRIPTION

I-1 LIGHT INDUSTRIAL

I. Purpose and Intent: The provisions of this district are intended to apply to an area located in close proximity to transportation facilities and which can serve general light manufacturing, storage, distribution and other general light industrial functions of the region. Restrictions herein are intended to minimize the adverse influence of these industrial areas and to eliminate unnecessary industrial traffic through non-industrial areas.

II. Principal Uses and Structures:

- (1) Warehousing and Wholesaling.
- (2) Light Industry.
- (3) Building Materials supply and storage.
- (4) Transportation terminals and freight handling facilities, except those facilities which are determined to be Developments of Regional Impact as defined by Section 380.06, Florida Statutes.
- (5) Public and semi-public utility plants and equipment storage, except those facilities which are determined to be Developments of Regional Impact, as defined by Section 380.06, Florida Statutes.
- (6) Industrial parks and office buildings, except those facilities which are determined to be Developments of Regional Impact as defined by Section 380.06, Florida Statutes.

III. Accessory Uses and Structures:

- (1) The sales of products manufactured, processed or stored upon the premises.
- (2) Except as otherwise provided therein, accessory uses and structures customarily incidental and subordinate to the permitted principal uses and structures which are clearly incidental and subordinate to the principal use and are in keeping with the industrial character of the district.

IV. Special Exceptions:

- (1) Storage of liquid petroleum products, combustible fuels, or other hazardous materials.
- (2) Any structure higher than forty (40) feet.

- (3) The relocation within the district of any structure.
- (4) All uses permitted in C-1 and C-2 zoning districts.
- (5) Mobile homes or other residential uses if related to the permitted use of property and used by the owner of the property or operation, or his employees for residential purposes.
- * (6) Wellfields and surface or ground water distribution system, except those used for agricultural purposes or private residential uses, or previously approved pursuant to a valid development of regional impact order issued by Hardee County prior to September 1, 1982.

V. Prohibited Uses and Structures:

- (1) Any use of structure being objectionable to the neighborhood or surrounding area or that would be noxious, injurious, or adversely affect the public health, safety, comfort, good order, appearance, morals, environment and the general welfare, is prohibited.

- (2) Prisons.

* Amended/added 11-16-82.

VI. DIMENSIONAL REQUIREMENTS (DISTRICT I-1)

USE AND MINIMUM LOT SIZE	MINIMUM AVERAGE LOT WIDTH	MINIMUM AVERAGE LOT DEPTH	MAXIMUM LOT COVERAGE	MINIMUM FLOOR AREA	MAXIMUM HEIGHT	MINIMUM BUILDING SETBACK			
						FRONT	SIDE INTERIOR	SIDE CORNER LOT	REAR
30,000 7,000-sq. ft. 10.2.1-3	70 ft.	100 ft.	-	-	-	50 ft.	None, except where a use dis- trict requiring such set- backs, such use will pro- vide the same set- backs as required for the abutting district. In addi- tion, additional setbacks may be required by the Board of Adjustment for reas- ons of public safety and welfare	10 ft.	15 ft.

VI. DIMENSIONAL REQUIREMENTS (DISTRICT I-1)

USE AND MINIMUM LOT SIZE	MINIMUM AVERAGE LOT WIDTH	MINIMUM AVERAGE LOT DEPTH	MAXIMUM LOT COVERAGE	MINIMUM FLOOR AREA	MAXIMUM HEIGHT	MINIMUM BUILDING SETBACK			
						FRONT	SIDE INTERIOR	SIDE CORNER LOT	REAR
10,000 sq. ft. 10.2.1-4	70 ft.	100 ft.	-	-	-	50 ft.	None, except where a use dis- trict requiring such set- backs, such use will pro- vide the same set- backs as required for the abutting district. In addi- tion, additional setbacks may be required by the Board of Adjustment for reas- ons of public safety and welfare	10 ft.	15 ft.

APPENDIX 10.2.2

POLK COUNTY ZONING DESCRIPTION

5.2C RURAL CONSERVATION (RC) DISTRICT:

The RC District is established to provide suitable areas for low density residential development in rural locations, to allow agricultural uses to be conducted in a rural environment, and to create open space and recreation areas.

1. Permitted Uses:

- a. Class III Agricultural Uses
- b. Parks and Open Space
- c. Nature Preserves and Wildlife Refuges
- d. Single Family Detached Dwellings - conventionally constructed buildings and mobile homes
- e. Foster Homes
- f. Home Occupations in accordance with Article III, Section 3.12
- g. Class I and II Essential Services
- h. Off-Premises Signs in accordance with the Polk County Sign Code
- i. Uses similar to or customarily accessory to the uses listed above

2. Conditional Uses - Non-Agricultural:

- a. Private clubs, fraternal organizations, and similar facilities
- b. Airports and Heliports
- c. Aircraft Hangars
- d. Cemeteries
- e. Group Care Homes - Levels I and II
- f. Day-Care Centers
- g. Boarding Kennels
- (h). Class III Essential Services, provided that all facilities are buffered from adjacent properties used for residential dwellings

3. Conditional Uses - Agricultural:

- a. Muck or Peat Removal
- b. Specialized forestry related facilities such as sawmills and mulching operations
- c. Specialized agricultural service establishments performing maintenance of grove equipment and farm machinery, fertilizer application, or grove installation and service
- d. Veterinary Services
- e. Agricultural bulk products collection, weighing, storage, and/or transfer facilities such as a citrus scalehouse
- f. Farm Employee Housing, provided the gross density requirements are met
- g. Other agriculture related uses similar to those listed previously which would not conflict with existing agricultural uses, are compatible, and are found necessary after consideration of alternative locations.

4. Issues - Conditional Agricultural Uses:

The following issues shall be considered by the Board in issuing permits for Conditional Agricultural Uses in addition to the requirements in Article VI, Section 6.4.

- a. Size of the proposed use and its relationship to its service area
- b. Conflicts or compatibility of the proposed use with existing land uses
- c. Need for the proposed use to be located in an agricultural area
- d. Availability of alternative, feasible locations for the proposed use
- e. Demand for additional public services created by allowing the proposed use and the ability of local government to provide these services without unreasonable burdens

- f. Effect of the proposed use on water, air, soil, and other natural resources
- g. Productivity of the land involved
- h. Other related considerations

5. Density and Lot Size Requirements:

- a. Gross density shall not exceed one (1) dwelling unit per acre.
- b. Minimum lot area shall be forty thousand (40,000) square feet for each dwelling unit exclusive of road right-of-ways.

6. Minimum Setbacks, Principal Structure:

- a. Front, exterior side, and exterior rear setbacks shall be determined by the distance from the road right-of-way (R/W) or road centerline (C/L), whichever results in the greater distance from the property line, based on the following table:

Highway/Road Classification	Minimum Setback Required	
	From R/W	From C/L
Arterial	65'	125'
Collector, Major	50'	90'
Collector, Minor	35'	65'
Local, 60' R/W	25'	55'
Local, 50' or Less R/W	25'	50'

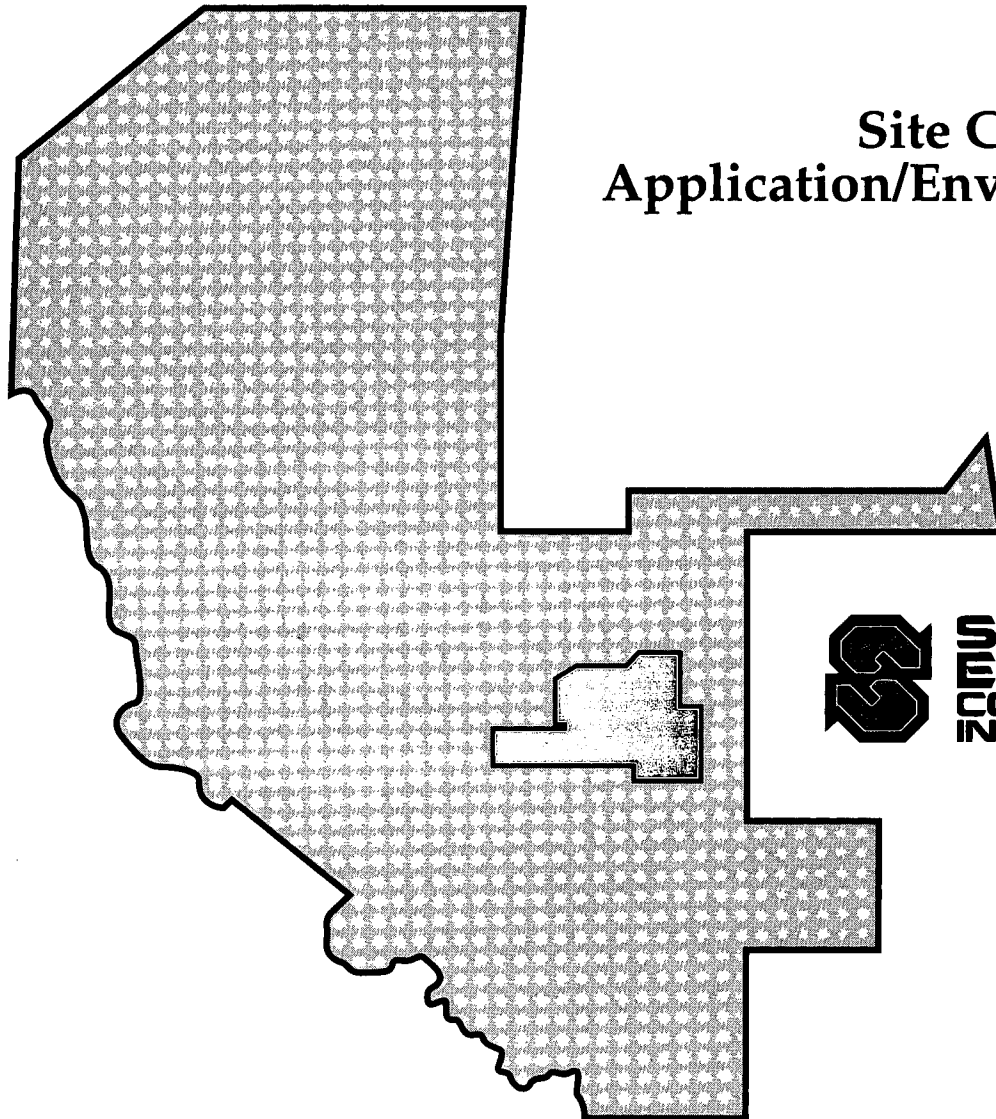
- b. Interior Side - Minimum of fifteen (15) feet
- c. Interior Rear - Minimum of forty (40) feet

7. Minimum Setbacks, Accessory Structure:

- a. No closer to an adjacent road than the principal structure
- b. Minimum of fifteen (15) feet from any side lot line, and a minimum of ten (10) feet from the rear lot line

HARDEE UNIT 3

Site Certification
Application/Environmental
Analysis



**SEMINOLE
ELECTRIC
COOPERATIVE
INCORPORATED**

Appendix 10.3



APPENDIX 10.3
LAND USE PLAN DESCRIPTIONS

APPENDIX 10.3.1

HARDEE COUNTY LAND USE DESCRIPTION

- c) Light industrial uses are permissible. Such uses shall not create strip or disorganized patterns of development, shall best utilize existing and planned transportation routes, shall adhere to programs of access management to regulate direct access to arterial or collector roadways, shall be located near existing industrial land uses or otherwise be compatible with surrounding land uses, shall be buffered as appropriate from adjacent land uses, shall not exceed a floor area ratio of 1.0, shall not exceed 90% impervious lot coverage, and shall not exceed 15% of the total area of a Rural Center.
- d) Existing agricultural land uses are permissible. The expansion of agricultural uses is permissible provided that such uses are compatible with and appropriately buffered from surrounding land uses. [9J-5.006(3)(c)(2,5,7)]

Policy L1.6:

The primary functions of Agricultural areas, as designated on the Future Land Use Map, shall be to protect and encourage agricultural activities, while providing for low density residential use, and to protect unique native habitats and maintain open space. [9J-5.006(3)(c)(7)]

- a) Residential development in an Agricultural area shall not exceed a maximum density of one dwelling unit per five gross acres.
- b) In an Agricultural area, the lowest order of commercial goods and services which serve the daily needs of nearby residents may be permitted only on arterial or collector roadways. Commercial areas in an Agricultural area shall be appropriately buffered, shall not exceed 3 acres in size, shall not exceed impervious surface lot coverage of 70 percent, and shall not be closer than 2 miles from other commercial development in an Agricultural area or in other future land use categories.
- c) Industrial uses within an Agricultural area may be permitted only when such activity is related to the extraction or processing of minerals; or when related to agriculture; or is of a scale and nature that would not be acceptable in a Town Center. Other industrial uses, such as power plants or manufacturing or processing facilities may be permitted, and shall have access to a collector or arterial roadway, shall meet all local regulations, and shall be appropriately buffered from surrounding land uses, including agricultural uses.
- d) Within an Agricultural area, the approval of residential development shall acknowledge that the protection of agricultural lands is a primary function of an Agricultural area, and that land management activities

associated with agricultural uses may be incompatible with residential development. However, such management activities are considered to be an essential element of the protection of successful operations on agricultural lands and the continuation of such activities shall take precedence.

e) The following planning controls shall guide development within Agricultural areas:

- Developments of 20 units or more shall retain a minimum of 80 percent of the project site as open space, and shall be clustered or otherwise developed as suitable for the site to protect agricultural areas, wetlands, native vegetative communities and wildlife habitats;
- Developments in excess of 4 units but less than 20 units shall retain a minimum of 50 percent of the project site as open space, and shall be clustered or otherwise developed as suitable for the site to protect agricultural areas, wetlands, native vegetative communities and wildlife habitats;
- Developments of 4 units or less are not required to retain open space except as otherwise required in this comprehensive plan or land development regulations;
- Developments in excess of 4 units shall be subject to access management guidelines regarding direct access and number of access points to collector or arterial roadways and, where appropriate, shall be buffered from the roadway;
- New development shall: provide buffering to prevent conflicts between agricultural and non-agricultural activities; protect natural resources; allow no ancillary uses detrimental to agriculture; require that post-development conditions for stormwater run-off equal pre-development conditions; and shall require the appropriate contribution from the developer to pay for off-site as well as on-site costs associated with the impacts of the development;
- Developments of 20 units or more are encouraged to provide commercial areas to support the residents of the development, subject to the criteria established for commercial development in Agricultural areas;
- Hardee County promotes the following guidelines for the conversion of lands in agricultural production to non-agricultural use: that the

proposed non-agricultural use is appropriately buffered from adjacent land uses, maintains the viability of continued agricultural uses on adjacent lands, contains suitable soils, is compatible with existing site-specific land characteristics, will have available the necessary public facilities and services concurrent with the impacts of anticipated development, and will avoid the extension of higher density land use categories that would create enclaves, pockets or finger areas.

Policy L1.7

The Recreation category is to recognize public or private lands utilized as recreation or open space, and accessible to the general public. The Intensity of development of recreation facilities shall not exceed 5% lot coverage. [9J-5.006(3)(c)(7)]

Policy L1.8

The Public/Institutional category is to accommodate existing land and facilities recognized as serving the public. This includes lands and facilities publicly owned, or owned by private or non-profit entities and intended for public, educational or institutional use. Impervious surfaces shall not exceed 85 percent of the site for new public buildings development. Schools shall be limited to not more than 65 percent impervious surface. When land surrounding a municipally owned public supply potable water well is designated as Public Buildings and Grounds, development shall be limited to facilities associated with the pumping or treatment of water only.

Policy L1.9:

Conservation category is to preserve and protect the unique natural resources of Hardee County, and to maintain public ownership of certain properties. A "Conservation" area is further defined as an area vital to the maintenance of environmental quality, least tolerant to changes caused by development, and vital to the ecological integrity of the region. Commercial and industrial development shall be prohibited in Conservation areas. Appropriate structures and facilities, including residential development at a density not to exceed 1 unit per 20 acres for park rangers, security and/or necessary maintenance personnel, are permissible, provided that they further the intent of a conservation area, and are necessary for the public appreciation of such areas. [9J-5.006(3)(c)(2,5,6,7)]

APPENDIX 10.3.2

POLK COUNTY LAND USE DESCRIPTION

POLICY 2.114-A3: PERMITTED ACTIVITIES -- The following activities shall be permitted within the Phosphate Mining land-use category as mapped pursuant to Policy 2.114-A2.

- a. Phosphate mining and allied industries;
- b. Land reclamation;
- c. Agriculture;
- d. Construction, operation and maintenance of Electric-Power Generation Facilities and ancillary uses and facilities that are required to be certified pursuant to Sections 403.501 - 403.518, FS (1990); hereinafter referred to as "Certified Electric-Power Generating Facilities";
- e. Construction, operation and maintenance of Electric-Power Generation Facilities and ancillary uses and facilities not required to be certified pursuant to Sections 403.501-403.518 (FL Stat. 1990); hereinafter referred to as "Non-certified Electric-Power Generating Facilities"; and
- f. Commercial hazardous-waste treatment facilities; and
- g. Other land uses with conditional approval which are compatible and related with the extraction and processing of phosphate.

SECTION 2.114-B PHOSPHATE MINING USES

POLICY 2.114-B1: DEVELOPMENT CRITERIA FOR PHOSPHATE MINING -- Development within these districts shall conform to the following criteria:

- a. Mining extraction activities and the construction, operation and maintenance of Electric-Power Generating Facilities shall be conducted in a manner that will minimize adverse effects upon water quality, fish and wildlife and adjacent land uses.
- b. All mining activities shall require approval through the County's development review procedures. This review will require the approval of a "Conceptual Mine Plan", which shall include, at a minimum:
 1. a "Mine-Area Map" to include, at a minimum, the locations of the mine boundaries, public rights-of-way, existing structures, and environmental features (e.g. topography, watersheds, and any endangered wildlife habitats);
 2. a "Mine-Area Layout" to include, at a minimum, planned locations for beneficiation operations, waste-storage areas, and any proposed permanent structures and/or roads;

3. a "Reclamation Plan" to include, at a minimum, all information required by applicable state regulations; and
 4. an "Operations Plan" to include, at a minimum:
 - (a) phasing plans,
 - (b) an Impact Mitigation Plan, and
 - (c) a Traffic Circulation Plan showing major access routes to the mine site.
- c. Once extraction activities are completed, the site shall be reclaimed (where reclamation is required by Chapter 16C-16, FAC) in accordance with the approved Reclamation Plan. Lands mined prior to reclamation requirements may be developed (reclaimed) without having to file a "reclamation plan".

POLICY 2.114-B2; ADJACENT DEVELOPMENT - New mining activities shall be setback and/or buffered from existing subdivisions a minimum of 250 feet, and 500 feet from a residential structure ("Polk County Phosphate Mining Ordinance" -- Ordinance 88-19), or as otherwise required by applicable law. New residential development on property adjacent to areas designated "PM" on the Future Land Use Map Series shall be required to provide appropriate buffering, if applicable.

SECTION 2.114-C CERTIFIED ELECTRIC-POWER GENERATION FACILITIES

POLICY 2.114-C1; LOCATION CRITERIA FOR CERTIFIED ELECTRIC-POWER GENERATION FACILITIES -- The construction, operation, and maintenance of Certified Electric-Power Generating facilities consistent with the requirements of the Polk County Comprehensive Plan and approved by the County via a conditional-use permit, shall occur within designated PM areas. The following factors shall be taken into consideration when determining the appropriateness of a location for a Certified Electric-Power Generating Facility within the Phosphate Mining area:

- a. The location of Certified Electric-Power Generating Facilities shall comply with all federal, state, and local laws, rules, and regulations pertaining to the siting, certification, permitting, and environmental requirements attendant thereto.
- b. The power block and fuel storage facilities that are part of an Certified Electric-Power Generating Facility shall be located:
 1. not less than one-quarter (1/4) mile from single-family residences,

2. one (1) mile from existing and developed residential communities consisting of not less than one hundred (100) single-family residences, and
 3. three (3) miles from the outer boundaries of incorporated municipalities existing at the time of the initial application for the conditional-use permit.
- c. Certified Electric-Power Generating Facilities shall be served by existing or new transportation systems comprised of collector or arterial roads of sufficient size so as to insure that no degradation to the level of service of the road network below the adopted standard will occur.
 - d. The power block and fuel-storage facilities that are part of a Certified Electric-Power Generating Facility shall not be located within 500 feet of the one-hundred year floodplain of the Peace river, the Alafia river or any "Outstanding Florida Waters" listed in Section 403.061(27) (a) and (b), FS (1990), as of the date of initial application for the conditional-use permit.
 - e. At least fifty percent (50%) of the entire site used for a Certified Electric-Power Generating Facility shall be comprised of lands previously disturbed by phosphate mining activities.

POLICY 2.114-C2: ENVIRONMENTAL CRITERIA -- Development of Certified Electric-Power Generating Facilities within Phosphate Mining Districts shall conform to the following environmental criteria:

- a. Environmentally sensitive areas shall be specifically detailed on the "Conceptual Electric-Power Generating Facility Site Plan" submitted as part of the conditional-use permit process.
- b. Certified Electric-Power Generating Facilities shall protect environmentally sensitive areas through buffering and/or other mitigating techniques imposed pursuant to Sections 403.501 - 403.518, FS.
- c. The location of all Certified Electric-Power Generating Facilities shall comply with all applicable environmental, federal, state, and local laws, rules, and regulations pertaining to the site, certification, permitting, and operation and maintenance requirements.

POLICY 2.114-C3: DEVELOPMENT APPROVAL CRITERIA -- The following development approval criteria shall apply:

- a. Polk County recognizes that the locational criteria are not exhaustive, therefore, Polk County shall require proposed Certified Electric-Power Generating Facilities to obtain approval as a Conditional Use Permit, or its functional equivalent, prior to the commencement of construction of the facility which approval shall demonstrate compliance

with all applicable County ordinances and these policies. Additional review criteria shall include, but not be limited to, the following:

1. that the delivery, and storage of the fuel source will not threaten the safety or health of residents;
 2. that height, bulk, and noise factors associated with the facility are compatible with other land uses in the area.
- b. Notwithstanding the Condition Use Permitting process, Polk County shall, at its sole discretion, remain a party to the Electrical Power-Plant Siting Act certification process.

POLICY 2.114-C4: ADJACENT DEVELOPMENT -- Certified Electric-Power Generating Facilities shall be set back and/or buffered from existing adjacent residential areas. Subsequent residential development on property designated as "PM" on the Land Use Map Series shall be required to provide appropriate buffering, if applicable.

SECTION 2.114-D: HAZARDOUS-WASTE TREATMENT FACILITIES

OBJECTIVE 2.114-D: In an effort to reduce illegal disposal of hazardous wastes in Polk County and to induce an improvement in the County's overall management of hazardous wastes, Polk County will carefully balance the need for commercial facilities to treat hazardous wastes regulated by the Resource Conservation and Recovery Act (RCRA) against the need to protect the health, safety and welfare of the citizens and the environment of the County by applying the following siting criteria policies when considering applications to construct Commercial Hazardous-Waste Treatment Facilities (Facilities) in the County.

POLICY 2.114-D1: Disposal facilities, as defined by RCRA, shall be prohibited, and facilities which generate and/or store RCRA regulated wastes shall be subject to industrial/commercial requirements, as regulated by Section 2.310 of this Plan.

POLICY 2.114-D2: Polk County shall require a minimum parcel size of at least 200% of the size of the development envelope to permit setbacks, to avoid floodprone areas, and to allow proper stormwater management, building separation, internal buffers, and ingress/egress design.

POLICY 2.114-D3: Polk County shall prohibit the siting, development, and/or expansion of Facilities:

- a. which have a development envelope within 1,000 feet of surface waters of the State of Florida;
- b. located within 2,500 feet of an Outstanding Florida Water; Class I Waters of the State; lands acquired under the Save Our Rivers/Save Our Lakes, Conservation and Recreation, and

REVISED PHOSPHATE MINING POLICIES: Amend the following Sections and Policies as follows:

SECTION 2.114 PHOSPHATE MINING

POLICY 2.114-A3: PERMITTED ACTIVITIES -- The following activities shall be permitted within the Phosphate Mining land-use category as mapped pursuant to Policy 2.114-A2:

- a. Phosphate mining and allied industries;
- b. Land reclamation;
- c. Agriculture;
- ~~d. Construction, operation and maintenance of Electric Power Generation Facilities and ancillary uses and facilities that are required to be certified pursuant to Sections 403.501-403.518, FS (1990), hereinafter referred to as "Certified Electric Power Generating Facilities",~~
- ~~e. Construction, operation and maintenance of Electric Power Generation Facilities and ancillary uses and facilities not required to be certified pursuant to Sections 403.501-403.518 (FL Stat. 1990), hereinafter referred to as "Non-certified Electric Power Generating Facilities", and~~
- ~~f. Commercial hazardous waste treatment facilities, and~~
- d. Other land uses with conditional approval which are compatible and ~~or~~ related with the extraction and processing of phosphate, ~~and~~

~~e. Subject to the adoption of a Comprehensive Plan amendment, any activities permitted within the following land use designations, which are appropriate for the redevelopment of lands formally utilized for phosphate mining operations and which demonstrate compliance with the Comprehensive Plan criteria for each use:~~

- ~~1. Preservation~~
- ~~2. Recreation and Open Space~~
- ~~3. Leisure/Recreation~~
- ~~4. Institutional~~
- ~~5. Rural Cluster Centers~~
- ~~6. Tourism-Commercial Centers~~
- ~~7. Business Park Centers~~
- ~~8. Industrial~~
- ~~9. Rural Mixed-Use Developments~~
- ~~10. New Communities~~

~~POLICY 2.114-A4: FUTURE DEVELOPMENT OF PM LANDS -- Polk County shall promote the redevelopment of PM lands by encouraging master-planned developments incorporating land uses permitted within Rural Development Areas which are supported by appropriate data and analysis and demonstrating consistency with the goals, objectives, and policies of the Plan, including, county-wide land use needs, compatibility with adjacent uses, and protection of existing natural resources.~~

SECTION 2.114-B PHOSPHATE MINING USES

POLICY 2.114-B1: DEVELOPMENT CRITERIA FOR PHOSPHATE MINING -- Development within these districts shall conform to the following criteria:

- a. ~~Any activities within lands designated as PM Mining extraction activities and the construction, operation and maintenance of Electric Power Generating Facilities shall be conducted in a manner that will minimize adverse effects upon water quality, fish and wildlife and adjacent land uses.~~

~~SECTION 2.114 C CERTIFIED ELECTRIC POWER GENERATION FACILITIES~~

~~SECTION 2.114 D. HAZARDOUS WASTE TREATMENT FACILITIES~~

NOTE: SECTIONS 2.114-C AND D to be deleted from the Phosphate Mining Section of the Plan and moved to the Special Use Section of the Plan as shown below.

SECTION 2.125 SPECIALIZED USES

POLICY 2.125-A1: IDENTIFICATION OF SPECIALIZED USES -- The Polk County Plan hereby identifies the following specialized uses, which are to be developed in accordance with the additional development criteria or standards specific to the use:

- a. isolated convenience stores;
- b. transitional areas;
- c. utilities;
- d. community facilities;
- e. special residential uses (greater than 15 DU/AC);
- f. non-phosphate mining;
- g. residentially based mixed-use developments; and
- h. non-certified electric-power generating facilities;
- ~~i. certified electric power generation facilities; and~~
- ~~j. hazardous waste treatment facilities.~~

POLICY 2.125-A2: PERMITTED LAND-USE CATEGORIES FOR SPECIALIZED USES
The land-use classifications within which the identified specialized uses shall be permitted, subject to the approval of Polk County, are:

SPECIALIZED USE	AUTHORIZED LAND-USE LOCATION*
Isolated Convenience Stores	All Residential
Transitional Areas	All**
Utilities	All
Community Facilities	All**
Special Residential	CACs and RACs
Non-Phosphate Mining	All (with qualifications)
Residentially Based Mixed-Use Developments	All Residential except A/RR
Non-Certified Electric-Power Generation Facilities	All non-residential (with qualifications)
Certified Electric-Power Generation Facilities	PM
Hazardous-Waste-Treatment Facilities	PM

Approved sites for these stated uses shall not be specifically designated nor mapped on the Future Land Use Map Series.

* All included SAPs, unless specifically excluded by the SAP

** All land uses, except Preservation Areas

~~SECTION 2.125-J CERTIFIED ELECTRIC-POWER GENERATION FACILITIES~~

~~SECTION 2.125-K HAZARDOUS-WASTE TREATMENT FACILITIES~~

NOTE: These Sections, deleted from the Phosphate Mining Section, are added here in their entirety and renumbered as SECTIONS 2.125-J AND K

POLICY 2.127-A5: FUTURE SELECTED-AREA STUDIES -- The Planning Division shall conduct, with public input from those areas affected, the following non-prioritized Selected-Area Studies:

- a. I-4 corridor;
- b. US 17 corridor from Winter Haven to Bartow;
- c. US 27 corridor from Haines City to Lake County line;
- d. US 92 corridor from Lakeland to Auburndale;
- e. US 98 corridor from Lakeland to Pasco County Line;
- f. US 98 corridor from Lakeland to Bartow.

- g. SR 37 corridor from Lakeland to Mulberry;
 - h. SR 60 corridor from Bartow to Lake Wales;
 - i. the proposed Polk County (Imperial) Parkway corridor;
 - j. County Line Road (west)
 - k. all Urban-Growth Areas (UGAs)
- l. potential area(s) suitable for designation as "Green-Way Districts" in accordance with the Policy 2.121-F2 (Green-Way Districts Designation and Mapping) to include investigating the possibility of creating a linear parkway which may connect various existing and potential state and local open spaces, recreation areas, rails-to-trails facilities, and waterbodies; and
 - m. "Bok Tower Gardens View-Shed SAS" for the three major vistas viewed from Bok Tower Gardens for the purpose of determining the potential and merits of the County adopting an overlay district for the purpose of adopting special development regulations for any, or all, of the three major view sheds, at a time when the expense-sharing policy established in Policy 2.127-A2 is met. and

~~n. those areas designated as "Phosphate Mining" on the Future Land Use Map Series.~~

SECTION 2.108 RURAL-DEVELOPMENT AREAS (RDA)

OBJECTIVE 2.108-A: The Polk County Plan shall provide areas for rural activities such as agricultural uses, mining activities, and rural residential uses, and for areas to be available for future long-range urban-expansion activities through:

- a. the designation and mapping of Rural-Development Areas (RDAs), and
- b. the establishment of policies to govern the development of land within RDAs.

POLICY 2.108-A1: DESCRIPTION -- Rural-Development Areas (RDA) shall be all unincorporated areas within the County that are not located within an Urban-Development Area, Urban-Growth Area, Suburban-Development Area, or Utility-Enclave Area.

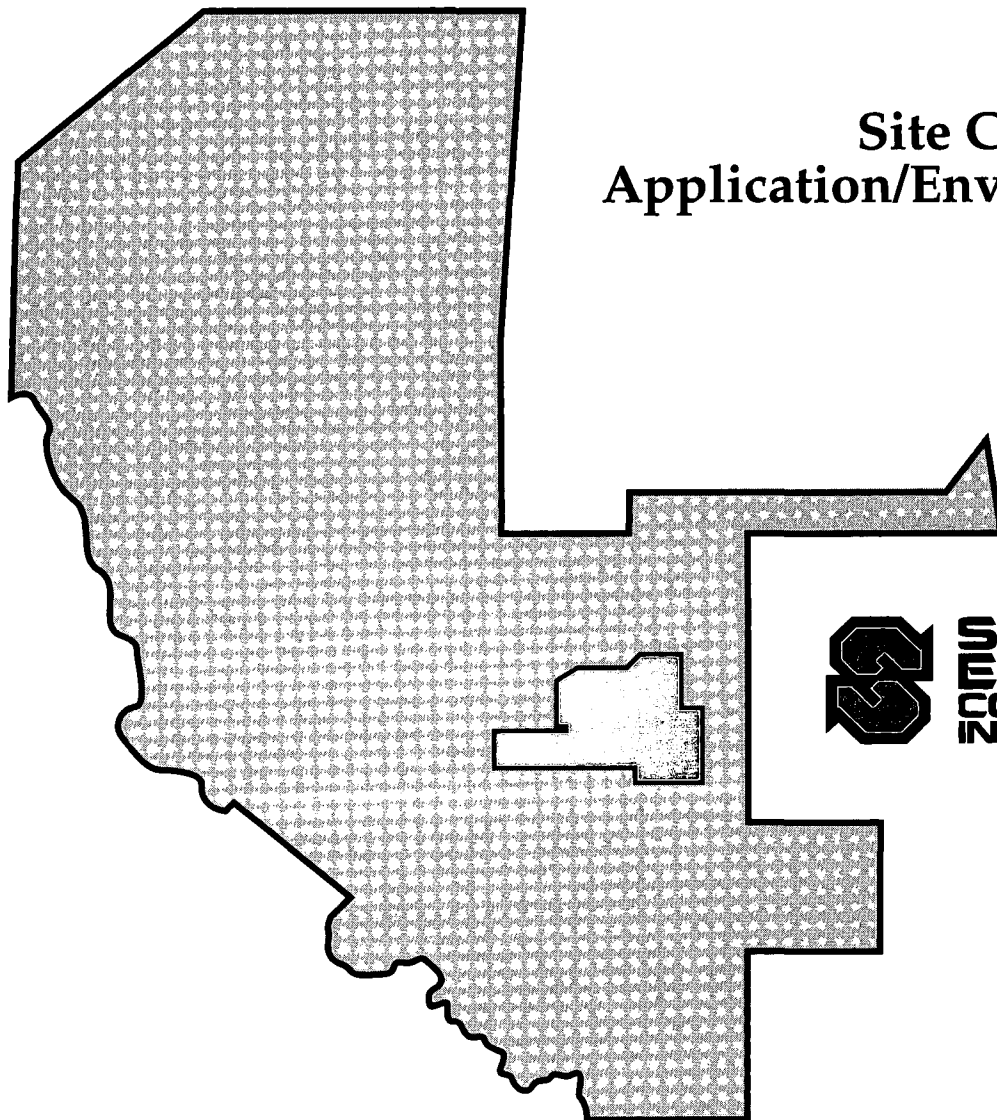
POLICY 2.108-A2: DESIGNATION AND MAPPING -- The Future Land Use Map Series shall designate and map Rural-Development Area base areas for those areas of the County meeting the general characteristics of this Section.

POLICY 2.108-A3: LAND-USE CATEGORIES -- The following land-use categories shall be permitted within Rural-Development Areas:

- a. ACTIVITY CENTERS: Rural-Cluster Centers, ~~Tourism Commercial Centers,~~ and Agri-related Business-Park Centers shall be permitted within RDAs in accordance with applicable criteria.

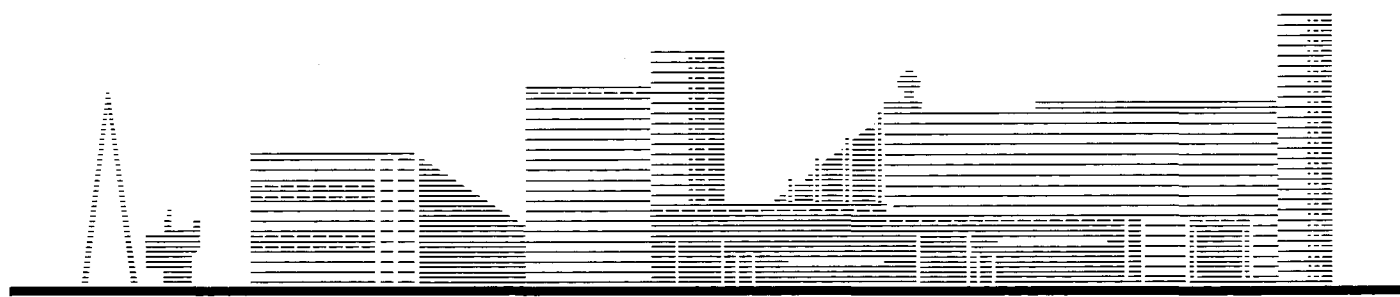
HARDEE UNIT 3

Site Certification
Application/Environmental
Analysis



**SEMINOLE
ELECTRIC
COOPERATIVE
INCORPORATED**

Appendix 10.4



APPENDIX 10.4
EXISTING STATE PERMITS

Existing state permits include the various authorizations contained in the Final Hardee Power Station Certification Order 89-25 (Appendix 10.4.1) and the Final Land Use Order (Appendix 10.4.2).

APPENDIX 10.4.1

**FINAL CERTIFICATION ORDER PA89-25
FOR HARDEE POWER STATION**

BEFORE THE GOVERNOR AND CABINET
OF THE STATE OF FLORIDA

RECEIVED
NOV 22 1990

IN RE: HARDEE POWER STATION)
POWER PLANT SITE CERTIFICATION)
APPLICATION, TECO POWER SERVICES,)
TAMPA ELECTRIC COMPANY, AND)
SEMINOLE ELECTRIC COOPERATIVE, INC.)
PA 89-25)

Hopping, Boyd, Green & Sams

DOAH CASE NO. 89-3560
OGC FILE NO. 89-0703

FINAL ORDER

BY THE GOVERNOR AND CABINET

On November 27, 1990, this matter came before the Governor and Cabinet, sitting as the siting Board pursuant to the Florida Electrical Power Plant Siting Act, Section 403.501 et seq., Florida Statutes (1989), for final action concerning a Recommended Order dated October 15, 1990, attached as Exhibit A, which recommends certification of the Hardee Power Station. On November 8, 1990,¹ Intervenor Katzen and Slack filed exceptions to the Recommended Order, attached as Exhibit B. On November 16, 1990, Co-Applicants TECO Power Services Corporation (TPS), Tampa Electric Company (TECO) and Seminole Electric Cooperative, Inc. (SECI) filed a Response to those exceptions.

Intervenor's Exceptions 1-4 contest to findings of fact set forth in the Recommended Order. Section 120.57(1)(b)10., Florida Statutes, limits an agency's authority to reject or modify findings of fact to the situation when, based upon

¹Intervenor's exceptions were filed late with the consent of the Co-applicants.

review of the entire record, it can be concluded that such findings "were not based upon substantial competent evidence or the proceedings upon which the findings were based did not comport with the essential requirements of law." Heifetz v. Department of Business Regulation, 475 So.2d 1277 (Fla. 1st DCA 1985) Upon review of the record, it is clear in this case that the findings of fact contested by the Intervenor's Exceptions are supported by competent substantial evidence. Therefore, Intervenor's Exceptions Nos. 1-4 are denied.

Intervenor's exception No. 5 objects to several conclusions of law contained in the Recommended Order. For the Board to adopt the Intervenor's suggested conclusions of law, as proposed in paragraphs A through G under Exception No. 5, the Board would be required to disregard numerous findings of fact contained in the Recommended Order. As already noted, there is no basis for rejecting any findings of fact. It is settled that the Board may not reject well-supported findings of fact by treating them as conclusions of law. Leapley v. Board of Regents, 423 So.2d 431 (Fla. 1st DCA 1982)

The Intervenor's contention that the procedure for alternate corridor consideration established in Section 403.527(5), Florida Statutes, pursuant to the Transmission Line Siting Act should be made available in this Power Plant Siting Act proceeding is rejected. The intention of the Florida Legislature is specifically articulated in each act. Had the

Legislature intended the same procedure to apply, it would have so stated. No provision was made for alternate corridor consideration under the Power Plant Siting Act.

The Intervenor's "denial of due process" claims are rejected as without legal foundation and contrary to the facts of this case, which demonstrate that the Co-Applicants have met or exceeded all statutory notice requirements. Moreover, Intervenor's were given full opportunity to be heard. Intervenor's have no entitlement to any process beyond that specified in the Act. Peoples State Bank of Indian River County v. State, Department of Banking and Finance, 395 So.2d 52 (Fla. 1980) Consequently, Intervenor's Exception No. 5 is rejected.

Pursuant to Sections 403.501-403.517, Florida Statutes (1989), having reviewed the Recommended Order, the Exceptions to Recommended Order, the Responses to the Exceptions, argument of counsel, and otherwise being fully advised herein, it is

ORDERED:

1. The Exceptions to the Recommended Order are rejected.
2. The Recommended Order (dated October 15, 1990) prepared by the Hearing Officer pursuant to Section 403.508(3), F.S., concerning the certification of the proposed Hardee Power Station is adopted in toto.
3. The Siting Board finds that the proposed Hardee Power Station should be certified subject to the conditions of certification included in the Recommended Order and attached hereto.

4. Pursuant to Section 403.509(3), F.S., this Final Order shall constitute approval for the granting of any necessary easements by the Game and Fresh Water Fish Commission over lands within the Cecil M. Webb Wildlife Management Area, in accordance with the Conditions of Certification.

Any party to this Order has the right to seek judicial review of the order pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of Siting Board, the Department of Environmental Regulation in the Office of General Counsel, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within thirty (30) days from the date this Order is filed with the clerk of the Siting Board.

DONE and ENTERED this 27th day of November, 1990, in Tallahassee, Florida pursuant to the vote of the Governor and Cabinet, sitting as the Siting Board, at a duly constituted Cabinet meeting November 27, 1990.

FILING AND ACKNOWLEDGEMENT
FILED, on this date, pursuant to §120.52
Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Neddy C. Carter 11-27-90
Clerk Date

BY THE GOVERNOR AND CABINET
SITTING AS THE SITING BOARD

Bob Martinez
THE HONORABLE BOB MARTINEZ
GOVERNOR

STATE OF FLORIDA
DIVISION OF ADMINISTRATIVE HEARINGS

IN RE: HARDEE POWER STATION,	)	
POWER PLANT SITE CERTIFICATION	)	
APPLICATION, TECO POWER SERVICES,	)	CASE NO. 89-3560
TAMPA ELECTRIC COMPANY, AND	)	
SEMINOLE ELECTRIC COOPERATIVE, INC.)	)	
PA 89-25	)	

RECOMMENDED ORDER

The final hearing in this case was held on August 13 through 15, 1990, in Wauchula, Florida, before Donald D. Conn, Hearing Officer, Division of Administrative Hearings. Appearances entered in this proceeding on behalf of all parties are included in Appendix A to this Recommended Order.

STATEMENT OF THE ISSUE

The issue in this case is whether the Hardee Power Station and its associated facilities, including the corridors for the directly associated transmission lines and the natural gas pipeline, should receive certification.

PRELIMINARY STATEMENT

On June 30, 1989, Co-Applicants filed their application for power plant site certification for the construction and operation of a combined cycle power station known as the Hardee Power Station, including directly associated electrical transmission lines, a natural gas pipeline, and other directly associated facilities. The Co-Applicants are TECO Power Services Corporation, Tampa Electric Company, and Seminole Electric

EXHIBIT A

Cooperative, Inc. (SECI). The Florida Electrical Power Plant Siting Act requires both a land use hearing and a certification hearing.

The land use hearing was held on March 6, 1990, in Wauchula, Florida, and on May 3, 1990, in Bartow, Florida. On June 6, 1990, the Hearing Officer entered a Recommended Order recommending that the Governor and Cabinet, sitting as the Siting Board, enter a Final Order finding that the sites of the Hardee Power Station electric generating facilities and cooling reservoir, associated natural gas pipeline, and directly associated transmission lines, as proposed in the site certification application, are consistent and in compliance with existing land use plans and zoning ordinances. On August 14, 1990, the Siting Board adopted the Hearing Officer's Recommended Order in toto, and later amended its order on August 23, 1990 to provide notice of the availability of judicial review.

At the certification hearing, Co-Applicants called as witnesses Gregory M. Nelson, Consulting Engineer in the Environmental Planning Department at Tampa Electric Company, Michael Opalinski, Manager of Environmental Affairs at SECI, Charles R. Black, Director of Engineering and Construction for TECO Power Services Corporation, Charles J. Schutty, accepted as an expert in the field of power plant engineering, Thomas J. Leto, accepted as an expert in geotechnical investigation, Kenneth L. Bachor, Manager of Transmission and Substation Services at SECI who was accepted as an expert in the field of transmission line engineering, Frederick M. Dietrich, accepted as

an expert in electrical engineering with expertise in electromagnetic field and corona effects of transmission lines, John K. Day, Jr., accepted as an expert in construction engineering, specifically relating to power plant site construction impacts, Lawrence J. Almaleh, accepted as an expert in geotechnical investigation, Raymond Williams, accepted as an expert in archeological and historical site analysis, Thomas F. Barnett, accepted as an expert in surface water management systems design, Frederick V. Ramsey, accepted as an expert in the field of civil engineering, surface water and ground water hydrology and water quality analysis, Robert C. McCann, Jr., accepted as an expert in air quality impact analysis, Kennard F. Kosky, accepted as an expert in the field of best available control technology analysis, Linda Conway Duever, accepted as an expert in ecology and wetland impacts, James R. Newman, accepted as an expert in the field of wildlife ecology and wildlife biology, Analee Moore, accepted as an expert in land use planning and socioeconomic impacts, John M. Bowers, accepted as an expert in landscape architecture and design, and Kenneth Milam, accepted as an expert in natural gas pipeline construction and operation. Co-Applicants offered on hundred thirty four (134) exhibits which were received into evidence.

The Central Florida Regional Planning Council called Brian Sodt, Director of Review Coordination for the Council. The Department of Environmental Regulation (DER) called Hamilton S. Oven, Jr., Administrator of DER's Office of Siting Coordination, accepted as an expert in environmental engineering. DER offered no exhibits.

The Florida Game and Fresh Water Fish Commission (FGFWFC) called Douglas B. Bailey, Assistant of Director of FGFWFC, Office of Environmental Services, accepted as an expert in wildlife biology with specific expertise in wildlife impact assessments, and Larry Campbell, a wildlife biologist with FGFWFC's Division of Wildlife, Bureau of Land Management, accepted as an expert in wildlife management in the Cecil M. Webb Wildlife Management Area (hereinafter Webb Area). FGFWFC introduced three (3) exhibits.

Intervenors James Slack and M. J. Katzen, Jr. called as witnesses Charles L. Kocur, Jr., accepted as an expert in the field of biology with specialties in natural resource identification and evaluation, wetlands, assessment of wetlands impacts, identification of wildlife, and assessment of impacts on wildlife including endangered species, Vernon Peeples, Jr. and Andrew J. Dodd. Intervenors introduced eleven (11) exhibits.

The remaining parties in this proceeding did not offer evidence at the certification hearing.

The following members of the public testified at the public hearing held at 6:00 p.m. on August 14, 1990: Randy Dunn, Melvin Katzen, Anna Lou Carlton, Wilbur E. Dees, Tim Steorts, Thomas J. Crawford, Kenneth Crawford, Douglas Mercer, Spencer Zielstorff, and Parker Keen. Two public exhibits were received by the Hearing Officer as part of the record in the certification hearing.

The transcript of the final hearing was filed on September 12, 1990, and the parties were allowed to file proposed

recommended orders by September 27, 1990. A ruling on each timely filed proposed finding of fact is included in Appendix B to this Recommended Order.

On September 19, 1990, Co-Applicants filed a Motion to Substitute Revisions to Hardee Power Station Composite Exhibit 3A, requesting a correction to Condition of Certification III.A.13 to include the parameter zinc in the surface water discharge mixing zone, and to correct an error in the placement of the decimal point for the limitation on discharges containing the parameter silver. The Motion was unopposed by any party, and after consideration, it is hereby granted. The Conditions of Certification contained in Appendix C reflect the corrections resulting from this Motion.

FINDINGS OF FACT

A. Procedural Matters

Alternate Corridors

1. On June 8, 1990, Intervenors James Slack and Melvin J. Katzen, property owners within and adjacent to the proposed Lee transmission line corridor in Charlotte County, filed a Notice of Proposed Alternate Corridor relating to the southern portion of one of the Co-Applicants' proposed directly associated transmission lines. The Co-Applicants and DER thereafter filed respective Motions to Strike Intervenors' Notice of Proposed Alternate Corridor on grounds that the procedure invoked by the Intervenors is not available under the Florida Electrical Power Plant Siting Act (PPSA). On June 27, 1990, the Hearing Officer

granted the motions to strike on grounds that the statutory basis relied upon by Intervenor, Section 403.527(5)(a), Florida Statutes (the Transmission Line Siting Act), is not applicable to the current proceeding, which is governed by the PPSA, found at Sections 403.501 through 403.517, Florida Statutes. On July 10, 1990, the Hearing Officer denied Intervenor's motion for rehearing on this issue. At the certification hearing, after considering further oral argument on the admissibility of evidence relating to Intervenor's proposed alternate corridor, the Hearing Officer reiterated that the issue in the present case is certification of the site, including transmission line corridors, proposed by Co-Applicants. Consequently, the Hearing Officer held that proposed evidence concerning the viability of a specific corridor that has not been proposed by the Co-Applicants is irrelevant. The Intervenor was permitted to proffer statements relating to a specific, alternative corridor at the conclusion of the certification hearing.

Stipulations

2. Co-Applicants entered into the following stipulations with state and local agencies as well as county and municipal governments, all of whom are parties to this proceeding, concerning the proposed project's compliance with the respective regulations of these governmental entities. The stipulations speak for themselves, and have been filed in this matter. In summary,

a. Stipulations have been executed stating that the Hardee Power Station and associated facilities, subject to the

proposed Conditions of Certification which are attached hereto as Appendix C, are consistent and in compliance with all applicable, nonprocedural standards of Hardee County, DeSoto County, Charlotte County, Lee County, and the City of Cape Coral. These stipulations resolve issues relating to local government transmission line crossing and access road approvals.

b. A stipulation was entered into between SECI, Agrico Chemical Company and the Florida Department of Natural Resources (DNR) in which DNR concluded that the Co-Applicants' proposal to construct a cooling reservoir on land subject to DNR's phosphate mining reclamation programs (and currently owned by Agrico), will comply with applicable DNR rules contained in Chapter 16C-16, F.A.C., provided that certain conditions are met including construction standards and creation of wetland and upland habitats.

c. Three agreements have also been entered into between the Co-Applicants and FGFWFC, resolving issues relating to threatened and endangered species, the location of the transmission line corridors as it borders the Webb Area, and the location of the transmission line as it crosses the Peace River in DeSoto County.

d. A stipulation has been entered into with the Board of Trustees of the Internal Improvement Trust Fund resolving issues relating to the crossing of sovereignty submerged lands. This stipulation recommends issuance of an easement for the proposed transmission line crossing of the Peace River, provided that no transmission line structures are located on state lands in that area.

e. The South Florida and the Southwest Florida Water Management Districts entered into stipulations with the Co-Applicants concluding that construction, operation, and maintenance of the Hardee Power Station project, subject to the proposed Conditions of Certification, will comply with all applicable nonprocedural standards of the water management districts.

f. Although DER did not enter into a formal stipulation, it did, at the certification hearing, endorse the proposed Conditions of Certification and confirm that the Co-Applicants have provided reasonable assurances of compliance with DER rules.

g. Co-Applicants will comply with all stipulated conditions relating to the location, construction, operation and maintenance of the facility, should it be certified.

Notices

3. DER published sufficient notices of the August 13 through 15, 1990 certification hearing in the Florida Administrative Weekly and newspapers of general circulation within the counties where the proposed power plant site, including the proposed electric transmission line corridors and natural gas pipeline corridor, is proposed to be located. Prior to this published notice, the Co-Applicants in 1988 and 1989 published notices in newspapers within the affected areas of public meetings to obtain input on possible transmission line corridors, PSC need determination hearings, and REA scoping meetings.

PSC Need Determination

4. The determination of need for the Hardee Power Station project was made by the Florida Public Service Commission (PSC) in Order No. 22335 issued on December 22, 1989. This order establishes the need for 295 megawatts of capacity in 1993 which is to be satisfied by the construction by TECO Power Services of one 220 megawatt combined cycle unit and one 75 megawatt combustion turbine unit. The PSC further found that the need for an additional 145 megawatts of capacity in 2003 would be satisfied by the construction by TECO Power Services of one 75 megawatt heat recovery unit and one 75 megawatt combustion turbine unit, all at the Hardee Power Station site. The PSC also addressed the three transmission lines and the natural gas pipeline associated with the Hardee Power Station site.

5. In its Order, the PSC found that this proposal, which is the subject of the site certification application at issue in this case, meets the stated need within the time frame required in the most cost effective manner, and provides adequate electricity at a reasonable cost. The PSC determination of need has been filed in this matter.

B. Project Description

6. Co-Applicants propose to construct and operate a combined cycle power plant, and associated electrical transmission lines and natural gas pipeline facilities, known as the Hardee Power Station. The site for the proposed Hardee Power Station electrical generating plant is a 1300-acre site located at the Polk County and Hardee County lines, between Payne Creek

and County Road 663. The electrical generating plant will include a 570-acre cooling reservoir to cool the steam from the heat recovery steam generator system so that the water can be reused in the system. The plant site will also have associated fuel oil storage and handling facilities, water treatment facilities, control building, warehouse, and administrative building.

7. Power generated from the Hardee Power Station will be distributed to the Pebbledale, Vandolah, and Lee County substations via three directly associated 230 kV transmission lines. The Hardee Power Station to Pebbledale substation transmission line (Pebbledale transmission line) heads north from the plant site and extends approximately 16 miles to the substation. The other two transmission lines proceed south from the Hardee Power Station: the Vandolah transmission line terminates eight miles south at the Vandolah substation in Hardee County, and the Lee transmission line terminates farther south at the Lee County substation in Lee County. An 18-inch underground natural gas pipeline, connected to Florida Gas Transmission's system near Polk City, will supply the primary fuel to the Hardee Power Station.

8. The Hardee Power Station project will consist of combined cycle generating facilities with an ultimate nominal capacity of 660 megawatts to be constructed in two phases. In Phase 1-A of the project, one nominal 220 megawatt combined cycle unit will be built along with one nominal 75 megawatt combustion turbine, resulting in a total of nominal 295 megawatts, to begin

commercial operation in January of 1993. In Phase 1-B of the project, an additional nominal 75 megawatt combustion turbine and a nominal 70 megawatt heat recovery steam generator system will be added to the existing nominal 75 megawatt combustion turbine to complete the second nominal 220 megawatt combined cycle unit, the capacity of which is scheduled to be on line in January of 2003. Phase 2 of the project consists of the addition of a third nominal 220 megawatt combined cycle unit at an unspecified future date.

9. The primary components of the 220 megawatt combined cycle facilities consist of combustion turbine units that exhaust hot gasses to heat recovery steam generators (HRSGs). The HRSGs are boilers that produce high temperature and pressure steam, which is directed to the steam turbine, which in turn uses the steam to turn a generator to produce power. The hot exhaust gasses exit the combustion turbine through either a 75-foot combustion turbine stack or through the 90-foot HRSG exhaust stack, and are dispersed into the atmosphere. The steam, after it is expanded through the steam turbine, is condensed through the use of circulating water in the condenser and pumped back to the HRSG. The circulating water is generated from, and returns to the cooling water reservoir. The sources of water to the reservoir include rainfall, runoff into the reservoir, treated wastewater discharge, and groundwater pumped from the lower Floridan Aquifer. Combined cycle plants are considerably more efficient in water use than alternatives such as coal-fired power plants.

10. The proposed location for the Hardee Power Station plant site is in a remote area where most of the land currently is being mined or has been mined for phosphate. The western boundary of the site coincides with the Payne Creek flood plain. The cooling reservoir will be located at the northwest portion of the site, in an area that is currently being mined. The site is located adjacent to an existing rail line and existing highway system installed to support the phosphate industry. The proposed location contains an abundant supply of groundwater necessary for the operation of the cooling reservoir associated with the plant.

11. Black and Veatch will perform the engineering function at the facility and Metric Constructors will be responsible for construction of the plant. Co-Applicant TECO Power Services will be responsible for project management at the Hardee Power Station, and plans to incorporate security measures at the site including staffing the facility on a seven-day week, 24-hour-a-day basis, and providing security personnel at the site. Co-Applicants expect the full-time staff for plant operations to consist of between 27 and 35 employees, most of whom will be drawn from surrounding counties. The employees will undergo an in-depth power plant training program sponsored in conjunction with General Electric Corporation, the turnkey supplier of the Hardee Power Station plant facility.

C. Description of Electrical Transmission Lines
and Natural Gas Pipeline Corridors

Transmission Line Corridors

12. The 16-mile Hardee Power Station to Pebbledale substation transmission line corridor exits the Hardee Power

Station in a northerly direction parallel to Ft. Green Road and the CSX railroad. The corridor continues to follow Ft. Green Road (which turns into Old Highway 37), and approaches the community of Bradley Junction, where it turns east and then back to the north, and begins to parallel Agricola Mine Road. The corridor continues north and makes the connection to the Pebbledale substation. The Hardee Power Station to Vandolah and Lee substations corridor (77 miles in length) exits the Hardee Power Station site in a southerly direction paralleling Ft. Green Road (also known as Ft. Green-Ona Road) and the CSX Railroad until it meets the Vandolah substation, where the Hardee Power Station to Vandolah substation transmission line corridor terminates. The Hardee Power Station to Lee substation corridor continues southward from the Vandolah substation parallel to the CSX Railroad and Ft. Green-Ona Road until it reaches the community of Limestone, where County Road 661 commences. The corridor continues southeast following the south side of State Road 70, then crosses the Peace River and turns south following an alignment between the Peace River and the City of Arcadia. The corridor then turns southeast following an alignment between the City of Arcadia and the Community of Nocatee, avoiding the development in both of these communities, and thereafter turns due south crossing the DeSoto-Charlotte County Line. The corridor continues south through Charlotte County, then turns west at the Prairie Creek Park development and proceeds south, crossing Shell Creek, until it reaches County Road 74, where it turns to the west again. The corridor proceeds west along County

Road 74 across the northern boundary of the Webb Area. The corridor then proceeds south along the western boundary of the Webb Area, and crosses I-75 and U.S. 41. Along the boundary of the Webb Area, the proposed corridor encounters existing disturbed areas such as roads, transmission lines, a sewage treatment plant and spray field, a large borrow pit, berms, a sparsely developed residential area, and firebreaks. The corridor continues south into Lee County, where it makes a short jog eastward, and then south into the Cape Coral city limits. The corridor then proceeds east near the northern boundary of Cape Coral, and then south, terminating at the Lee substation.

Natural Gas Pipeline Corridor

13. The natural gas pipeline corridor leaves the Hardee Power Station site heading north parallel to Fort Green Road and then after a short westward route along county Road 630, heads north parallel to an existing natural gas pipeline located along the east side of the State Road 37 right-of-way. The corridor continues north along Bonnie Mine Road, and at the City of Bartow meets and follows State Road 60 parallel to another existing natural gas pipeline. The pipeline continues north through the far western edge of the City of Auburndale, then turns to the northwest and continues along an existing CSX railroad right-of-way, continuing north to the City of Polk City where it connects with the St. Petersburg lateral pipeline.

D. Proposed Design, Construction and
Maintenance of the Hardee Power Station Site

Plant Site

14. Several geotechnical investigations have been performed at the Hardee Power Station site consisting of soil borings and installation of groundwater monitoring wells, as well as a power block and sink hole investigation. The bearing support layer under the site is primarily 80 feet of marine deposits overlying the Hawthorne Formation and varies from sands to clays, generally increasing in density or strength with depth. Expert testimony adduced at the final hearing demonstrated that the Hardee Power Station site is a suitable location from a geological standpoint.

15. There will be five basic stages of construction of the Hardee Power Station site: site preparation, construction of underground utilities, foundation construction, erection of mechanical equipment and systems, and construction of the various buildings. Work is scheduled to begin on Phase 1-A of the project at the beginning of 1991, and end in 1992. A site drainage and erosion control plan has been developed which will implement control measures during construction for erosion and sediment transport, including the use of silt fences or straw bales around the perimeter of the site. During the construction period, the detention pond will be modified to act as a retention structure, and all water during the construction phase will be filtered prior to discharge. Expert testimony offered at the hearing demonstrated that the surface water management plan employed during construction at the facility will comply with

applicable requirements of the Southwest Florida Water Management District and DER.

16. Standards pertaining to safety of employees or other workers will be followed during construction of the Hardee Power Station, including applicable regulations of the Occupational Safety and Health Administration and statutory requirements of the Florida Workers' Compensation Act. As a result, a safe working environment will be present.

17. After construction, general wastes associated with the Hardee Power Station will include such things as construction debris, general trash, sanitary sludge and demineralizer waste. Hazardous waste may be generated as a product of the cleaning or operation processes. All wastes will be ultimately disposed of off-site in accordance with all applicable state, local, and federal regulations. Wastewater associated with the demineralizer system for the Hardee Power Station will be treated at a neutralization basin. Wastewater discharges from the plant and equipment drains will be routed to an oil/water separator for treatment, and wastewater from the facility will be run to the waste treatment system for treatment. All treated waste effluents will be routed to the cooling reservoir.

Cooling Water Reservoir

18. The cooling water reservoir has been designed to provide adequate cooling for the Hardee Power Station as it increases to its ultimate site capacity of 660 megawatts. The cooling reservoir will be built in-ground with outer slopes no steeper than 20 to 1, horizontal to vertical, and with interior

slopes of no greater than 4 to 1, horizontal to vertical. The reservoir will include a divider dike which ensures the proper cooling of the reservoir waters. The cooling water will be returned to the reservoir through inlet/outlet structures. The reservoir will include a discharge structure for storm events in excess of the 10-year, 24-hour storm event allowing overflow into Payne Creek as permitted by the National Pollutant Discharge Elimination System permit program, and applicable state agency programs.

19. An earthen berm will be constructed around the perimeter of the cooling reservoir. Specifications for construction of the earthen berm have been prepared for the various phases of construction including base preparation, dewatering, materials selection, and compaction requirements. Furthermore, methods of control will be identified for the handling of equipment traffic and soil testing to ensure that the specifications are met. A soil testing laboratory representative will be present to aid in selection of soils and ensure that proper soils and compaction methods are used. The Co-Applicants have developed an inspector's handbook that details the types of problems that could potentially occur with respect to the earthen berm, and identifies recommended corrective procedures as well as routine maintenance activities. Expert testimony offered at the hearing demonstrated that the earthen berm will comply with good engineering practices.

E. Impacts of the Hardee Power Station
Site Upon the Public and Environment

Existing Land Uses

20. The Hardee Power Station site is an appropriate location in terms of land use. Construction of the cooling reservoir will entail the reclamation of mined phosphate land resulting in a beneficial land use change. The power plant site will be located in a generally unpopulated area surrounded with compatible phosphate and agricultural land uses. The plant is close enough to major metropolitan areas to provide an ample supply of skilled labor for construction and operation of the plant. The increase in employment and tax base revenues would benefit the area without burdening local governments with additional infrastructure services. The site also contains adequate highway and rail access. The construction traffic at the site will be temporary in nature and replace traffic that is presently associated with mining activity in the area. After construction, the traffic associated with the 27 to 35 permanent employees will not have a significant impact on the roads in the area.

Air Quality

21. During construction, fugitive emissions such as dust will be controlled through water application, installation of interim road bases as early as possible, and sealing of road bases.

22. During operation, the principal air emissions from the Hardee Power Station will consist of sulfur dioxides, nitrogen oxides, volatile organic compounds, carbon monoxide and

particulate matter. Emissions will be reduced by the use of clean fuels, such as natural gas and number two fuel oil, and proper operation and maintenance of the equipment. Co-Applicants will also install duct modules into the heat recovery steam generator system so that future pollution control devices can be added, if subsequently required.

23. Best Available Control Technology (BACT) is an emission-limiting standard that represents the maximum degree of emissions reduction achievable, taking into account energy, environmental and economic impacts, as well as other costs for the project. More specifically, BACT is defined at Rule 17-2.100(28), F.A.C., as follows:

"Best Available Control Technology" or "BACT" - 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.

24. An analysis was performed to determine BACT for the Hardee Power Station. After the BACT review was performed, it was determined that three types of techniques will be used to control air emissions. The control techniques evaluated in the BACT analysis were then translated into a pound-per-hour limitation for certain contaminants.

25. For nitrogen oxides, BACT control technology will be the injection of water to reduce the temperature when oxygen

and nitrogen combine within the combustion zone. The pounds per hour emission limitation for nitrogen oxide is 215.9 pounds per hour when the plant uses natural gas as a fuel, and 383.8 pounds per hour when the plant is fired using distillate oil.

26. The BACT for particulate matter is combustion control and translates into an emission limit set at five pounds per hour when natural gas is used as fuel, and 10 pounds per hour if oil is used. Since particulate matter is related to visible emissions, DER verifies compliance with the particulate matter limitations using opacity limits of 10 percent for natural gas fuel and 20 percent for oil fuel.

27. The BACT for sulfur dioxide is based on a limitation of the sulfur in oil, which would be a maximum of .5 percent and a facility annual average of .3 percent. This translates to an emissions limitation for sulfur dioxide of 35.8 pounds per hour if the plant is fired with natural gas fuel and 734.4 pounds per hour for oil fuel.

28. Emissions of carbon monoxide and volatile organic compounds (VOCs) are controlled by regulating combustion. The emissions limitations, which represent BACT for control of emissions, are as follows: for carbon monoxide, 31.3 pounds per hour if natural gas is used as fuel, and 93.4 pounds an hour if oil is used; for VOCs, 3.6 pounds per hour using natural gas and 10.3 pounds per hour using oil.

29. The proposed facility can also be expected to emit small amounts of non-regulated, non-criteria pollutants. The estimated emissions for sulfuric acid mist is 1.6 pounds per hour

if natural gas is used and 33.7 pounds per hour if oil is used; .0333 pounds per hour for beryllium with oil used as fuel; .0144 pounds per hour for mercury using natural gas and .0039 pounds per hour using oil; and for fluorides, .0427 pounds per hour for oil firing.

30. An EPA and DER approved air dispersion model analysis was performed to determine what ambient air quality impacts can be expected in connection with the Hardee Power Station's emissions of sulfur dioxide, particulate matter, and nitrogen dioxide. This modeling exercise was conservative in nature, using the plant's maximum capacity of 660 megawatts for every hour in a 5-year data base obtained from the National Weather Service station in Tampa. Modeling was performed over 300 separate locations around the facility to a distance of six kilometers to determine the facility's maximum impact.

31. The results of the air quality modeling demonstrate that the maximum impacts, based on the facility's maximum capacity of 660 megawatts from sulfur dioxide, nitrogen dioxide, and particulate matter emissions, will not cause exceedances of applicable air quality standards.

32. The prevention of significant deterioration (PSD) increments limit the impacts from new emissions of sulfur dioxide, particulate matter, and nitrogen dioxide in the particular area where air quality standards have been attained. The proposed facility will not cause exceedances of the PSD increments.

33. In connection with the PSD requirements, an analysis was performed on the impacts of air emissions on soils, vegetation, visibility, and growth-related air quality impacts. The results of this analysis indicate no significant adverse effects on soil, vegetation, visibility, or growth.

34. The stack for both the by-pass and HRSG units will comply with the good engineering practice stack height requirement as required by DER Rule 17-2.270, F.A.C. The proposed stack heights of 75 and 90 feet at the Hardee Power Station comply with good engineering practices.

Surface Water Quality and Quantity

35. A surface water management system has been designed for the Hardee Power Station site in accordance with DER and Southwest Florida Management District (SWFWMD) surface water requirements, for the purpose of conveying storm water runoff, controlling discharge water quality, and controlling runoff quantity at discharge points. The stormwater management plan is divided into three areas: a) the entrance road from County Road 663 to the general plant site; b) the main plant area, and; c) the access road to the cooling reservoir. Drainage from the entrance road will slope to ditches and swales where the water will percolate into the ground or be conveyed through the ditches to an enlarged swale area where the water will percolate or sheet-flow into Payne Creek. Drainage from the main plant area will sheet-flow away from the main foundation to ditch systems adjacent to perimeter roads. The ditch systems will convey the water through culverts and additional ditches to a detention pond

which will treat the first inch of runoff water from the site. Additional runoff water from the 25-year, 24-hour rainfall event will discharge at a spillway. With respect to the cooling reservoir access road, a concrete box culvert has been designed to convey runoff from an off-site drainage ditch area. The culvert will be sized for the peak 100-year storm event. Expert testimony presented at the hearing demonstrated that the surface water management plan for the operation of the proposed facility will comply with applicable requirements of SWFWMD and DER for controlling surface water discharges.

36. There are two surface water discharges planned for the Hardee Power Station site. The first will be from the cooling reservoir to Payne Creek identified as NPDES Outfall No. 001. A second discharge from the stormwater management facility to Payne Creek is identified as NPDES Outfall No. 002. Studies were conducted by Co-Applicants assessing the surface water impacts from the Hardee Power Station including a water budget, evaluation of long-term water quality of the reservoir, potential runoff and dispersion modeling for reservoir discharges, and runoff modeling for the stormwater system. Expert testimony adduced at the hearing demonstrated that all surface water discharges from the proposed Hardee Power Station site will comply with applicable water quality criteria. Because of the reservoir's water management functions, discharges from the reservoir will only occur due to extreme-event rainfalls which will exceed the 10-year, 24-hour rainfall event.

Groundwater Quality and Quantity

37. There will be no direct discharges to groundwater from the Hardee Power Station site. Indirect discharges may occur from the cooling reservoir and from the stormwater treatment pond. Studies were undertaken concerning these indirect discharges, including the collection of baseline data to characterize the aquifer in the area, seepage analyses to evaluate water losses from the cooling reservoir, and construction of dispersion models to evaluate transport from the reservoir to the surrounding water bodies. Based on these studies, expert opinion was adduced that the indirect groundwater discharges will meet applicable groundwater discharge criteria both at the point of discharge or in the zone of discharge authorized by DER.

38. The sources of water for the cooling reservoir include rainfall, runoff into the reservoir, treated wastewater discharge, and water pumped from wells connected to the lower Floridan Aquifer. Three wells will be constructed to supply water to the cooling reservoir and will be located northwest of the plant site, between the plant site and the cooling reservoir. Evaluations were undertaken in connection with the use of groundwater for the Hardee Power Station including baseline groundwater quantity and quality characterizations and consumptive use groundwater modeling to simulate groundwater drawdown as a result of well pumping for the cooling reservoir makeup supply. Expert opinion adduced at the hearing, based on the groundwater studies undertaken at the site, indicated that

the consumptive use proposed for the Hardee Power Station will comply with applicable SWFWMD rules regarding consumptive use of water and will not have an adverse impact on the groundwater resources of adjacent properties.

Site Biology and Wildlife

39. The construction and operation of the Hardee Power Station site will have minimal impacts on wildlife. Information from FGFWFC was obtained, seasonal wildlife surveys undertaken, and the habitat in the site area characterized. Most of the plant site is mined, or being mined, and consequently offers very poor wildlife habitat and the probability of the occurrence of endangered, threatened, or species of special concern on the plant site is very low. Although it is possible for endangered or threatened species to potentially reside within the site, only one listed species was observed -- an indigo snake. Since the construction and operation of the Hardee Power Station will not impact off-site habitat, species residing in this area will not be affected by the proposed facility. The cooling reservoir will act as an additional habitat for birds, fish, and other species of animals.

Archaeological and Historical Resources

40. Co-Applicants' archaeological/historical consultant conferred with archaeologists on staff at the Florida Department of State, Division of Historical Resources, for the purpose of reviewing any known archaeological sites in the project area. The proposed plant site, which has been surveyed previously as part of another project, was not found to be significant in terms

of potential archaeological sites by the Division of Historical Resources. The Conditions of Certification proposed for the Hardee Power Station require that should any archaeological site be found during construction, a certified archaeologist will evaluate the site, and in consultation with the Division of Historical Resources, determine the significance of the find, and whether measures need be undertaken to preserve or mitigate the impact of the site.

Noise

41. During construction of the Hardee Power Station plant, measures will be undertaken to minimize noise, including ensuring that all equipment is in proper operating condition with properly installed mufflers. Residents will be notified prior to commencing the process of line blows associated with clearing steam lines during startup. With respect to the operation of the Hardee Power Station plant, a noise impact analysis was performed which indicates that the predicted noise impacts of the facility will not be measurable beyond the plant boundaries. As a result, noise levels will comply with EPA recommendations in terms of impacts to both residential, commercial and outdoor activities, as well as with the noise standards contained in the land use code for Hardee County.

Landscape Architecture and Visual Impacts

42. The Hardee Power Station plant site is an appropriate location for this facility in terms of landscape architecture. The plant site is in an area where there are existing phosphate plants, and the characterization of those

plants in terms of height, bulk, and mining activities, would be consistent with the visual impact of the power plant site. The site is in a remote area with fewer opportunities for viewing, with a visual buffer of vegetation to the west of the site near Payne Creek.

Socioeconomic

43. The Hardee Power Station will result in a beneficial economic impact to the affected counties due to increased employment, as well as tax benefits. The construction work force during peak construction of the Hardee Power Station will be approximately 350 persons, and over the two year construction period, the average construction work force will number approximately 200 persons. There will be 27 to 35 permanent employees associated with the facility. The Hardee Power Station will have a substantial impact on the Hardee County tax base by increasing the total tax base by approximately 30 to 35 percent, thereby increasing tax revenues for Hardee County. Estimated taxes that will accrue to Hardee County due to the plant over its 30-year life will be approximately \$51.5 million. The tax benefits will not be offset by local spending on infrastructure and services due to the fact that the facility will have its own water treatment and wastewater treatment plants.

F. Proposed Design, Construction and Maintenance
of the Proposed Electrical Transmission Lines
and Natural Gas Pipeline

Transmission Lines

44. The proposed corridors for the Hardee Power Station associated transmission lines vary in width, but in general are approximately one-half mile wide.

45. The actual rights-of-way ultimately required for construction and operation of the transmission lines are expected to vary in width from approximately 100 to 150 feet. The minimum right-of-way width will be 100 feet for H-frame structures, and 60 feet for single-pole structures. The height of transmission line structures will vary from 65 feet to 125 feet.

46. Transmission lines convey bulk power between substations or from a power plant to a substation. While the final engineering design of the transmission lines is not complete, the primary components of the proposed 230 kV transmission lines will include conductors, support structures, insulators, and overhead shield wires.

a. The conductors, which convey electrical current, will have a nominal voltage of 230 kV and a maximum current rating of 1657 amperes. The size will range from single 1590 aluminum conductive steel reinforced (ACSR) to a bundle of two 2156 (ACSR) conductors, and the maximum operating temperature will be 140⁰ C.

b. The support structures hold the conductors. The Co-Applicants expect to utilize H-frame support structures, constructed of wood, steel, or concrete, in most areas. Wooden

H-frame structures will be used in the Webb Area. Single-pole support structures, composed of concrete or steel, will be utilized in more limited circumstances. Where H-frame structures are utilized, and the line turns at a sharp angle, three pole structures with guys and anchors may be utilized. Span lengths between transmission line structures will vary depending upon structure type, rights-of-way widths, and other factors. Spans between transmission line structures may range from 600 to 1300 feet, with the typical span being 600 to 700 feet.

c. The insulators consist of non-conducting media that prevent the electrical current from transmitting from the conductors to the structures.

d. The overhead shield wires protect the transmission lines from lightening strikes.

47. Transmission line access roads, having a maximum width of 20 feet, will be required for transmission line construction and maintenance.

a. Access roads will be constructed only in areas where soil conditions will not support the type of equipment needed for construction and maintenance of the transmission line, or where elevation needs to be raised above the normal water line.

b. Access road locations and cross-sections will be specified and submitted for agency review prior to construction.

c. There are three potential types of access roads associated with the Hardee Power Station associated transmission lines: the first type entails clearing vegetation without

altering elevation; the second type involves cutting swales and utilizing the swale materials to raise access road elevation approximately six inches above natural grade; the third type involves hauling in fill material to construct elevated road area.

d. Construction of raised elevation access roads will be accompanied by the design and emplacement of appropriate culverts to minimize potential disruption of surface water flow.

e. Construction of all three associated transmission lines is estimated to require a maximum of 18 months. The accumulated construction period for any one mile of transmission line is estimated to be one month.

f. Transmission line construction impacts on nearby residents will be minimal.

48. Transmission line structure pads will be required for erection of the support structures in areas characterized by soft soil conditions and in low or wet areas where it is necessary to raise the elevation above the water table. In general, structure pads will be located adjacent to access roads and will be characterized by a maximum width of from 50 feet to 80 feet.

49. The transmission lines will be constructed in several phases.

a. First, center lines will be selected within the approved corridors, and the boundaries of the rights-of-way will be surveyed and specified.

b. After rights-of-way easements are acquired, the boundaries of the rights-of-way will be surveyed and identified with stakes, and a clearing crew will trim the trees and shrubs that are required to construct, operate, and maintain the transmission line.

c. A survey crew will then delineate all structure, access road and structure pad locations, and a contractor will construct the required access roads and structure pads.

d. The Co-Applicants then will haul in the materials required to construct the transmission lines, and erect the various components.

e. Emplacement of the structures entails augering holes, placing the poles in the holes and backfilling with natural soil, crushed rock, or concrete. The structures will be embedded between ten and twenty feet into the ground.

f. The next step involves hanging the insulators and overhead shield wire on the structures.

g. The final phase of the construction process involves clean up of the right-of-way.

50. The Co-Applicants will construct and operate the proposed transmission lines with applicable design requirements of the National Electric Safety Code and appropriate ANSI, AST, or ACI standards, as required. The Co-Applicants also will comply with applicable provisions of the DOT utility accommodation guide and local utility crossing rules and connection regulations. Moreover, the transmission lines are designed to accommodate the highest winds anticipated for their location and to withstand flooding.

51. With respect to maintenance of the associated transmission lines, the Co-Applicants will utilize light vehicles for periodic inspection. Bucket trucks or line trucks will be utilized where repair to the transmission lines is required. Tractors will be utilized for mowing in the rights-of-way. Any road washout problems will be corrected by hauling in fill and then spreading and compacting it.

Natural Gas Pipeline

52. Natural gas pipelines such as those to be utilized at the proposed Hardee Power Station are designed, constructed and operated according to United States and Florida Department of Transportation (DOT) guidelines. In constructing the pipeline, a right-of-way crew clears and levels the right-of-way for the stringing of the pipeline along the corridor. The pipeline is then welded to form a continuous line along the pipeline route. X-ray crews examine each weld for defects. A coating is then applied to protect the pipe from corrosion. The pipeline is then lowered into the ditch allowing for 36 inches of cover over the pipeline. After the ditch is backfilled and the area cleared, the pipeline undergoes a hydrostatic test to detect leakage. The pipeline is then dewatered, purged with natural gas, and placed in active service. Special procedures are undertaken where the pipeline crosses water bodies, including measures to prevent erosion. At major road crossings, the pipeline is run through a steel pipe casing, insulated and sealed. When crossing minor streets, state DOT procedures will be followed. The pipeline construction should take approximately three months and involve

approximately 200 persons. Several maintenance programs will be performed to meet federal and state DOT regulations, including density surveys and placement of pipeline markings. Leak surveys are performed in heavily populated areas two to four times a year with gas leak detection instruments. Aerial patrols are also performed to detect any possible leakage.

G. Impacts of the Electrical Transmission Lines
and Natural Gas Pipeline Upon the Public
and the Environment

Existing Land Uses

53. The Pebbledale, Vandolah and Lee transmission line corridors are appropriate locations from a land use stand-point. The corridors follow existing linear facilities, such as other existing transmission lines, roads, and railroads. Where there are no existing linear facilities to follow, the corridors follow section lines or property lines. The transmission line corridors generally avoid populated areas, thus reducing potential visual impacts. A Final Order issued by the Siting Board has confirmed that these transmission line corridors are consistent, and in compliance with local government land use plans and zoning ordinances.

54. The natural gas pipeline corridor also conforms to existing land use patterns. For its entire 49-mile length, the corridor follows existing linear facilities, primarily the old CSX rail line, and then south of there, the existing natural gas pipeline, and beyond that, roads and the CSX rail line leading to the plant site. Because the corridor follows existing linear facilities, there are opportunities for right-of-way sharing with

those facilities, and as a result, from a land use standpoint, the pipeline corridor conforms to development patterns and thereby minimizes the potential for disruption of land uses in the future. Total land requirements for the pipeline are minimized. Since the pipeline will be buried pursuant to applicable safety standards, it will be appropriate to the population densities in the areas through which the pipeline passes.

Landscape Architecture and Visual Impacts

55. The locations of the transmission line corridors are appropriate from a landscape architecture perspective. The transmission line corridors generally follow existing linear facilities such as roadways, railroads, and other transmission facilities, and in other circumstances, follow section lines or edges of developments. These circumstances present the opportunity to construct the transmission lines in a manner that mitigates potential visual impacts.

Surface Water Quantity and Quality

56. The surface water resources within the proposed transmission line corridors were identified in detail in the site certification application and at the certification hearing. The Pebbledale transmission line corridor crosses a number of drainage ways and/or existing water bodies related to phosphate mining activities or road drainage, a river prong, and also the tributary to a creek. The transmission line corridor from the Hardee Power Station plant to the Vandolah substation crosses a variety of unnamed drainage ways relating to agricultural or

mining development, a number of isolated wetlands, Payne Creek and Shirttail Branch. The Lee transmission line corridor crosses a river tributary, a variety of creek tributaries, several creeks, the Peace River, a variety of man-made unnamed drainage ways, an unnamed waterway, and the Gator Slough Canal.

57. The construction of the transmission lines within the three corridors will not have an adverse impact on flood heights or flood levels. Although any corridor sited in this area would cross some water bodies, the proposed corridors have been located to avoid major water bodies to the maximum extent possible. Furthermore, culverts will be used in access road construction to maintain the natural drainage flow that currently exists. Actual selection of the number and size of the culverts will be an ongoing process which continues beyond construction in order for the culverts to be reviewed and replaced as required. Detailed construction specifications must also be submitted to DER and the water management districts prior to culvert construction. Through the use of culverts and minimization of fill for road construction, little topographic change will result from the corridor construction.

58. The associated transmission lines will not have adverse impacts on historical surface water flows within the proposed corridors. This conclusion is based upon avoidance of major water bodies, the fact that access roads will be constructed of dirt instead of impervious surface materials, and the maintenance of vegetative cover along the transmission lines.

59. With respect to water quality, the construction operation of the transmission lines within the corridors will not cause adverse impacts. There will be a lack of pollutant sources associated with the runoff generated within the corridor. During the construction process, commonly utilized erosion control techniques will be used to minimize and preclude generation of runoff in the area. During the operation of the corridor, the roadway will receive very little traffic.

60. The natural gas pipeline corridor crosses various unnamed drainage features associated with residential, mining and agricultural development, a variety of small unnamed wetlands, three creeks, and a river prong.

61. The natural gas pipeline will not adversely impact flood heights or flood levels since there are no above ground structures to interfere with the flow of water. Since the pipeline will be constructed primarily along existing rights-of-way, land cover disturbances will be minimized, thereby minimizing changes in flow patterns. For these same reasons, the pipeline will also have no significant impact on water quality or runoff. With respect to water quality, the pipeline is not expected to have an adverse impact due to the lack of above ground structures associated with the pipeline, and the fact that there will be no sources of pollutants from the pipeline itself. Furthermore, during the construction process, erosion control techniques will be used to control upland erosion, sedimentation and turbidity for the water crossings. After construction has been completed, the area will be subjected to little road activity, thereby limiting erosion or pollution.

Sinkholes

62. With respect to sinkholes, the pipeline corridor was reviewed and information of sinkhole occurrences researched to determine the potential for sinkhole sites along the corridor. The historical data indicates that the corridor area has a very low number of sinkhole occurrences, with the exception of one area. Expert testimony adduced at the final hearing demonstrated that there is a very low probability of sinkhole occurrence in the pipeline corridor.

Vegetation and Wetlands

63. The vegetative communities within the proposed transmission line corridors were specified in detail in the site certification application, and at the certification hearing. The Pebbledale transmission line corridor crosses primarily uplands disturbed by phosphate mining with occasional patches of flatwoods and disturbed wetlands. The majority of the undisturbed land in the Vandolah and Lee transmission line corridors consists of uplands such as pine flatwoods and prairies with interspersed areas of wetlands and scattered live oak trees. The northern portion of the Vandolah transmission line corridor is disturbed by mining activities; proceeding south, there is increasing conversion of natural areas to citrus groves. In the Webb Area, the vegetative habitat consists of pine flatwoods, and pasture and palmetto areas, interspersed with wet prairies or herbaceous wetland habitats. Melaleuca and Brazilian pepper invasion begins to dominate at the southern end of the corridor beginning at the western edge of the Webb Area. As the Lee

transmission line corridor crosses into Lee County, patches of cypress domes and wet prairie appear amid flatwoods, with a heavy invasion of melaleuca.

64. Impacts to the vegetation along the corridor will be minimal because the corridor does not cross particularly sensitive habitats. Moreover, the wetlands that the corridor crosses are generally small, and proposed construction techniques will prevent severe impacts. Furthermore, a number of conditions have been worked out and agreed to by various agencies with regulatory jurisdiction to reduce impacts to wetland areas.

65. Although efforts will be undertaken to minimize activities in wetlands, installation of the transmission lines will require some dredging and filling in wetland areas.

a. Techniques that the Co-Applicants will utilize to minimize potential adverse impacts to wetland areas include compacting fill material to reduce erosion, seeding side slopes of fill material, and minimizing interruption of surface water flow through the design and installation of culverts.

b. The Co-Applicants, in conjunction with DER, SWFWMD, FGFWFC, Charlotte County, and Lee County, have agreed to proposed Conditions of Certification that will minimize transmission line impacts to wetlands. The Co-Applicants have stated their intention to comply with these stipulated Conditions of Certification.

c. The proposed Conditions of Certification, conscientiously implemented by the Co-Applicants, will minimize the proposed transmission lines' potential adverse impacts to wetlands and wildlife.

66. In order to obviate the possibility that construction and operation of the transmission lines could exacerbate the invasion of exotic plant species, the Co-Applicants have agreed to Conditions of Certification requiring appropriate pre-construction and post-construction control techniques.

67. The majority of lands crossed by the pipeline corridor consist of upland habitat such as pine flatwoods and pasture areas with several small isolated wetlands. As the corridor approaches the plant site, much of the land is disturbed by phosphate mining. The pipeline corridor will have a minimal impact on vegetation and wetland communities since much of the land it crosses has already been disturbed by agricultural or mining activities.

Wildlife

68. The Pebbledale transmission line and natural gas pipeline corridors cross primarily upland habitat, including a large amount of land disturbed by phosphate mining activities and residential areas. The Vandolah and Lee transmission line corridors also cross predominately upland habitats, interspersed with wetland habitats, either forested or herbaceous. As the corridor proceeds south, out of the Webb Area, herbaceous and forested wetlands occur with more frequency, but the presence of exotic species such as melaleuca lowers the quality of the habitat. There is one significant wildlife habitat along the corridor, located near the Lee substation, which is a scrub habitat for the Florida Scrub Jay. This Scrub Jay habitat is the

subject of a specific condition of certification that the Co-Applicants agreed to in a stipulation with Lee County, and that is contained in the proposed Conditions of Certification.

69. A total of 22 threatened and endangered species and other species of regional and state concern were researched for potential occurrence with five miles of the transmission line and pipeline corridors. All these animals are wide-ranging with the exception of the red-cockaded woodpecker and Florida Scrub Jay, which are habitat specific. The proposed pipeline and transmission lines will not adversely impact any of these wildlife species. Due to the poor quality of the habitat and developed nature of the corridors, the corridors do not contain habitat that is essential to the survival of any of these 22 species. There will be sufficient space within the transmission line and gas pipeline corridors to site the right-of-way such that minimum impact will result to wildlife. Furthermore, where impacts do occur, there will be appropriate mitigation performed by Co-Applicants pursuant to the Conditions of Certification. The Intervenor's expert on wildlife impacts conceded that these mitigation measures, if applied conscientiously, will minimize potential adverse impacts to wildlife. The specific habitat requirements of the red-cockaded woodpecker, which is found in the corridor in the vicinity of the Webb Area, is discussed in detail below.

Webb Wildlife Management Area

70. Passing through Charlotte County, the proposed Lee transmission line corridor traverses portions of the northern and

western boundaries of the Webb Area, as well as certain directly adjacent lands. The Webb Area comprises approximately 65,000 acres of land owned by the FGFWFC. The western boundary of the Webb Area is approximately 120 feet to 150 feet from residences. The FGFWFC's management of the area is directed towards preserving and enhancing resident wildlife and its habitat, and providing various forms of associated public recreational opportunity. In its preliminary and final reports, the FGFWFC recommended against certification of the portion of the Lee transmission line corridor traversing the Webb Area, citing various adverse impacts to area resources and management efforts. In addition, these concerns were generally reiterated in the reports of other commenting agencies, which recommended the adoption of an appropriate agreement between the Co-Applicants and the FGFWFC as a condition of certification of the portion of the proposed corridor impacting the Webb Area.

71. However, SECI was informed by persons who own property adjacent to the Webb Area of their preference that the Lee transmission line be sited on the Webb Area. Co-Applicant SECI thereafter entered into negotiations with the FGFWFC in an effort to determine under what circumstances, if any, siting of the proposed transmission line facilities on the Webb Area would be appropriate. SECI also performed several on-site field surveys of the Webb Area. These negotiations and investigations resulted in the execution and subsequent filing of an Agreement between SECI and FGFWFC that addressed the conditions under which certification of the subject portion of the Lee transmission line

corridor would be acceptable to the FGFWFC. The Agreement includes the general identification of a suitable right-of-way within the Webb Area, certain Conditions of Certification specifically applicable to this right-of-way, certain mitigative measures to be undertaken by SECI, and a provision requiring that certain applicable nonprocedural requirements identified by the FGFWFC in its agency reports be satisfied as conditions precedent. This Agreement has been incorporated into the proposed Conditions of Certification, which SECI has agreed to comply with.

72. The subject Agreement does not require the siting of the Lee transmission line on the Webb Area. Rather, the right-of-way identified by SECI and FGFWFC in the Agreement and proposed Conditions of Certification is directly adjacent to the northern and western boundaries of the Webb Area. This right-of-way traverses approximately 13.5 miles of land in the Webb Area constituting approximately 160 acres for the 100-foot wide right-of-way. It is estimated that between 50 to 75 percent of the right-of-way traversing the Webb Area will not require new access roads since there are available upland areas or existing access roads already in place.

73. In the proposed Conditions of Certification, SECI and FGFWFC expressly contemplated the prospect of mutual agreement to minor adjustments to this right-of-way in order to address any site-specific concerns identified prior to construction. Neither the Agreement nor the proposed Conditions of Certification require that the transmission line be

constructed on the Webb Area. For both of these reasons, SECI seeks certification of the entire proposed corridor, not merely the right-of-way.

74. The Agreement and proposed Conditions of Certification provide that if SECI utilizes the right-of-way in the Webb Area, SECI will purchase 427 acres of undisturbed land that is on a parcel of property directly adjacent to the northeast corner of the Webb Area. SECI also agreed to undertake mitigation measures during construction and design of the transmission line to minimize wildlife impacts in the Webb Area. These measures have been included in the Conditions of Certification.

75. The vegetation of the Webb Area was reviewed by Linda Duever, an expert in ecology in wetland classification and impacts, by walking the right-of-way proposed for the Webb Area and reviewing aerial photographs as well as seeking input from soil scientists and other wetland ecologists. Based upon the evaluations and the construction techniques proposed for the Webb Area, Ms. Duever opined that the proposed Lee transmission line would have minimal impact on vegetation and wetland communities. The Intervenor's wetlands expert, Charles Kocur, conceded that adherence to the proposed Conditions of Certification would mitigate potential adverse wetlands impacts within the Webb Area.

76. With respect to potential impacts from the proposed Lee transmission line on wildlife resources in the Webb Area, surveys conducted by the FGFWFC and the Co-Applicants demonstrate that the majority of wildlife activity occurs in the area of the

corridor lying closest to the interior of the Webb Area. In the immediate vicinity of the proposed right-of-way within the Webb Area, documented wildlife activity is generally limited to: some foraging activity by red-cockaded woodpeckers; the presence of gopher tortoises along portions of the fence line separating the western portion of the Webb Area from adjacent private lands; and avian species crossing over the right-of-way area in the course of flying between the Webb lands and adjacent lands.

77. Red-cockaded woodpeckers, designated as a threatened species pursuant to Rule 39-27.004, F.A.C., forage for food over comparatively vast expanses of land surrounding their nesting trees. Construction of the Lee transmission line in the vicinity of the Webb Area will necessitate the clearing of a small amount of suitable red-cockaded woodpecker foraging habitat. However, considering the significant areas of foraging and nesting habitat available in the remainder of the Webb Area, construction and maintenance of the Lee transmission line in accordance with the FGFWFC/SECI Agreement will not have a significant adverse impact upon red-cockaded woodpeckers population in the Webb Area or adjacent lands.

78. Gopher tortoises are designated by Rule 39-27.005, Florida Administrative Code, as a species of special concern. Although evidence indicates the presence of some gopher tortoise burrows in the area of the fence line comprising the western boundary of the Webb Area, no competent evidence was presented which would indicate that the construction and maintenance of the Lee transmission line would result in adverse impacts to these

animals. To the contrary, un rebutted expert testimony established that the proposed transmission line would not adversely impact gopher tortoise populations. Moreover, the Co-Applicants have proposed a condition of certification which will require consultation with the FGFWFC in order to assure that any applicable regulatory constraints are satisfied.

79. Detailed surveys indicate that certain avian species may cross the area of the right-of-way in the course of flight between the Webb Area and adjacent lands. Potential adverse impacts due to bird collisions have been appropriately minimized by agreement to a condition of certification that will require the placement of appropriate visual indicators (aviation marker balls) in any area in which avian collisions are reasonably possible.

80. To the extent the Lee transmission line may be located within the Webb Area, the right-of-way identified in the Agreement between SECI and FGFWFC, viewed in conjunction with the various proposed Conditions of Certification, effects of minimal adverse impact on wildlife resources. Charles Kocur, testifying on behalf of the Intervenor as an expert on wildlife impacts, conceded that the proposed Conditions of Certification will minimize potential adverse impacts to wildlife.

81. Similarly, to the extent the line is ultimately located on the Webb Area, the placement of the Lee transmission line in accordance with the Agreement between SECI and the FGFWFC will result in minimal interference with area management practices and public use opportunities. By locating the

transmission line right-of-way generally along the Webb Area boundary, the Agreement will preclude the creation of enclave parcels within the Webb Area, and obviate corresponding management and public use problems. In addition, such an alignment will facilitate area management by creating a low vegetation buffer between the Webb Area and adjacent private lands, thus preventing or minimizing conflicts between necessary area management practices (such as controlled burning) and the lawful use and enjoyment of adjacent private lands.

82. The subject Agreement also sets forth certain special Conditions of Certification applicable to the Webb Area right-of-way, including subjects such as the control of public access, the preservation of existing hydrological conditions, the placement and maintenance of fire lanes, and the maintenance of boundary and interior fences. These conditions will operate to further minimize any adverse impacts to wildlife resources or area management.

83. Finally, in order to offset the loss of public lands and available wildlife habitat occasioned by the location of the Lee transmission line, the subject Agreement requires that, in consideration for an easement over approximately 160 acres of Webb lands, SECI shall be required to convey to the FGFWFC title to approximately 427 acres of property located adjacent to the northeastern corner of the area. In addition to being a significantly greater quantity of land than that required for the right-of-way, these mitigation lands are of superior quality (in terms of wildlife habitat) than the perimeter lands

required for the right-of-way. Notwithstanding the partial loss of use of the perimeter land comprising the right-of-way, acquisition of the mitigation lands will result in a significant net positive benefit to the Webb Area, its resident wildlife, and the public.

Electric and Magnetic Fields

84. Transmission lines produce both electric and magnetic fields. DER Rule 17-274, F.A.C., sets standards for electric and magnetic fields for transmission lines of 69 kV or higher. Transmission line electric and magnetic fields under Rule 17-274, F.A.C., are calculated at the edge of the right-of-way using a worst case scenario of maximum conductor voltage, minimum conductor ground clearance, and maximum continuous current. Expert testimony established that the electric and magnetic fields generated by each proposed transmission line configuration that could potentially be used by Co-Applicants will comply with the standards of Rule 17-274, F.A.C., which require the electric field for a 230 kV line not to exceed 8 kilovolts per meter (kV/m) on the right-of-way and 2.00 kV/m at the edge of the right-of-way, and that the magnetic field not exceed 150 milliGauss (mG) at the edge of the right-of-way. Hamilton S. Oven, Jr., DER's Administrator of the Office of Siting Coordination, who coordinated DER's rule development efforts for the electromagnetic fields rule contained in Chapter 17-274, F.A.C., confirmed that the proposed Pebbledale, Vandolah, and Lee associated transmission lines can reasonably be expected to comply with the standards contained in this rule. The

proposed Conditions of Certification require that the associated transmission lines comply with the electric and magnetic standards contained in Chapter 17-274, F.A.C., in addition to other DER rules.

Noise

85. During fair weather, noise from the proposed lines will be substantially below measurable levels. Transmission lines produce noise due to a corona effect when foreign particles, such as water droplets, are deposited on the line. During rainy weather, when the conductors are wet, the sound level generated depends on the line configuration. Assuming worst case conditions for audible noise, the H-frame configured transmission line may have a noise level at the edge of the right-of-way during rainfall as high as 38 dbA; the triangular and vertically configured transmission lines may have maximum noise levels that reach 38.7 and 48 dbA, respectively. Where, as in Hardee County, a bundled conductor configuration will be utilized, the maximum worst case noise levels for the H-frame, triangular, and vertical configurations during rainfall would be to 27, 27.2 and 36.5 dbA, respectively. These noise levels decrease as distance from the right-of-way increases. Because these noise levels occur only during and shortly after rainfall, the sound of the rain, which is similar in magnitude and quality, will mask the transmission line noise. The predicted noise levels from the Pebbledale, Vandolah, and Lee transmission lines are substantially lower than the noise levels produced by most existing 230kV transmission lines. In all instances, the noise

from the proposed transmission lines will comply with all applicable local government noise ordinances.

Radio and Television Interference

86. Frequency modulated (FM) radio transmissions are virtually immune to interference by transmission lines. FM radio transmission is used in FM radios, public service radios, and other radio communications.

87. Amplitude modulated (AM) radio transmission, such as found in AM radios and the video portion of television, may experience some interference from transmission lines in limited circumstances. During foul weather, where the point of AM radio or television reception is near the edge of the right-of-way, the transmission line may cause interference to marginal AM radio transmission and marginal television video transmission on channels two through six.

88. The Federal Communications Commission requires operators of transmission lines to investigate and correct any interference to radio or television. Moreover, new techniques in conductor design have minimized the potential for interference.

Archeological and Historical Resources

89. Some areas along the transmission line corridors were considered possibly sensitive archeological areas by the Division of Historical Resources, and preliminary investigations in these areas were performed. If archeological sites are found during construction, Co-Applicants are required under the proposed Conditions of Certification to inform the Division of Historical Resources who will determine if the site is

significant and what mitigation will be required. The Co-Applicants and Lee County have agreed to a condition of certification that will result in compliance with the Lee County Historic Preservation Ordinance.

Socioeconomic

90. The transmission lines will result in a beneficial economic impact to the affected counties due to resulting tax benefits. Since transmission lines are subject to ad valorem or personal property taxation, there will be an additional accrual of tax revenue in Hardee County attributable to the transmission lines. Other counties crossed by the transmission lines will also receive such tax revenues in proportion to the length of the line that passes through each jurisdiction. However, any such tax benefits will be reduced in Charlotte County due to the loss of private property resulting from the donation of certain lands to the Webb Area by SECI, pursuant to the Agreement with FGFWFC. Sales taxes will also be generated from the construction and operation of the plant and transmission lines.

H. Compatibility With State Comprehensive Plan and Comprehensive Regional Policy Plans

91. The Hardee Power Station plant will be compatible with the policies, goals and objectives of the State Comprehensive Plan. The plant will make use of existing facilities developed for mining activity in the area, notably the road and railroad system. The plant will also have a positive impact on the economy and employment in the area, and will be constructed to protect historic or archeological resources, and all other applicable regulations relating to water resources, air

quality, wastes, and mining reclamation. The plant will also comply with all policies of the Central Florida Comprehensive Regional Policy Plan.

92. Unrebutted expert testimony demonstrated that the Hardee Power Station associated transmission lines and natural gas pipeline will comply with the policies of the State Comprehensive Plan, the Southwest Florida Comprehensive Regional Policy Plan, and the Central Florida Comprehensive Regional Policy Plan. The proposed Conditions of Certification agreed to by the various agencies and the Co-Applicants sufficiently address the factors set forth in those plans.

I. DER Site Certification Review

93. DER conducted studies and made evaluations relating to general site suitability concerns in construction and operational safeguards, as well as facilities specific concerns relating to air quality, water availability, cooling system requirements, wastewater control, and construction impacts. Hamilton S. Oven, Jr., DER's Administrator of the Office of Siting Coordination, administers the power plant siting program and is an expert in environmental engineering with special expertise in the field of electric and magnetic fields. In his opinion, which is credited, the Co-Applicants provided DER with reasonable assurances that the project can be constructed and operated in conformance with DER rules.

CONCLUSIONS OF LAW

The Division of Administrative Hearings has jurisdiction over the parties to, and the subject matter of, these proceedings. Section 120.57(1) and 403.508(3), Florida Statutes. This proceeding was held pursuant to the Florida Electrical Power Plant Siting Act (PPSA), Chapter 403, Part II, Florida Statutes, and Chapter 17-17, Florida Administrative Code, and at the request of the parties for good cause shown, certain otherwise applicable time limits have been altered pursuant to the provisions of Section 403.5095, Florida Statutes.

Section 403.502, Florida Statutes, sets forth the legislative intent in adopting and providing for the implementation of the PPSA, as follows:

The Legislature finds that the present and predicted growth in electric power demands in this state requires the development of a procedure for the selection and utilization of sites for electrical generating facilities and the identification of a state position with respect to each proposed site. The Legislature recognizes that the selection of sites and the routing of associated transmission lines will have a significant impact upon the welfare of the population, the location and growth of industry, and the use of the natural resources of the state. . . . It is the policy of this state that, while recognizing the pressing need for increased power generation facilities, the state shall ensure through available and reasonable methods that the location and operation of electrical power plants will produce minimal adverse effects on human health, the environment, the ecology of the land and its wildlife, and the ecology of state waters and their aquatic life. It is the intent to seek courses of action that will fully balance the increasing demands for electrical power plant location and operation with the broad interests of the public. Such action will be based upon these premises:

(1) To assure the citizens of Florida that operation safeguards are technically sufficient for their

welfare and protection.

(2) To effect a reasonable balance between the need for the facility and the environmental impact resulting from construction and operation of the facility, including air and water quality, fish and wildlife, and the water resources and other natural resources of the state.

(3) To provide abundant, low-cost electrical energy.

Notice of this proceeding was provided to all persons and parties entitled thereto, as well as to the general public. All necessary and required governmental entities were parties to this proceeding, and all required reports and studies were completed and presented to the DER, including: a) reports from the Department of Community Affairs concerning the compatibility of the proposed facility with the State Comprehensive Plan, pursuant to Section 403.507(1)(a), Florida Statutes; b) the Florida Public Service Commission's report as to the present and future need for electrical generating capacity to be supplied by the proposed plant; and, c) reports of the South and Southwest Florida Water Management Districts as to the impact of the proposed facility on water resources. DER also conducted, or required the Co-Applicants to conduct additional studies, and completed its report and recommendations with respect thereto.

Based upon a preponderance of competent substantial evidence presented at hearing, it is concluded that the Co-Applicants have met their burden of proving that their application is entitled to certification for the location, construction and maintenance of the Hardee Power Station, its associated facilities, directly associated transmission lines, and the natural gas pipeline, subject to certain Conditions of

Certification found at Appendix C. Florida Department of Transportation v. J.W.C. Co., Inc., 396 So.2d 778 (Fla. 1st DCA 1981). If constructed, maintained and operated in accordance with the recommended Conditions, the project will produce minimal adverse impacts on human health, the environment, the ecology of the land and its wildlife, and the ecology of state waters and their aquatic life. Certification is consistent with the legislative purpose set forth in Section 403.502, above, of providing abundant, low-cost electrical energy and a reasonable balance between those minimal environmental impacts which will occur. In addition, the location, construction and maintenance of the Hardee Power Station, associated facilities, and associated gas pipeline and transmission lines, is consistent with the State Comprehensive Plan, Chapter 187, Florida Statutes.

The location, construction and maintenance of the Hardee Power Station, cooling reservoir, and associated facilities will produce minimal adverse effects upon the public and the environment. The plant area will be located in a remote area that has been, or will be, mined for phosphate. The plant will offer economic and employment benefits to the affected area, and will not impact the limited habitat for wildlife and vegetation within the plant site, or impact the water resources within the area if constructed and maintained in conformance with the recommended Conditions. The proposed placement of the natural gas pipeline and associated transmission lines will produce minimal adverse impacts upon the public or the environment, since the corridors substantially follow existing

linear facilities which have already impacted the public and the environment, and such impacts will not be increased by this placement. Where there are no existing linear facilities to follow, the corridors follow section and property lines, which is beneficial to, and consistent with, appropriate land uses. Where the corridors contact existing residential development, their placement is appropriately at the outer edges of that development.

Regarding the location of the Lee transmission line corridor in the Webb Area, there has been a reasonable balance effected between the need for low-cost, available power, and any impacts upon the public and the environment. It is recognized that power plants and their associated transmission lines will have an effect upon the welfare of the population of the State of Florida, but it has been shown that such effects will be minimal and that the environment, public safety and health will be protected through adherence to the Conditions recommended herein.

This certification constitutes permission for the Co-Applicants to use, connect to, and cross over the works and properties of the Florida Department of Transportation, and all local governments which are parties to this proceeding, subject to Condition XLII of the recommended Conditions of Certification. Additionally, this certification constitutes the grant of an easement for the Lee transmission line to cross the Peace River within the approved corridor, provided that no transmission line structures are placed upon state lands in the area.

The impacts of the Hardee Power Station project on air and water quality, wetlands, vegetation, wildlife, and electromagnetic field effects are well below acceptable standards established by regulatory agencies having jurisdiction over this project. The location of this project is appropriate and in compliance with applicable regulatory requirements. This project appropriately addresses the PSC's need determination, and provides a reasonable balance between that need and the environmental impacts of the project.

Subsequent to the land use hearing in this matter and the filing of the resulting Recommended Order on June 6, 1990, but prior to this certification hearing, the Intervenor's Slack and Katzen proposed consideration of an alternate corridor for the Lee transmission line. The PPSA does not authorize consideration of alternate corridors, although an alternate corridor procedure is allowed under the Electrical Transmission Line Siting Act (TLSA), Sections 403.52 through 403.536, Florida Statutes. The Legislature has specifically provided that the provisions of the TLSA do not apply to directly associated transmission lines for which certification is sought under the PPSA. Section 403.524(1), Florida Statutes. Therefore, evidence pertaining to alternate corridors which Intervenor's sought to introduce was excluded as irrelevant, as provided by Order Granting Motion to Strike Notice of Proposed Alternative Corridor filed on June 27, 1990.

Additionally, evidence which Intervenor's sought to introduce concerning the impact of the Lee transmission line on

adjacent property values was excluded as irrelevant. This issue is not appropriate for consideration during the certification phase of proceedings under the PPSA. Certification of Pasco County Solid Waste Resource Recovery Facility, 10 F.A.L.R. 5503, 5510 (Final Order of Siting Board entered August 23, 1988); Miller v. Department of Environmental Regulation, 504 So.2d 1325, 1327 (Fla. 1st DCA 1987). The impact of a project certified under the PPSA on property values is not one of the enumerated issues which is to be studied in this process. Section 403.507 (2), Florida Statutes. The Circuit Courts have exclusive jurisdiction over eminent domain under Chapters 73 and 74, Florida Statutes, and certification under the PPSA is admissible evidence as to public need and necessity, but not as to any diminution in property values, in eminent domain proceedings in Circuit Court. Section 403.539(1), Florida Statutes.

RECOMMENDATION

Based upon the foregoing findings of fact and conclusions of law, it is recommended that the Governor and Cabinet, sitting as the Siting Board, enter a Final Order granting certification for the location, construction and maintenance of the Hardee Power Station, its associated facilities, directly associated transmission lines, and the natural gas pipeline as presented in the Co-Applicants site certification application, subject to the Conditions of Certification contained in Appendix C.

DONE AND ENTERED this 15th day of October, 1990 in
Tallahassee, Florida.


DONALD D. CONN
Hearing Officer
Division of Administrative Hearings
The DeSoto Building
1230 Apalachee Parkway
Tallahassee, Florida 32399-1550

Filed with the Clerk of the
Division of Administrative Hearings
this 15th day of October, 1990.

NOTICE OF RIGHT TO SUBMIT EXCEPTIONS

All parties have the right to submit written exceptions to this Recommended Order. All agencies allow each party at least 10 days in which to submit written exceptions. Some agencies allow a larger period within which to submit written exceptions. You should consult with the agency that will issue the Final Order in this case concerning their rules on the deadline for filing exceptions to this Recommended Order. Any exceptions to this Recommended Order should be filed with the agency that will issue the Final Order in this case.

Copies furnished to all
persons shown in Appendix A

APPENDIX A

APPEARANCES

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APPENDIX B

RULINGS ON PROPOSED FINDINGS OF FACT
(DOAH Case No. 89-3560)

The proposed findings of fact contained in the Joint Proposed Recommended Order filed on behalf of the Co-Applicants and the Department have been substantially adopted in Findings 1-93.

The following rulings are made on proposed findings of fact contained in the Proposed Recommended Order filed on behalf of the Florida Game and Fresh Water Fish Commission:

- 1-2. Adopted in Finding 70.
- 3. Adopted in Finding 71.
- 4. Adopted in Findings 72, 73.
- 5. Adopted in Finding 76.
- 6. Adopted in Finding 77.
- 7. Adopted in Finding 78.
- 8. Adopted in Finding 79.
- 9. Adopted in Finding 80.
- 10. Adopted in Finding 81.
- 11. Adopted in Finding 82.
- 12. Adopted in Finding 83.

The following rulings are made on proposed findings of fact contained in the Proposed Recommended Order filed on behalf of Intervenor's Slack and Katzen:

- 1-2. Adopted in Finding 1.
- 3-6. Rejected as unnecessary since this is not in dispute.
- 7. Adopted in Finding 46.
- 8-10. Adopted in Finding 12, but otherwise Rejected as not based on competent substantial evidence.
- 11. Adopted and Rejected in Findings 71-73.
- 12. Adopted in Finding 90.
- 13-14. Rejected as not based on competent substantial evidence
- 15-16. Adopted in Finding 45.
- 17. Adopted in Finding 48.
- 18. Adopted in Findings 64, 65.
- 19. Adopted in Findings 46, 71.
- 20. Adopted and Rejected in Findings 46, 75.
- 21-26. Rejected in Findings 75-83, and as not based on competent substantial evidence.
- 27. Rejected in Findings 76, 80, 83, and as not based on competent substantial evidence.

- 28-30. Adopted in Finding 12, but otherwise Rejected as immaterial and unnecessary.
- 31. Rejected in Finding 84, and otherwise as not based on competent substantial evidence.
- 32. Adopted in Finding 84.
- 33. Adopted in Finding 85.
- 34. Rejected as not based on competent substantial evidence and immaterial.
- 35. Adopted in Finding 46.
- 36-37. Rejected in Findings 71-73.
- 38. Adopted in Findings 53, 54.
- 39. Rejected in Finding 53, and otherwise as not based on competent substantial evidence.
- 40. Adopted in Finding 53.
- 41-42. Rejected as immaterial and irrelevant.
- 43-44. Adopted in Finding 70.
- 45. Adopted in Findings 75-83.
- 46. Rejected as a conclusion of law and not a proposed finding of fact.
- 47-48. Rejected as unnecessary and cumulative.
- 49. Adopted and Rejected in Finding 79.
- 50-53. Rejected as unnecessary, immaterial and irrelevant.
- 54-55. Rejected in Finding 84 and otherwise as not based on competent substantial evidence.
- 56-57. Adopted in Finding 70.
- 58. Rejected as speculative, irrelevant, and as not based on competent substantial evidence.
- 59-60. Adopted in Finding 70.
- 61. Rejected in Finding 84 and otherwise as not based on competent substantial evidence.
- 62. Adopted and Rejected in Finding 78.
- 63-64. Adopted and Rejected in Findings 76-80.
- 65. Rejected as not based on competent substantial evidence
- 66-71. Adopted in Findings 74, 76 and 79, but otherwise Rejected in Finding 80 and as unnecessary.
- 72. Rejected as unnecessary.
- 73. Rejected as not based on competent substantial evidence
- 74. Rejected in Findings 73, 75.
- 75. Rejected as unnecessary.
- 76. Rejected in Finding 77.
- 77-78. Rejected as irrelevant and immaterial.

APPENDIX C

CONDITIONS OF CERTIFICATION

STATE OF FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION
TECO POWER SERVICES/SEMINOLE ELECTRIC COOPERATIVE, INC.
TAMPA ELECTRIC COMPANY
HARDEE POWER STATION
PA 89-25

CONDITIONS OF CERTIFICATION

I. GENERAL

A. Definitions

The meaning of the terms used herein shall be governed by the definitions contained in Chapters 403, 378, 373, 372, and 253, Florida Statutes, and any regulation adopted pursuant thereto and the statutes and regulations of any agency. In the event of any dispute over the meaning of a term used in these conditions which is not defined in such statutes or regulations, such dispute shall be resolved by reference to the most relevant definitions contained in any other state or federal statute or regulation or, in the alternative, by the use of the commonly accepted meaning as determined by the department. As used herein:

1. "Application" shall mean the Site Certification Application for the Hardee Power Station, as supplemented.

2. "CFRPC" shall mean the Central Florida Regional Planning Council.

3. "DER" shall mean the Florida Department of Environmental Regulation.

4. "DHR" shall mean the Florida Department of State, Division of Historical Resources.

5. "DNR" shall mean the Florida Department of Natural Resources.

6. "Emergency conditions" shall mean urgent circumstances involving potential adverse consequences to human life or property as a result of weather conditions or other calamity, and necessitating new or replacement gas pipeline, transmission lines, or access facilities.

7. "Feasible" or "practicable" shall mean reasonably achievable considering a balance of land use impacts, environmental impacts, engineering constraints, and costs.

8. "GFWFC" shall mean the Florida Game and Freshwater Fish Commission.

9. "Lee transmission line" shall mean the corridor depicted in Attachment A.

10. "Linear facility" shall mean any one of the three transmission lines or the natural gas pipeline associated with the Hardee Power Station.

11. "M/C" shall mean mitigation/compensation.

12. "Pebbledale transmission line" shall mean the corridor depicted in Attachment B.

13. "Permittees" shall mean TECO Power Services Corporation (TPS), Tampa Electric Company (TEC), and Seminole Electric Cooperative, Inc. (SECI).

14. "Power plant" shall mean the electric power generating equipment and appurtenances to be constructed on a site in Hardee County and Polk County, as generally depicted in the Application.

15. "Project" shall mean the Hardee Power Station and all associated facilities, including: the power plant and related facilities; the cooling reservoir and related facilities; any off-site mitigation/compensation areas; and all of the linear facilities.

16. "ROW" shall mean the transmission line and natural gas pipeline rights-of-way to be selected by the Permittees within the certified corridors in accordance with the conditions of certification.

17. "SFWMD" shall mean the South Florida Water Management District.

18. "SWFRPC" shall mean the Southwest Florida Regional Planning Council.

19. "SWFWMD" shall mean the Southwest Florida Water Management District.

20. "USFWS" shall mean the United States Fish and Wildlife Service.

21. "Vandolah transmission line" shall mean the corridor depicted in Attachment C.

22. "WMD" shall mean water management district.

23. "ISO" shall mean International Organization for Standardization, ISO 3977-1978(E) standard conditions for gas turbines = 14.7 psia, 15°C, relative humidity 60%.

B. Identification of Permittees Responsible for Compliance

In general, where a specific condition is intended to apply solely to one of the Permittees, this shall be indicated in the title for that specific condition by the following abbreviations:

TPS - TECO Power Services Corporation
TEC - Tampa Electric Company
SECI - Seminole Electric Cooperative, Inc.

Similarly, where a specific condition is intended to apply to any two of the Permittees, this shall be indicated by listing in the title the respective abbreviations. Where a specific condition is intended to apply to TPS, TEC, and SECI, the designation "HPS" (for "Hardee Power Station") shall appear.

C. Applicable Rules

The construction and operation of the HPS shall be in accordance with all applicable provisions of at least the following regulations of the Department: Chapters 17-2, 17-3, 17-4, 17-5, 17-6, 17-7, 17-12, 17-21, 17-22, 17-25, 17-274, 17-302, and 17-610, Florida Administrative Code (F.A.C.) or their successors as they are renumbered.

II. AIR (TPS)

A. Emission Limitations for HPS

The construction and operation of HPS shall be in accordance with all applicable provisions of Chapters 17-2, F.A.C.. In addition to the foregoing, EPS shall comply with the following conditions of certification as indicated.

1. On or before April 1 of each year, the Permittee shall submit to the Division of Air Resource Management and the Air Section, Southwest District Office, an annual report for the previous calendar year showing:

(a) The annual average capacity factor for each individual generating unit;

(b) The cumulative lifetime average capacity factor for each individual generating unit;

(c) The annual average capacity factor for the Hardee Power Station; and,

(d) The cumulative lifetime average capacity factor for the Hardee Power Station.

The annual average capacity factor shall be calculated by dividing each unit's megawatt hours output of generation by the product of the official megawatt rating of the unit and the number of hours in a year. Cumulative lifetime average capacity factor shall be calculated by dividing the cumulative total of megawatt hours output of generation by the product of the official combined cycle megawatt rating and the cumulative period of hours since commercial operation.

2. The Permittee shall install duct module(s) suitable for future installation of SCR equipment when constructing any combined cycle generating unit at the Hardee Power Station. Should any annual report demonstrate that the cumulative lifetime average capacity factor for the Hardee Power Station exceeds 60% at any time, the Permittee shall install SCR or another technology of equal or greater NOx reduction capability. In no event shall any such SCR or equivalent NOx control technology installation and compliance testing occur later than 30 months from the date that the permittee requested or the facility exceeded the 60% cumulative lifetime average capacity factor.

3. Only natural gas or No. 2 fuel oil shall be fired in the turbine.

4. The maximum heat input to each CT shall neither exceed 1268.4 MMBtu/hr while firing natural gas, nor 1312.3 MMBtu/hr while firing fuel oil (@32° F). Each CT's fuel consumption shall be continuously measured and recorded.

5. The maximum allowable emissions from each CT in accordance with the BACT determination, shall not exceed the following:

Pollutant	Fuel	Emission Limitations	
		concentration	lb/hr/CT
NOx	Gas	42 ppmvd @ 15% O ₂	215.9
	Oil	65 ppmvd "	383.8
VOC	Gas	2 ppmvd	3.6
	Oil	5 ppmvd	10.3
CO	Gas	10 ppmvd	31.3
	Oil	26 ppmvd	93.4
PM/PM10	Gas	--	5.0
	Oil	--	10.0
SO ₂	Gas	--	35.8
	Oil	0.3% S oil	734.4

6. The following emissions, most determined by BACT, are tabulated for PSD and allowable inventory purposes:

Pollutant	Fuel	Maximum Allowable Emissions (@ 32° F.)	
		concentration	lb/hr/CT
H ₂ SO ₄ Acid Mist	Gas	---	1.6
	Oil	---	22.0 (avg)/33.7 (max)
Mercury	Gas	---	0.0144
	Oil	---	0.0039
Fluoride	Oil	---	0.0427
Beryllium	Oil	---	0.0333

NOTE: Sulfur dioxide emissions assume a maximum of 0.5 percent sulfur in fuel oil for hourly emissions and an average sulfur content of 0.3 percent for annual emissions.

7. Visible emissions shall neither exceed 10% opacity while burning natural gas, nor 20% opacity while burning distillate oil.

8. Initial (I) compliance tests shall be performed on each Combustion Turbine using both fuels. The stack test for each turbine shall be performed within 10% of the maximum heat rate input for the tested operating temperature. Annual (A) compliance tests shall be performed on each Combustion Turbine with the fuel(s) used for more than 400 hours in the preceding 12-month period. Tests shall be conducted using EPA reference methods in accordance with the July 1, 1988 version of 40 CFR 60 Appendix A:

- a. 5 for PM (I,A)
- b. 8 for sulfuric acid mist (I, for oil only)
- c. 9 for VE (I,A)
- d. 10 for CO (I,A)
- e. 20 for NO_x (I,A)
- f. 25A for VOC (I,A)
- g. 104 for Beryllium (I, for distillate oil only) A fuel analysis for Be using either Method 7090 or 7091, and sample extraction using Method 3040, as described in the EPA solid waste regulations SW 846, is also acceptable.
- h. ASTM D 2880-71 for sulfur content of distillate oil (I,A)
- i. ASTM D 1072-80, D 3031-81, D 4084-82 or D 3246-81 for sulfur content of natural gas (I, and A if deemed necessary by DER)

Other DER approved methods may be used for compliance testing after prior Departmental approval.

9. The average annual sulfur content of the No. 2 fuel oil shall not exceed 0.3% by weight. The maximum sulfur content of the No. 2 fuel oil shall not exceed 0.5%. Compliance shall be demonstrated in accordance with the requirements of 40 CFR 60.334 by testing all oil shipments for sulfur content using ASTM D 2880-71, and testing for nitrogen content.

10. For all generating units, water injection shall be utilized for NOx control. The water to fuel ratio at which compliance is achieved shall be incorporated into the permit and shall be continuously monitored for all units.

11. To determine compliance with the capacity factor condition, the permittee shall maintain daily records of power generation for each turbine. All records shall be maintained for a minimum of three years after the date of each record and shall be made available to representatives of the Department upon request.

12. The project shall comply with all the applicable requirements of Chapter 17-2, Florida Administrative Code (F.A.C.) and the July 1, 1988, version of 40 CFR 60 Subpart GG, Gas Turbines.

13. Any change in the method of operation, fuels, equipment, phase design, shall be submitted for approval to DER's Bureau of Air Regulation.

14. If start/black start capability for the CTs is provided by a combustion unit, the Department shall be notified of the type/model, output capacity, anticipated hours of operation, and air emissions of the unit.

15. The permittee shall have required sampling tests of the emissions performed within 60 days after achieving the maximum turbine firing rate, but not later than 180 days from the start of operation. Thirty (30) days prior notice of the initial sampling test and fifteen (15) days notice before subsequent annual testing shall be provided to the Southwest District Office. Written reports of the tests shall be submitted to the Southwest District office within 45 days of test completion.

16. If construction does not commence on the first three units within 18 months of issuance of this certification/permit, then the Permittee shall obtain from DER a review and, if necessary, a modification of the control technology and allowable emissions for the unit(s) on which construction has not commenced (40 CFR 52.21(r)(2)). Units to be constructed in later phases of the project will be reviewed and limitations established under the supplementary review process of the Power Plant Siting Act.

17. Quarterly excess emission reports, in accordance with the July 1, 1988 version 40 CFR 70.7 and 60.334, shall be submitted to DER's Southwest District office. Annual reports shall be

submitted to the District office in accordance with F.A.C. Rule 17-2.700(7).

18. Literature of equipment selected shall be submitted as it becomes available. A CT-specific graph of the relationship between NOx emissions and water injection, and also another of ambient temperature and heat inputs to the CT shall be submitted to DER's Southwest District office and the Bureau of Air Regulation.

19. Stack sampling facilities shall be provided for both the bypass stack (CT) and the main stack (HRSG).

20. Construction period fugitive dust emissions shall be minimized by covering or watering dust generation areas.

III. SURFACE WATER DISCHARGES (TPS)

Discharges into surface waters of the state during construction and operation of the project shall be in accordance with applicable provisions of Chapters 17-3, 17-4, 17-302, 17-650, and 17-660, Florida Administrative Code, and the following conditions of certification.

A. Plant Effluents and Receiving Body of Water

For discharges made from the HPS the following conditions shall apply:

1. Receiving Body of Water (RBW) - The receiving body of water has been determined by the Department to be those waters of Payne Creek which are considered to be waters of the State within the definition of Chapter 403, Florida Statutes.

2. Point of Discharge (POD) - The point of discharge has been determined by the Department to be where the effluent physically enters the waters of the State in Payne Creek from either the storm water runoff retention pond or the cooling reservoir; however, compliance monitoring will be required at the cooling pond overflow weir and the stormwater detention pond discharge pipes.

3. Thermal Mixing Zones - The instantaneous zone of thermal mixing for the HPS cooling system shall not exceed a distance of 50 feet from the POD. The temperature at the POD into Payne Creek shall not be greater than 95 degrees F. The temperature of the water at the edge of the mixing zone shall not exceed the limitations of Section 17-302.520(5)(b), F.A.C..

4. Chemical Wastes from HPS - All discharges of low volume wastes (demineralizer regeneration, floor drainage, labs drains, and similar wastes) shall be treated in an adequately

sized and constructed treatment facility prior to discharge into the cooling reservoir.

5. pH - The pH of the combined discharges to the cooling reservoir from Outfall Serial Number (OSN) 003 shall be such that the pH will fall within the range of 6.0 to 9.0 and any discharge from the reservoir at OSN 001 to Payne Creek shall not fall outside the 6.0 to 8.5 range.

6. Polychlorinated Biphenyl Compounds - There shall be no discharge of polychlorinated biphenyl compounds.

7. During the first 18 months, the permittees shall monitor the cooling reservoir at the condenser cooling water intake for the following parameters in the manner prescribed; upon completion of the 18 month monitoring period, the monitoring frequency may be decreased to once per year:

Parameter	Monitoring Requirements	
	Measurement Frequency	Sample Type
Total Dissolved Solids	1/quarter	grab
Turbidity (NTU)	1/quarter	grab
Ammonia Nitrogen	1/quarter	grab
Ammonia (un-ionized)	1/quarter	grab
Beryllium	1/quarter	grab
Cadmium	1/quarter	grab
Chlorophyll A.	1/quarter	grab
Copper	1/quarter	grab
Cyanide	1/quarter	grab
Iron	1/quarter	grab
Lead	1/quarter	grab
Nitrogen, Total	1/quarter	grab
Nitrogen, Organic	1/quarter	grab
Mercury mg/L	1/quarter	grab
pH	1/quarter	grab
Selenium	1/quarter	grab
Silver	1/quarter	grab
Zinc	1/quarter	grab
Temperature	1/quarter	grab
TKN	1/quarter	grab
Ortho-phosphorus	1/quarter	grab
Total Phosphorus	1/quarter	grab

The results of the monitoring shall be submitted to the DER Southwest District Office in Tampa within 45 days of collection. The permittees shall maintain a summary of the results in the form of a yearly average for the life of the project. If any of the above parameters should reach 80% of the water quality criteria as contained in Chapter 17-302, F.A.C., the permittees shall notify the department. The department may then require sampling on a monthly basis in the reservoir and in Payne Creek and may approve mixing zones for parameters that exceed criteria.

8. The permittees shall monitor any discharge from the cooling reservoir at Outfall Serial Number 001 in the following manner:

<u>Parameter</u>	<u>Monitoring Requirements</u>	
Flow (quantity and duration)	by Calculation during Discharge	
Temperature	Twice per day during Discharge	
Total Dissolved Solids	1/week during Discharge	
Gross Alpha	1/week discharge	grab
Radium 226	1/week discharge	grab
Turbidity (NTU)	1/week discharge	grab
Cadmium	1/week discharge	grab
Cyanide	1/week discharge	grab
Iron	1/week discharge	grab
Lead	1/week discharge	grab
Mercury mg/L	1/week discharge	grab
Dissolved Oxygen	1/week discharge	grab
pH	1/week discharge	grab
Selenium	1/week discharge	grab
Silver	1/week discharge	grab
Zinc	1/week discharge	grab

9. Chemical Metal Cleaning - There shall be no discharge of chemical metal cleaning wastes to the cooling reservoir. TPS shall arrange for a contractor to remove the wastes from site before or after treatment for disposal in a licensed facility.

10. Storm Water Runoff - During construction and operation discharge from the storm water runoff collection system from a storm event less than the once in ten-year twenty-four hour storm shall meet the following limits and shall be monitored at OSN 002 by a grab sample once per discharge, but not more often than once per week:

<u>Effluent Characteristic</u>	<u>Discharge Limits</u>
	<u>Instantaneous Maximum</u>
Flow (MGD)	Report
TSS (mg/l)	50
pH	6.0-8.5

a. During plant operation, necessary measures shall be used to settle, filter, treat or absorb silt-containing or pollutant-laden storm water runoff to limit the suspended solids to 50 mg/l or less at OSN 002 during rainfall periods less than the 10-year, 24-hour rainfall.

b. Control measures shall consist at the minimum of filters, sediment traps, barriers, berms or vegetative planting.

Exposed or disturbed soil shall be protected as soon as possible to minimize silt, and sediment-laden runoff. The pH shall be kept within the range of 6.0 to 8.5 in the discharge to the Payne Creek.

c. Special consideration must be given to the control of sediment laden runoff resulting from storm events during the construction phase. Best management practices erosion controls should be installed early during the construction period so as to prevent the transport of sediment into surface waters which could result in water quality violations and Departmental enforcement action. Revegetation and stabilization of disturbed areas should be accomplished as soon as possible to reduce the potential for further soil erosion. Should construction phase runoff pose a threat to the water quality of state waters, additional measures such as treatment of impounded runoff or the use of turbidity curtains (screens) in on-site impoundments shall be immediately implemented with any releases to state waters to be controlled.

d. It is necessary that there be an entity responsible for maintenance of the system pursuant to Section 17-25.027, FAC.

e. Correctional action or modification of the system will be necessary should mosquito problems occur.

f. All swale and retention basin side slopes shall be seeded and mulched within thirty days following their completion and a substantial vegetative cover must be established within ninety days of seeding.

11. Steam System Blowdown - Blowdown discharge from the steam electric generating system to the cooling reservoir shall be limited and monitored as specified below:

Effluent Characteristic	Discharge Limits		Monitoring Requirements	
	<u>Daily Average</u>	<u>Daily Maximum</u>	<u>Sample Type</u>	<u>Measurement Frequency</u>
TSS	30.0	100.0	grab	1/month
Oil and Grease	15.0	20.0	grab	1/month
Flow	Report	Report	Calculation	1/month

12. Construction Dewatering

a. Discharge of construction dewatering to Payne Creek in the event of once in ten-year 24-hour or greater storm from outfall serial numbers 001 or 002 shall be limited and monitored as specified below:

Effluent Characteristic	Discharge Limits	Monitoring Requirements	
		Measurement Frequency	Sample Type
Flow - m ³ /day (MGD)	-	daily	Calculation
Turbidity (NTU)	-	1/week	grab
TSS mg/l	50.0	1/week	grab
pH	6.0-9.0	1/week	grab

b. Project discharge descriptions - Dewatering water, outfalls 001 and 002, includes all surficial groundwater extracted during all excavation construction on site for the purpose of installing structures, equipment, etc. Discharges to the storm water runoff sedimentation pond or cooling reservoir at a location to be depicted on an appropriate engineering drawing to be submitted to DER and SWFWMD. Final discharge after treatment is to Payne Creek. The permittee shall report to DER the date that construction dewatering is expected to begin at least one week prior to the commencement of dewatering.

c. If the storm water run off detention pond should discharge more frequently than once per year during construction, then the following parameters shall be monitored at OSN 001 or 002 at least once per week per discharge:

Parameter	Sample Type
Cadmium	grab
Cyanide	grab
Gross alpha	grab
Iron	grab
Oil and grease	grab
Mercury	grab
Radium 226	grab
Selenium	grab
Silver	grab

13. Mixing Zones - The discharge of the following pollutants shall not violate the Water Quality Standards of Chapter 17-302, F.A.C., beyond the edge of the designated mixing zone, which shall be 200 feet from the point of discharge (POD). For purposes of compliance monitoring, the following limitations shall apply at the POD.

Parameter	Limit at POD
Cadmium	2.6 ug/l
Cyanide	0.01 mg/l
Mercury	0.5 ug/l
Selenium	22. ug/l
Silver	0.8 ug/l
Gross alpha	22.2 pC/l
Radium 226	6.2 pC/l

Turbidity
Iron
Lead
Zinc

31 NTU

The Secretary of DER may authorize alternative mixing zones for the above parameters in accordance with Condition XXI upon a demonstration that such mixing zone would not interfere with beneficial use of the creek.

14. Sanitary wastes from the HPS shall be collected and treated in an appropriately designed domestic wastewater treatment plant. The permittee shall fill out the appropriate DER application for a domestic wastewater treatment facility including the design specifications for the proposed facility and, shall submit such application and specifications to the DER Southwest District Office for approval at least 90 days prior to start of construction of that facility.

B. Water Monitoring Programs

1. The necessity and extent of continuation for any water monitoring program may be modified in accordance with Condition No. XXI, Modification of Conditions.

2. Chemical Monitoring - The parameters described in Condition III. shall be monitored during discharge as described in Condition III commencing with the start of construction or operation of the HPS and reported quarterly to the Southwest District Office.

IV. GROUND WATER (TPS)

A. Water Well Construction

Prior to the construction, modification, or abandonment of a production well for the HPS, the permittee must notify the SWFWMD pursuant to Chapter 40D-2, Florida Administrative Code. Construction, modification, or abandonment of a production well will require modification of the HPS consumptive use conditions when such construction, modification or abandonment is other than that specified and described on HPS consumptive use information as addressed in the application. The construction, modification, or abandonment of a monitor well specified in Condition IV.F. will require the prior approval of the Department.

B. Well Criteria, Tagging and Wellfield Operating Plan

Leaking or inoperative well casings, valves, or controls must be repaired or replaced as required to put the system back in an operative condition acceptable to the SWFWMD. Failure to make such repairs will be cause for deeming the well abandoned in accordance with Chapter 17-532.200, Florida Administrative Code, Chapter 373.309, Florida Statutes. Wells deemed abandoned will require plugging according to applicable regulations.

A SWFWMD-issued identification tag must be prominently displayed at each withdrawal site by permanently affixing such tag to the pump, header, valve or other withdrawal facility as

provided by Section 40D-2, Florida Administrative Code. The HPS must notify the SWFWMD in the event that a replacement tag is needed.

C. Maximum Annual Withdrawals

The use of groundwater from the proposed wellfield shall not exceed 3.8 million gallons per day ("mgd") on an average daily basis (averaged over a 12 month period) or a maximum 8.64 mgd on any day.

The use of the Floridan aquifer potable water for control of fugitive dust emissions is prohibited when alternatives are available, such as treated discharges, shallow aquifer wells, or stormwater. The use of Floridan aquifer potable water for the sole purpose of waste stream dilution is prohibited.

D. Water Use Transfer

The SWFWMD must be notified, in writing, within 90 days of the transfer of this certification. All transfers are subject to the provisions of Chapter 40D-2, Florida Administrative Code, which state that all terms and conditions of the permit shall be binding of the transferee.

E. Emergency Shortages

Nothing in this certification is to be construed to limit the authority of the SWFWMD to declare a water shortage and issue orders pursuant to Section 373.175, Florida Statutes, or to formulate a plan for implementation during periods of water shortage, pursuant to Section 373.246, Florida Statutes. In the event of a water shortage, as declared by the District Governing Board, the HPS shall adhere to reductions in water withdrawals as specified by the SWFWMD.

In the event SWFWMD declares that a water shortage exists pursuant to Chapter 40D-21, FAC, SWFWMD may alter, modify, or declare inactive all or parts of this certification as necessary to address the water shortage, after notice and a reasonable opportunity for compliance.

F. Monitoring and Reporting

1. Report Submission

All required reports of data shall be submitted to SWFWMD on or before the tenth day of each month and shall be addressed to:

Permits Data Group
Southwest Florida Water Management District
2379 Broad Street
Brooksville, Florida 33469-6988

2. Flow Meters

BPS wells identified with District withdrawal Nos. 1, 2, and 3 shall be equipped with totalizing flow meters or other flow measuring devices as approved in writing by the Director, Bartow Permitting Department, Resources Regulation. Such devices shall have and maintain an accuracy within 5 percent of actual flow. Those designated withdrawal points not equipped with such devices on the date the site certification is granted must be equipped within 120 days of the site certification date or upon completion of construction of the withdrawal facility, unless an extension is approved in writing by the Director, Bartow Permitting Department, Resource Regulation.

3. Total withdrawal from each monitored source shall be recorded on a monthly basis and reported to SWFWMD (using District forms) on or before the tenth day of the following month.

G. Sampling and Analysis Report

1. The Permittee shall submit a report describing the sampling and analytical methodologies employed. The report shall address all parameters for which analyses are performed. The report shall be included with the first data submitted after the date the site certification is granted and upon any change in sampling and/or analytical method.

2. Reports of the analyses shall be submitted to SWFWMD (using District forms) on or before the tenth day of the following month. The parameters and frequency of sampling and analysis may be modified by SWFWMD staff as necessary to ensure the protection of the resource. Water quality samples shall be collected and analyzed, for the specified withdrawal point, parameter, and frequency.

District I.D. No.	Parameter	Sampling Frequency
1	Chlorides, Sulfates Total Dissolved Solids	Quarterly

Analyses shall be performed according to procedures outlined in the current edition of Standard Methods for the Examination of Water and Wastewater by the American Public Health Association-American Water Works Association-Water Pollution Control Federation (APHA-AWWA-WPCF) or Methods for Chemical Analyses of Water and Wastes by the U.S. Environmental Protection Agency (EPA).

H. Ground Water Monitoring Requirements

After consultation with the DER and SWFWMD, the permittee shall install a monitoring well network to monitor ground water quality horizontally and vertically through the aquifer above the Hawthorn Formation. Ground water quantity and flow directions will be determined seasonally at the site through the preparation of seasonal water table contour maps, based upon water level data obtained during the applicant's preoperational monitoring program. From these maps and the results of the detailed subsurface investigation of site stratigraphy, the water quality monitoring well network will be located. A ground water monitoring plan that meets the requirements of Section 17-28.700(d), F.A.C., shall be submitted to the Department's Southwest District Office for review. Approval or disapproval of the ground water monitoring plan shall be given within 60 days of receipt. Ground water monitoring shall be required at HPS's sedimentation pond. Insofar as possible, the monitoring wells may be selected from the existing wells and piezometers used in the permittees preoperational monitoring program, provided that the wells construction will not preclude their use. Existing wells will be properly sealed in accordance with Chapter 17-21, F.A.C., whenever they are abandoned due to construction of facilities. The water samples collected from each of the monitor wells shall be collected immediately after removal by pumping of a quantity of water equal to at least three casing volumes. The water quality analyses shall be performed monthly during the year prior to commercial operation and quarterly thereafter. No sampling or analysis is to be initiated until receipt of written approval of a site-specific quality assurance project plan (QAPP) by the Department. Results shall be submitted to the DER by the fifteenth (15th) day of the month following the month during which such analyses were performed. Testing for the following constituents is required around unlined ponds or storage areas:

TDS	Cadmium
Conductance	Zinc
pH	Copper
Redox	Nickel
Sulfate	Selenium
Sulfite	Chromium
Color	Arsenic
Chloride	Beryllium
Iron	Mercury
Aluminum	Lead
Radium 226	Gross Alpha

I. Zone of Discharge

The EPS shall meet the groundwater criteria of Chapter 17-3, F.A.C. at the boundary of a mixing zone extending 100 feet from the outside toe of the cooling reservoir. A ground water

monitoring program as described in Condition IV.H. shall be implemented to verify compliance with these requirements. Such sampling program shall commence at least 12 months prior to start of commercial operation of the HPS.

J. Water Samples

SWFWMD may collect water samples from any withdrawal point listed in the certificate or may require the Permittee to submit water samples when SWFWMD determines there is a potential for adverse impacts to water quality.

K. SWFWMD Access

The Permittee shall provide access to an authorized SWFWMD representative to enter the property at any reasonable time to inspect the facility and make environmental or hydrologic assessments. The Permittee shall either accompany SWFWMD staff onto the property or make provision for access onto the property.

L. Surface Water Reduction

The Permittee shall cease or reduce surface water withdrawal as directed by SWFWMD if water levels in lakes, other than the cooling reservoir, fall below applicable minimum water level established in Chapter 40D-8, FAC, or rates of flow in streams fall below the minimum levels established in Chapter 40D-8, FAC.

M. Conservation

The Permittee shall cease or reduce withdrawal as directed by SWFWMD if water levels in aquifers fall below the minimum levels established by the SWFWMD Governing Board.

The Permittee shall practice water conservation to increase the efficiency of transport, application, and use, as well as to decrease waste and to minimize runoff from the property. At such time as the SWFWMD Governing Board adopts specific conservation requirements for the Permittee's water use classification, the Permittee shall be subject to those requirements upon notice and after a reasonable period for compliance.

N. Special Regulations

SWFWMD may establish special regulations for Water-Use Caution Areas. At such time as the SWFWMD Governing Board adopts such provisions, the Permittee shall be subject to them upon notice and after a reasonable period for compliance.

O. Legal Use Impacts Mitigation

The Permittee shall mitigate, to the satisfaction of SWFWMD, any adverse impact to existing legal uses caused by withdrawals. When adverse impacts occur or are imminent, SWFWMD may require the Permittee to mitigate the impacts. Adverse impacts include:

1. A reduction in water levels which impairs the ability of a well to produce water;
2. Significant reduction in levels or flows in water bodies such as lakes, impoundments, wetlands, springs, streams or other watercourses; or
3. Significant inducement of natural or manmade contaminants into a water supply or into a usable portion of an aquifer or water body.

P. Environmental Impact Mitigation

The Permittee shall mitigate to the satisfaction of SWFWMD any adverse impact to environmental features or offsite land uses as a result of withdrawals. When adverse impacts occur or are imminent, SWFWMD may require the Permittee to mitigate the impacts. Adverse impacts include the following:

1. Significant reduction in levels or flows in water bodies such as lakes, impoundments, wetlands, springs, streams, or other watercourses;
2. Sinkholes or subsidence caused by reduction in water levels;
3. Damage to crops and other vegetation causing financial harm to the owner; and
4. Damage to the habitat of endangered or threatened species.

Q. Alternative Source Investigation

The Permittee shall investigate alternate sources of water supply on an on-going basis in an effort to reduce groundwater withdrawals. SWFWMD may direct the Permittee to report on the investigation through a written request, and allow the Permittee adequate time to prepare such a report.

V. CONTROL MEASURES DURING CONSTRUCTION (TPS)

A. Sanitary Wastes

Disposal of sanitary wastes from construction toilet facilities shall be in accordance with applicable regulations of the Department and the Hardee County Health Department.

B. Environmental Control Program

Each permittee shall establish an environmental control program under the supervision of a qualified person to assure that all construction activities conform to good environmental practices and the applicable conditions of certification. A written plan for controlling pollution during construction shall be submitted to DER within sixty days of issuance of the Certification. The plan shall identify and describe all pollutants and waste generated

during construction and the methods for control, treatment and disposal. Each permittee shall notify the Department's Southwest District Office by telephone within 24 hours if possible if unexpected harmful effects or evidence of irreversible environmental damage are detected by it during construction, shall immediately report in writing to the Department, and shall within two weeks provide an analysis of the problem and a plan to eliminate or significantly reduce the harmful effects or damage and a plan to prevent reoccurrence.

C. Construction Dewatering Effluent

Should the permittee's dewatering operation create shoaling in adjacent water bodies, the permittee is responsible for removing such shoaling.

All offsite discharges resulting from dewatering activities must be in compliance with water quality standards required by DER Chapters 17-3, 17-4 and 17-302, F.A.C., or such standards as issued through a variance by DER.

VI. SAFETY (TPS)

The overall design, layout, and operation of the facilities shall be such as to minimize hazards to humans and the environment. Security control measures shall be utilized to prevent exposure of the public to hazardous conditions. The Federal Occupational Safety and Health Standards will be complied with during construction and operation. The Safety Standards specified under Section 440.56, F.S., by the Industrial Safety Section of the Florida Department of Commerce will also be complied with.

VII. SCREENING (TPS)

The permittee shall provide screening of the site to the extent feasible through the use of aesthetically acceptable structures, vegetated earthen walls and/or existing or planted vegetation.

VIII. TOXIC, DELETERIOUS OR HAZARDOUS MATERIALS (TPS)

The spill of any toxic, deleterious, or hazardous materials shall be reported in the manner specified by Condition XI, Noncompliance Notification.

IX. SOLID WASTE STORAGE AND DISPOSAL (TPS)

Solid waste produced by the operation of the HPS shall be removed from site and disposed of in a permitted disposal facility.

X. CHANGE IN DISCHARGE (TPS)

All discharges or emissions authorized herein to HPS shall be consistent with the terms and conditions of this certification. The discharge of any pollutant not identified in the application or any discharge more frequent than, or at a level in excess of, that authorized herein shall constitute a violation of this certification. Any anticipated facility expansions, production increases, or process modification which will result in new, different or increased discharges or expansion in steam generating capacity will require a submission of new or supplemental application to DER's Siting Coordination Office pursuant to Chapter 403, F.S.

XI. NONCOMPLIANCE NOTIFICATION (TPS)

If, for any reason, either permittee does not comply with or will be unable to comply with any limitation specified in this certification, the permittee shall notify the Deputy Assistant Secretary of DER's Southwest District office by telephone as soon as possible but not later than the first DER working day after the permittee becomes aware of said noncompliance, and shall confirm the reported situation in writing within seventy-two (72) hours supplying the following information:

A. A description and cause of noncompliance; and

B. The period of noncompliance, including exact dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the noncomplying event.

XII. FACILITIES OPERATION (TPS)

Unless granted an exception by a specific condition herein, each permittee shall at all times maintain in good working order and operate as efficiently as possible all of its treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this certification. Such systems are not to be bypassed without prior notice to the Department (Southwest District) and approval, except where otherwise authorized by applicable regulations.

XIII. ADVERSE IMPACT (HPS)

The permittees shall take all reasonable steps to minimize any adverse impact resulting from noncompliance with any limitation specified in this certification, including, but not limited to, such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying event.

XIV. RIGHT OF ENTRY (TPS)

The Permittees shall allow DER authorized representatives, upon the presentation of credentials:

- A. To enter upon the Permittees' premises where an effluent source is located or, during business hours, in which records are required to be kept under the terms and conditions of this permit;
- B. To have access to and to make copies of all records required to be kept under the conditions of this certification;
- C. To inspect any monitoring equipment or monitoring method required in this certification and to sample any discharge or pollutants; and
- D. To assess any damage to the environment or violation of ambient standards.
- E. SWFWMD authorized staff, upon proper identification, will have permission to enter, inspect, and observe surface water management facilities and water use facilities in order to determine compliance with the approved plans, specifications, and conditions of this certification.
- F. SFWMD authorized staff, upon proper identification, will have permission to enter, inspect, and observe permitted and related transmission line facilities in order to determine compliance with the approved plans, specifications, and conditions of this certification.
- G. Moreover, the Permittees shall allow authorized representatives of DER and other appropriate agencies, acting within the scope of their jurisdiction and authority, upon the presentation of credentials:
 1. To enter upon the project site or mitigation area, or during business hours to enter the Permittees' premises in which records are required to be kept under the terms and conditions of this certification; and
 2. To have access to and copy all records required to be kept under the conditions of this certification.

XV. REVOCATION OR SUSPENSION (EPS)

This certification may be suspended, or revoked pursuant to Section 403.512, Florida Statutes, or for violations of any Condition of Certification.

XVI. CIVIL AND CRIMINAL LIABILITY (HPS)

This certification does not relieve either permittee from civil or criminal responsibility or liability for noncompliance with any conditions of this certification, applicable rules or regulations of the Department, or Chapter 403, Florida Statutes, or regulations thereunder.

Subject to Section 403.511, Florida Statutes, this certification shall not preclude the institution of any legal action or relieve either permittee from any responsibilities or penalties established pursuant to any other applicable State Statutes or regulations.

XVII. PROPERTY RIGHTS (HPS)

The issuance of this certification does not, unless noted otherwise, convey any property rights in either real or personal property, tangible or intangible, nor any exclusive privileges, nor does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations. The permittees shall obtain title, lease or right of use to any sovereign submerged lands occupied by the plant, transmission line structures, or appurtenant facilities from the State of Florida.

XVIII. SEVERABILITY (HPS)

The provisions of this certification are severable, and, if any provision of this certification or the application of any provision of this certification to any circumstances is held invalid, the application of such provision to other circumstances and the remainder of the certification shall not be affected thereby.

XIX. CERTIFIED SITE (HPS)

The site of the certified power plant is generally depicted in the application. The sites of directly associated transmission line and natural gas pipeline corridors for which certification is granted are generally depicted in the application. Except where noted otherwise, ROWs of linear facilities will be established in the post-certification information submittal and review process in accordance with the conditions of certification.

XX. REVIEW OF SITE CERTIFICATION (HPS)

A. The certification shall be final unless revised, revoked, or suspended pursuant to law. At least every five years from the date of issuance of this certification or any National Pollutant Discharge Elimination Control Act

Amendments of 1972 for the plant units, the Department shall review all monitoring data, including groundwater quality monitoring data, that has been submitted to it or its agent(s) during the preceding five-year period for the purpose of determining the extent of the permittee's compliance with the conditions of this certification and the environmental impact of this facility. The Department shall submit the results of its review and recommendations to the permittees. Such review will be repeated at least every five years thereafter.

XXI. MODIFICATION OF CONDITIONS (HPS)

The conditions of this certification may be modified in the following manner:

- A. The Siting Board pursuant to 403.516(1), Florida Statutes, hereby delegates to the Secretary of DER the authority to modify, upon application by the Permittees and after notice and opportunity for hearing, any conditions pertaining to monitoring; sampling; mixing zone; zone of discharge; surface water, groundwater, and air effluent or emission limitations; variances or exemptions to water quality standards; and transmission lines.
- B. All other modifications shall be made in accordance with Sections 403.516, Florida Statutes.

Replacement of any portion of the gas pipeline, transmission lines, or access roads constructed under this certification necessitated by emergency conditions shall not be considered a modification. A verbal report of any such emergency shall be made to DER as soon as possible. Within 14 calendar days after correction of an emergency which would require the Permittees to perform an activity not in accordance with the conditions of certification, a report to the DER shall be made outlining the details of the emergency and the steps taken for its temporary relief. The report shall be a written description of all of the work performed and shall set forth any pollution control measures or mitigative measures which were utilized or are being utilized to prevent pollution of waters, harm to sensitive areas, or alteration of archaeological or historical resources.

XXII. FLOOD CONTROL PROTECTION (HPS)

The plant and associated facilities shall be constructed in such a manner as to comply with the Bardee County flood protection requirements.

XXIII. EFFECT OF CERTIFICATION (HPS)

Certification and conditions of certification are predicated upon design and performance criteria indicated in the application and explained at the certification hearing. Thus, conformance to those criteria, unless specifically amended, modified, or as the Department and parties are otherwise notified, is binding upon the applicants in the preparation, construction, and maintenance of the certified project. In those instances where a conflict occurs between the application's design criteria and the conditions of certification, the conditions shall prevail.

XXIV. NOISE (TPS)

To mitigate the effects of noise produced by the steam blowout of steam boiler tubes, the permittees shall conduct public awareness campaigns prior to such activities to forewarn the public of the estimated time and duration of the noise.

XXV. ENFORCEMENT (HPS)

A. The Secretary may take any and all lawful actions as he or she deems appropriate to enforce any condition of this certification.

B. Any participating agency (federal, state, local) may take any and all lawful actions to enforce any condition of this certification that is based on the rules of that agency. Prior to initiating such action, the agency head shall notify the Secretary of that agency's proposed action.

XXVI. ENDANGERED AND THREATENED SPECIES (HPS)

Prior to start of construction, the permittee shall survey the site for endangered and threatened species of animal and plant life. Plant species on the endangered or threatened list shall be transplanted to an appropriate area if practicable. Gopher Tortoises and any commensals on the rare or endangered species list shall be relocated after consultation with the Florida Game and Fresh Water Fish Commission. A relocation program, as approved by the FGFWFC, shall be followed.

XXVII. DESIGN AND PERFORMANCE CRITERIA (HPS)

The power plant may be operated at up to 115% of the maximum electrical output at ISO conditions projected from design information without the need for modifying these conditions. Treatment or control facilities or systems installed or used to achieve compliance with the terms and conditions of this certification are not to be bypassed without prior DER approval.

Moreover, the Permittees shall take all reasonable steps to minimize any adverse impacts resulting from noncompliance with any limitation specified in this certification, including, but not limited to, such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying event.

XXVIII. COMPLIANCE (HPS)

Except as otherwise provided herein and in the certification order, and subject to Section 403.511(5), Florida Statutes, construction, maintenance, and operation of the permitted facility shall comply with the applicable nonprocedural rules of all agencies, unless a variance or waiver was obtained as part of the certification process.

XXIX. ROW DELINEATION AND COMPLIANCE VERIFICATION (HPS)

TPS is responsible for compliance with this General Condition with respect to the natural gas pipeline. TEC is responsible for compliance with this condition with respect to the Pebbledale transmission line. SECI is responsible for complying with this condition with respect to the Vandolah and Lee transmission lines.

At least 90 days prior to commencement of construction, three copies of blue-line reproductions of aerial photographs of at least 1:400 scale shall be submitted to DER and one copy to each water management district (insofar as an area within its jurisdiction is involved) delineating the ROW routes selected, boundaries, preliminary pole and pad locations, and access roads. The Permittees shall notify all parties of such filing. These photographs shall be submitted prior to commencement of construction on the various segments of the linear facility; it is recommended that this information be submitted in segments rather than waiting until the entire ROW is acquired. DER, the water management districts, and any other party who requests to do so shall have 30 days from receipt of notice to review the photographs and to call any apparent conflicts with the requirements of the conditions of certification to the Permittees' attention. However, this paragraph shall not operate to avoid the need for post-certification submittals and compliance reviews otherwise required by the conditions of certification.

If DER or any substantially affected party has reason to believe that the construction of the linear facility and access roads within the Permittees' designated ROW cannot be accomplished in compliance with the conditions of certification, the Permittees shall be so notified in writing. Failure of such a notice to be served on Permittees within 30 days from the notice of filing of the various segments in the aerial photographs with DER constitutes acknowledgment that construction of the linear facility and access roads can be accomplished in compliance with the conditions of certification within the designated ROW or the various segments of ROW submitted for review.

The acquisition of a particular ROW or the expenditure of funds toward acquisition of a particular ROW prior to post-certification review pursuant to this condition will be at the Permittees' risk, and no party will be estopped by such acquisition to seek disapproval of the construction of the linear facility or access roads within the ROW in accordance with these conditions of certification.

XXX. DISPUTE RESOLUTION (HPS)

If a situation arises in which mutual agreement cannot be reached between the Permittees and an agency exercising its regulatory jurisdiction, then the matter shall be immediately referred to the Division of Administrative Hearings (DOAH) for disposition in accordance with the provisions of Chapter 120, Florida Statutes. A hearing under Section 120.57, Florida Statutes, shall be held within 30 days after its referral to DOAH. The hearing officer shall issue the decision 30 days after the termination of such hearing. All exceptions to the hearing officer's order shall be filed with the Governor and Cabinet within 10 days of the issuance of such order. The Governor and Cabinet shall issue a decision within 30 days of the filing of the exceptions.

XXXI. POST-CERTIFICATION SUBMITTALS (HPS)

Conditions of certification which provide for the post-certification submittal of information to agencies by the Permittees are intended to allow the agencies to monitor the effects arising from the location of the natural gas pipeline and transmission line rights-of-way and the construction and maintenance of the permitted activities to thereby assure continued compliance with state water quality requirements, other agency nonprocedural rules and standards, and the conditions of certification, without any further government action.

XXXII. TRANSMISSION (TEC and SECI) AND PIPELINE (TPS) ROWs

A. Construction

1. The Permittee shall avoid impacting wetlands within all certified corridors wherever practicable. When necessary and feasible, the location of the span between power poles shall be maximized or varied to eliminate or reduce wetland impacts.

2. The Permittee shall, wherever practicable, utilize adjacent existing public roads for access to the ROW for construction, operation and/or maintenance purposes.

3. The Permittee shall consult with the Bureau of Wetland Resource Management prior to final determination of the access road locations, (including those not located on the ROW), tower locations, and construction techniques which are to be reflected on any post-certification review information submittals. At DER's request, the Permittee shall conduct field inspection with staff of this agency.

4. Prior to clearing activities within any of the ROW associated with the various linear facilities, an ecological survey shall be conducted to identify the presence of threatened or endangered species (plant and animals) as defined in the application, likely to occur in the ROW based on range and habitat. This survey shall also identify the location of any wading bird colonies. Results of this survey shall be submitted to the DER and the Florida Game and Freshwater Fish Commission (FGFWFC) and the United States Fish and Wildlife Service (USFWS). If any clearing activity will take place in or otherwise adversely affect jurisdictional wetlands, survey results will also be submitted to the appropriate water management district. If it is determined that any of these species will be affected by the construction of any of the linear facilities, the Permittee shall consult with DER and FGFWFC to determine the appropriate steps to be taken to avoid, minimize, mitigate, or otherwise appropriately deal with, any adverse impacts within each agency's respective jurisdiction.

5. After all ROWs have been selected, the Permittee shall conduct a survey of archaeological sensitive areas, as determined in consultation with the Department of State, Division of Historical Resources, where they are crossed by the ROW. This report shall be submitted to DER. If practicable, sites considered to be eligible for the National Register shall be avoided during construction of the linear facilities, and subsequently during maintenance of the ROWs. For any other significant site, Permittee shall consult with DER to determine appropriate action. If avoidance is not practicable, impact shall be mitigated through archaeological salvage operations or other methods acceptable to DER.

6. All materials used for any purpose related to the construction of the transmission lines or other linear facilities shall come from fill sources in compliance with applicable local ordinances. No fill materials shall be obtained from excavated wetlands within the ROW unless authorized by DER and appropriate water management district in accordance with a mitigation plan submitted in compliance with certification.

7. The Permittee shall provide mitigation/compensation (M/C) for any wetland or open water habitat within the jurisdiction of DER or WMD which is degraded or destroyed as a result of the construction of any portion of the transmission lines, natural gas pipelines, or power plant facilities. M/C may include the creation of new wetland or openwater habitat, the restoration of degraded habitat, the enhancement of functions and values provided

by existing wetland or openwater habitats, removal of exotics, or other activities found by the relevant agencies and appropriate local government to be in compliance with their applicable regulations. Prior to the elimination or degradation of any such wetland or openwater habitat, the Permittee shall concurrently submit mitigation plans to DER, Bureau of Wetland Resources Management and the appropriate water management district. These mitigation plans shall, at a minimum, include the following:

- (a) Specific acreage figures, descriptions and locations of all jurisdictional wetlands, both within the ROW as well as adjacent to it which would be impacted by the construction or ROW maintenance activities, including an explanation of why no feasible alternative exists which would avoid impact to these wetlands;
- (b) A discussion and a detailed set of plan-view and cross-sectional drawings of the proposed M/C activities to be undertaken, including the location of all M/C areas and a description of the manner in which these areas will be created, restored or otherwise enhanced. Success standards will be determined based on the functional values of wetlands impacted and created. The Permittees will work with the appropriate agency staff to establish success criteria. The M/C plans proposed by Permittees shall be submitted concurrently to DER and the appropriate water management district for review and compliance monitoring.
- (c) A timetable for accomplishing the proposed M/C activities (i.e., the time for commencement and completion of activities for each mitigation area) concurrently with the construction of the various aspects of proposed facilities and any associated wetland impacts.
- (d) A monitoring and maintenance program including success criteria, to ensure the survival and success of any created, restored, or enhanced wetlands.

8. M/C plans must be found to fully compensate for the functions and values provided by wetlands that will be degraded or eliminated. DER and WMDs will work with the permittee in the development of acceptable mitigation plans. The mitigation plans proposed by the permittee shall be submitted for review and compliance monitoring to DER and the appropriate water management district and such review shall be subject to the time constraints set forth in specific Conditions XXXII. 9., and XXXV. C. below, as appropriate.

9. For all construction activities in waters of the State where DER has wetland resource protection jurisdiction pursuant to Chapter 403, Florida Statutes, the Permittees shall file with DER, Office of Siting Coordination and Bureau of Wetland Resource Management the information described in Florida Administrative Code Rule 17-17.665 and 17-1.212(1), Section 3.2.2.

- (a) - DER shall promptly review the submittal for completeness and sufficiency. If the submittal is found to be incomplete or insufficient, Permittee shall be so notified. Failure to issue such a notice within 30 days after filing of the submittal shall constitute a finding of completeness and sufficiency.
- (b) Within 90 days filing complete and sufficient information, DER shall determine whether there is reasonable assurance of compliance with applicable substantive agency regulations as required by the conditions of certification if the plans are executed as filed. If it is determined that reasonable assurance has not been provided, the Permittee shall be notified with particularity and possible corrective measures suggested. Failure to notify Permittee in writing within 90 days of receipt of a complete information submittal shall constitute a compliance verification.
- (c) If DER does not object within the time period specified, Permittee may begin construction pursuant to the terms of the conditions of certification and the subsequently submitted construction details and DER shall provide to the Corps of Engineers a letter indicating that the full requirements of this condition have been met and the water quality certification for the purposes of 33 USC Section 1341 is thereby conveyed.
- (d) Permittee, at its option, may submit information for different wetlands modification activities at different time intervals. Each submittal shall be processed by DER separately.

10. Semi-annual narrative reports shall be submitted to DER's Bureau of Wetlands Resource Management in Tallahassee and DER's Southwest District Office, indicating the status of all construction activities within waters of the State. These reports shall be submitted until all construction in that respective area is complete. The reports include the following information:

- (a) Date the activity (dredge and fill) began; if work has not begun on-site, please so indicate.
- (b) Brief description and extent of work completed since the previous report.
- (c) Brief description and extent of work anticipated in the next six months.

11. Upon completion of construction, the permittee shall provide DER with detailed engineering drawings which depict the pre and post construction contours in all areas in which construction occurred in waters of the State.

12. During construction all Brazilian Pepper, Australian Pine, and melaleuca in each ROW shall be removed or the trees cut and

the stumps treated with an approved herbicide consistent with these conditions. A plan for removal and disposal of such exotic species which minimizes seed dispersal shall be developed by the Permittee in consultation with DER. The Permittee shall abide by the plan.

13. Following construction, a plan for maintenance and control of Brazilian Pepper, Australian pine, and melaleuca within the ROWs shall be developed by the Permittee in consultation with DER. The Permittee shall abide by the plan.

14. The Permittee shall perform the work authorized under the certification in a manner so as to minimize any adverse impacts on fish, wildlife, native vegetation, natural environmental valued, water resources, and water quality.

15. The Permittee shall develop a water quality monitoring program to measure the turbidity generated by construction in all open waters to be crossed by the proposed natural gas pipeline. This program shall be developed in coordination with the Bureau of Wetland Resource Management of the Department prior to the commencement of construction.

16. The Permittee shall be responsible for the correction of any water quality problems that result from the construction, operation and/or maintenance of works authorized under this certification. The Permittee will work with DER to determine additional methods necessary to ensure that State Water Quality Standards are not violated as a result of construction.

17. Where necessary to prevent secondary impacts to adjacent wetlands during construction, adjacent wetland areas outside of the limits of construction shall be isolated from the construction area by silt fences. These silt containment devices shall be maintained and remain in place until all construction is complete and all associated side slopes or areas denuded of vegetation have been adequately stabilized. The Permittee shall be responsible for explaining the significance of these barriers to all construction personnel prior to construction. The Permittee shall use turbidity control as necessary so that turbidity levels in adjacent areas do not exceed 29 N.T.U.'s above natural background. Any placement of fill or encroachment into jurisdictional wetlands or waterbodies outside the limits of construction shall be immediately reported to DER, Southwest District Office in Tampa, and the Bureau of Wetland Resource Management in Tallahassee. Appropriate remedial action to restore the affected area shall be immediately undertaken.

18. In addition to the erosion and turbidity control measures specified above, best management practices, including but not limited to the use of floating silt screens in flowing waters, as well as the use of staked hay bales and silt curtains shall be used wherever necessary at all times during project construction. These erosion and turbidity control devices shall be regularly inspected and maintained when necessary. These devices shall remain in place until all construction is complete

and all fill side slopes or denuded areas have been stabilized with suitable vegetation.

19. No dewatering operation shall be allowed unless the Permittee can provide reasonable assures to DER or WMD that no unauthorized adverse, off-site water resource impacts will occur as a result of the construction operation, and/or maintenance of the project.

B. Operation

1. Ground vehicles to be used in wetlands for maintenance access shall be low ground pressure vehicles unless limited to the access roads and structure pads.

2. Only EPA approved herbicides may be used in Waters of the State, or the use of other herbicides in any areas of the ROW, shall only be allowed with the concurrence of DER.

XXXIII. MINE RECLAMATION (SECI)

A. General Conditions to Approval of the AGR-PC-CPC
Conceptual Plan Modification and AGR-PC-PC1 LRU
Applications

1. Approval of these applications shall not constitute a statement, admission or waiver by the State of Florida concerning the ownership of any interest in lands within the conceptual plans.

2. In restoring drainage patterns, the DNR and Agrico and its successors reserve the right to reexamine, in each stage of reclamation and restoration program application, the placement and configuration of the lakes, streams, wetlands, and watersheds which have been proposed in the conceptual plan, to assure that the natural functions of the lakes, streams, and wetlands are restored in accordance with the provisions of the then-existing standards and criteria of Chapter 16C-16, F.A.C.

B. Specific Conditions to Approval of the AGR-PC-CPC
Conceptual Plan Modification and AGR-PC-PC1 LRU
Applications

1. SECI and its successors shall assure that vegetation adversely affected by cooling water, prior to release of the wetlands, within the reservoir's zone of fluctuation shall be replaced in accordance with subparagraph 16C-16.0051(9)(d)1., F.A.C. A monoculture of nuisance species will not be an acceptable form of herbaceous vegetation in reclamation. Exotic species will be controlled within the cooling reservoir until the waterbody and its associated herbaceous wetlands are completely released of the reclamation obligation.

2. Agrico and its successors shall perform the proposed compensation in compliance with reclamation standards detailed in Chapter 16C-16, F.A.C. Should the operator proposed a reduction

in wetland or upland forest to be vegetated within the AGR-PC-PC1, AGR-PC-PC2, and AGR-PC-SP(2) LRUs; the bureaus will review the reduction considering the impacts to the intent of the waiver of paragraphs 16C-16.0051(5)(a and b), F.A.C., and the approved mitigation.

3. SECI and its successors shall insure that the water quality conditions of AGR-PC-PC1 meet the water quality requirements of the Hardee Power Plant Site Certification Order.

XXXIV. DIVISION OF FORESTRY (SECI)

SECI shall consult with the Division of Forestry (DOF) to locate the proposed HPS - Lee Substation 230 kV transmission line as far from the DOF's Punta Gorda Work Station as practicable or maintain at least a 250 foot separation between the line and DOF facilities.

XXXV. PROJECT SURFACE WATER AND STORMWATER MANAGEMENT FACILITIES (HPS)

Permittees shall be responsible for the construction, operation, and maintenance of the surface water management systems and stormwater facilities installed for the project. TPS is responsible for compliance with this specific condition in regard to the power plant and natural gas pipeline. TEC is responsible in regard to the Pebbledale transmission line. SECI is responsible in regard to the Vandolah and Lee transmission lines.

A. General.

1. Permittees Confirmation.

The operational phases of the surface water management systems authorized under this certification shall not become effective until the Permittees confirm in writing, upon completion of each phase, that these facilities have been constructed consistent with the conditions of certification. Such confirmation shall include a certification by an engineer (practicing in the State of Florida, having the appropriate experience in surface water management design and construction, and in compliance with Chapter 471, Florida Statutes, unless exempt thereunder), that the facilities have been constructed in accordance with the approved project design. Within 30 days after completion of construction of each phase of the surface water management system, the Permittees shall submit the confirmation, including "as-built" construction drawings with the engineer's certification and a description of any deviations; and notify the water management district that the facilities are ready for inspection for consistency with the conditions of certification and information submitted hereunder.

2. Minimum Standards.

This certification is predicated on Permittees' submitted information to SWFWMD and SFWMD which reasonably demonstrates that adverse off-site water resource related impacts will not be caused by the authorized activities. The plans, drawings, and design specifications submitted shall be considered minimum standards for compliance.

3. Post-Certification Information Submittals.

Information submitted to the water management districts subsequent to certification, in compliance with the conditions of this certification, shall be for the purpose of water management district monitoring and confirming compliance with the conditions of certification and the criteria contained in 40D-4 and 40E-4 (Surface Water Management), Florida Administrative Code, as applicable, prior to the commencement of the subject construction, operation and/or maintenance activity, covered thereunder.

4. Liability.

Permittees shall hold and save SWFWMD and SFWMD harmless from any and all damages, claims, or liabilities which may arise by reason of the construction, operation, maintenance and/or use of any facility authorized by this certification, to the extent allowed under Florida law.

5. Enforcement.

Authorized representatives of the SWFWMD and SFWMD shall be allowed reasonable escorted access to the project site and any authorized off-site mitigation/compensation areas to inspect and observe any activities associated with the project construction and/or the operation and/or maintenance of the surface water management system(s) and stormwater facilities in order to determine compliance with the conditions of this certification.

6. Monitoring.

Post-certification monitoring requirements may be determined and specified as a result of technical review of construction information, where necessary, to demonstrate compliance with water management district regulations. If monitoring data is required by SWFWMD or SFWMD in conjunction with post-certification review, it shall be submitted to the respective water management district and the DER. Parameters to be monitored may include those listed in Chapter 17-302, Florida Administrative Code. Permittees also shall, if required, provide data to SWFWMD or SFWMD regarding: construction, operation, and maintenance of surface water management systems; NGVD levels; volumes and timing of water discharged, including total volume discharged during period of sampling and total discharges from the property. Environmental monitoring may also be required in conjunction with wetlands compensation/mitigation.

B. Construction Conditions.

This project must be constructed in compliance with and meet all applicable requirements set forth in Chapter 373, Florida Statutes, and Chapters 40D-4 and 40E-4, Florida Administrative Code, as applicable.

C. Project Informational Requirements.

1. General.

a. At least 90 days prior to the commencement of construction of any portion of the project for which additional information is required under Condition XXXV.C.2. below, for that portion proposed for construction, the Permittees shall submit such information to SWFWMD or SFWMD staff, as applicable, for a completeness and sufficiency review. If the water management district staff does not issue a written request for additional information within 30 days of receipt of the information, the information will be deemed to be complete and sufficient.

b. Within 60 days of the determination by SWFWMD or SFWMD staff that the additional information is complete and sufficient, the water management district shall determine and notify the Permittees in writing whether the proposed activities conform to applicable criteria in Chapters 40D-4 and 40E-4, Florida Administrative Code, and the conditions of certification. If necessary, the water management district shall identify what items are in need of clarification. Construction activities which impact works of the water management district or have surface water management impacts shall not begin until the water management district has an opportunity to assure that the activities are in compliance with the applicable water management district rule criteria and conditions of site certification, either in writing or by failure to notify the Permittees in writing.

c. Subsequent modifications to the drawings and supporting calculations submitted to SWFWMD or SFWMD which may significantly alter the quantity and/or quality of waters discharged off site shall also be submitted to the respective water management district for a determination that the modifications are in compliance with Chapters 40D-4 or 40E-4, Florida Administrative Code, as appropriate, prior to the commencement of construction. However, minor deviations from construction plans deemed necessary in the field including, but not necessarily limited to, changes in the number, size, and location of culverts and other structures, shall be allowed.

d. The respective water management districts and the Permittees may mutually agree to vary the information requirements.

2. Surface Water Management.

Prior to the commencement of construction of any portion or phase of the project which may obstruct, divert, control, or impound waters of the state, such construction must be reviewed by the water management district with jurisdiction for a determination of compliance with Chapters 40D-4 or 40E-4, Florida Administrative Code and the conditions of certification, as appropriate. "Construction" activities for which such review is required includes but is not limited to, installation of all surface water and stormwater management facilities, the placement of structure pads, dredging and filling, the installation of access/maintenance roads and culverts and fill materials, wetlands mitigation/compensation and related activities in circumstances where a permit from the water management district would ordinarily be required under applicable rules. For all construction activities, the applicable information requirements of Chapters 40D-4 and 40E-4, Florida Administrative Code, shall be submitted as may be appropriate. The Permittee shall submit to SWFWMD erosion control plans for the HPS construction project (or discrete phases of the project) detailing measures to be taken to prevent the offsite discharge of turbid waters during construction. These plans must also be provided to the construction contractor prior to the initiation of construction. For all construction activities related to linear facilities, the following information shall be provided at a minimum:

- a. A centerline profile of existing topographic features along the proposed access/maintenance road(s) sufficient to show contours and drainage patterns;
- b. Construction plans and designs of the proposed access/maintenance and finger road(s) with elevations and dimensions shown;
- c. Typical cross-sections of the proposed access/maintenance and finger road(s);
- d. Cross-section(s) of each wetland, stream or creek at the points to be crossed by the access/maintenance and finger road(s) or other construction;
- e. Specifications showing the location of each linear facility structure, finger and maintenance/access road, and culvert to be constructed, including all areas to be filled or excavated;
- f. Specifications, including supporting assumptions and calculations, showing the type and size of water control structures (ditch, culvert, equalizer, etc.) to be used, with proposed flowline elevations marked, drainage areas identified and design capacity verified;
- g. A cross-section of all proposed fill/excavation areas, with the exception of fill/excavation directly associated with transmission line support poles, showing the proposed depth;

h. Identification of wet season water table elevations for each basin affected by construction.

3. In addition to the requirements of Section 2 above, specific detailed information shall be provided by the Permittees before, during and after construction which will be required to be submitted to the appropriate water management district to demonstrate compliance with recognized standards for reservoir and dam design, safety, construction, operation, and maintenance. The Permittees shall develop technical criteria and requirements which represent commonly recognized and accepted engineering and technical standards for reservoir and earthen dam design, safety, construction, operation, and maintenance. The criteria or standards shall be submitted to the District prior to final design of the dam and reservoir for consideration in accordance with the information submittal and review process outlined in the conditions of certification.

4. The Permittee shall employ culverts or other appropriate techniques and implement suitable maintenance practices where necessary to comply with the applicable regulation of the applicable WMD or DER and to maintain existing drainage patterns, hydroperiods, and sheetflow along the ROWs. The exact number, spacing, diameter, orientation, and length of culvert necessary to maintain existing hydrologic conditions and to maintain surface water flow conditions in the area shall be determined by the Permittee in consultation with applicable WMD or DER based on site-specific information. This information shall be submitted to SFWMD or SWFWMD as applicable for approval prior to construction to ensure that the culverting or other appropriate techniques meets applicable standards within all affected wetlands areas.

XXXVI. WEBB WILDLIFE MANAGEMENT AREA (SECI)

A. Parties to Agreement

Florida Game & Fresh Water Fish Commission (Commission) and Seminole Electric Cooperative, Inc., (Seminole) are parties to the following agreement relating to the location of a ROW in the Cecil M. Webb Wildlife Management Area as generally depicted in Exhibit A.

B. Conditions of Agreement

This Agreement shall bind the parties hereto and their assigns and successors in interest, provided however, that this Agreement is contingent upon the following:

1. Issuance of a Site Certification Order by the Siting Board in accordance with the terms of this Agreement,

2. Approval of this Agreement by the Board of Trustees of the Internal Improvement Trust Fund, in accordance with section 372.023, Florida Statutes.

3. Approval of this Agreement by the United States Department of the Interior, Fish and Wildlife Service, in accordance with the provision of the Federal Aid in Wildlife Restoration Act and regulations promulgated thereunder.

4. Approval of the Hardee Power Station Project by the United States Rural Electrification Administration.

C. Actions by Seminole

Upon satisfaction of the conditions listed in paragraph XXXVI. B. hereof, Seminole shall allocate the sum of \$1,025,000 (One million, twenty-five thousand dollars) to be expended for the purchase of the 427 acres, more or less, adjacent to the Webb WMA (Hall Acquisition), as shown in Exhibit B. Fee simple title to the Hall Acquisition shall be conveyed to the Commission, by warranty deed, no later than one hundred and twenty (120) days following the granting of an easement of the Commission for the transmission line ROW, or following receipt of all of the approvals listed in paragraph 5, below, whichever is later. Cost of closing, including title insurance and survey, shall be borne by Seminole.

D. Actions by Commission

Contingent upon paragraph XXXVI. B. hereof, the Commission shall, no later than thirty (30) days following issuance of site certification by the Siting Board, execute and deliver to Seminole a ROW easement for the area described and depicted in Exhibit A, which easement shall convey to Seminole the right and privilege to construct, operate, and maintain the proposed 230 kV transmission line for such period of time as Seminole may use the line or until use thereof is abandoned; this right shall include the right to construct, operate, and maintain necessary communication and other wires, poles, guys, anchors, ground connections, attachments, fixtures, equipment, and accessories in connection with the Lee Transmission Line over, upon and across the ROW in the Webb WMA. The Commission and Seminole reserve the right to mutually agree to minor adjustments in the final ROW location depicted in Exhibit A. Said easement shall also grant Seminole the right to patrol, inspect, alter, improve, repair, rebuild, or remove the Lee Line equipment and accessories, including the right to trim, cut and clear such trees, limbs, and undergrowth along the line and trees adjacent thereto as may endanger the proper operation thereof, including the reasonable right to enter upon lands of the Commission for the purpose of exercising the rights therein granted. The Commission covenants that it has the right to convey said easement, and that Seminole, its successors and assigns shall have quiet and peaceful possession, use and enjoyment of the easement for the consideration set forth in paragraph C. above.

E. Joint Conditions (SECI)

1. The transmission line right-of-way (ROW) in Cecil M. Webb Wildlife Management Area (Webb WMA) shall generally follow the route described and depicted in Exhibit A, and shall, except

where specifically agreed to by the Commission, directly adjoin the property boundary of the Webb WMA.

2. Yellow aviation markers balls or their equivalent shall be placed on each of the two groundwires at 100 foot intervals in a staggered fashion in any area, identified by the Commission, and as shown generally on the transmission line location map contained in Exhibit A, where bird collisions are reasonably possible. Final locations of marker balls may be adjusted depending upon field surveys.

3. Single pole transmission structures shall be utilized in the area of the I-75/Tucker's Grade interchange as generally depicted in Exhibit A, the ROW in this area shall not, absent Commission approval, exceed 75 (seventy-five) feet in width.

4. Seminole shall install and, in conjunction with the Commission's prescribed burning plans for the Webb WMA, annually (by November 1 of each year) maintain fire lanes, (which may include the access road) no less than 15 feet in width, along and within the ROW boundary.

5. Seminole shall control vegetation in the ROW as dictated by fire safety consideration; provided, however, that no herbicides shall be used in the Webb WMA without written approval of the Commission.

6. Seminole shall coordinate with Commission personnel during any prescribed burns so as to minimize the possibility of interference between use of the ROW by Seminole and the prescribed burning activities of the Commission.

7. Seminole shall control exotic vegetation species such as Melaleuca and Australian Pine within the ROW during the construction process, in coordination with the Commission personnel.

8. Seminole shall install gates with high security locks at the entrance and exit of the ROW through the Webb WMA, and at all interior fences crossed by the ROW, in order to prevent unauthorized user access.

9. Seminole shall protect all affected Commission boundary and interior fences during construction and utilization of the ROW, and shall be responsible for all fence repairs necessitated by utilization of the ROW.

10. To the extent necessary to maintain the natural flow of water through the ROW, Seminole shall, in consultation with the Commission, install culverts or such other water control structures as may be required.

11. Seminole shall coordinate with the FGFWFC to assure that construction and maintenance of the transmission line and its right-of-way on the Webb Wildlife Management Area shall, to the extent practicable, be conducted in a manner which does not interfere with public hunting or other recreational use of the

area. Activities occurring during established hunting seasons for the area shall, in consultation with the FGFWFC, be scheduled and coordinated in order to avoid interference with public use or hazards to area users or Seminole employees or agents.

XXXVII. PEACE RIVER (SECI) AND EAGLES NEST (TEC) RESTRICTIONS

A. In the area of the Peace River floodplain, west of the City of Arcadia, the Lee transmission line ROW shall be located in a manner which avoids those areas designated as Zone "A" on Exhibit C, attached hereto. In addition, to the extent practicable, the ROW shall avoid those areas designated as Zone "B" on the attached Exhibit C. To the extent avoidance of areas designated as Zone "B" is impracticable, SECI shall take all reasonable measures to avoid or minimize the loss or modification of wildlife habitat in such areas.

B. Within the proposed corridor for the Hardee Power Station to Pebbledale substation transmission line, adjacent to Polk County Road 663, in Township 32 South, Range 23 East, Section 1, the 150 foot ROW shall be located a minimum of 750 feet from the eagle's nest as shown on the attached Exhibit D.

XXXVIII. CHARLOTTE COUNTY CONDITIONS (SECI)

A. The Lee transmission line shall span Shell Creek without emplacing transmission line structures within the minimum buffer zone required by Section 5.A. of Ordinance No. 89-53. Moreover, the Lee transmission line shall comply with the upland buffer zone requirement set forth at Section 7.B. of Ordinance No. 89-54. The natural vegetative buffer adjacent to Shell Creek shall be managed in accordance with environmentally acceptable techniques given the site specific conditions of the transmission line ROW.

B. The Permittees shall perform the work authorized under the certification in a manner so as to minimize any adverse impact of the work on fish, wildlife, and water quality. The Permittees shall institute necessary measures during the construction period, including necessary compaction of any fill material placed around newly installed structures, to reduce erosion, turbidity, nutrient loading and sedimentation in the receiving waters.

C. The Permittees shall be responsible for the correction of any sedimentation, turbidity, erosions, and/or shoaling problems that result from the construction, operation and/or maintenance of the project.

D. It is the responsibility of the Permittees to provide reasonable measures to assure that unauthorized adverse off-site water resource related impacts do not occur during construction, operation and/or maintenance of the project.

E. The Permittees shall, where practicable, utilize adjacent existing roads for access to the linear facility ROWs for construction, operation and/or maintenance purposes.

F. Access road construction in Charlotte County shall include culverts as necessary and feasible to preserve pre-construction hydric flows.

XXXIX. DESOTO COUNTY CONDITIONS (HPS)

A. Seminole Electric Cooperative, Inc. shall comply with DeSoto County Ordinance No. 87-19, Sec. 2-6.

B. Consistent with sound transmission line design and ROW location practices, the Lee and Vandolah transmission lines shall be located and constructed in a manner that minimizes impacts on adjacent land uses. To the extent feasible, Permittee shall locate the ROWs so as to avoid the taking of homes.

XL. HARDEE COUNTY CONDITIONS (SECI)

A. The Hardee Power Station and all associated facilities shall be operated in conformance with the substantive performance standards set forth in Section 2.13 of Hardee County Ordinance No. 82-2.

B. Consistent with sound transmission line design and ROW location practices, the Lee and Vandolah transmission lines shall be located and constructed in a manner that minimizes impacts on adjacent land uses. To the extent feasible, Permittee shall locate the ROWs so as to avoid the taking of homes.

XLI. LEE COUNTY CONDITIONS (SECI)

A. After Lee County portions of the Lee transmission line ROW have been selected, following certification of the corridor and prior to any project related land clearing or ground disturbing activities, any level two archaeological areas crossed by the ROW, as identified in An Archaeological Site Inventory and Zone Management Plan for Lee County, Florida (1987), will be subjected to a professional archaeological survey. Prior to conducting this survey, SECI's project archaeologist will consult with Lee County staff and coordinate regarding appropriate field methodology. The survey report shall be forwarded to the Lee County Department of Community Development. If avoidance is not feasible, SECI shall mitigate impacts through archaeological salvage excavation or by other methods acceptable to Lee County.

B. New access roads providing entry into previously inaccessible areas of Lee County north of Cape Coral shall be gated, if the owner of the subject property consents.

C. Access road construction within wetlands regulated under the Lee County Wetlands Protection Ordinance shall be at grade where feasible; culverts shall be included as necessary and feasible to preserve preconstruction hydric flows.

D. Where not inconsistent with restraints imposed under the Lee County Protected Species Ordinance, as many shrubs as practicable shall be retained within the Lee County portion of the Lee transmission line ROW.

E. The Lee transmission line ROW shall be sited, to the extent feasible, so as to avoid scrub inhabited by Florida scrub jays near the Lee substation.

F. After portions of the Lee transmission line ROW in Lee County, north and east of Cape Coral, have been selected, following certification of the corridor and prior to any project related land clearing or ground disturbing activities, the ROW will be surveyed for plant and animal species of special concern, and threatened or endangered species as identified in the Protected Species Ordinance (No. 89-29). Prior to conducting this survey, SECI's project biologist will consult with Lee County staff and coordinate regarding proper survey areas and methodology. The resulting survey report shall include aerial depictions of appropriate FLUCCS registers, transects walked and applicable visibility limits, and locations of sitings within the ROW. The survey report shall also include tables indicating the percentage of the area surveyed, calculated densities and abundance, dates and times the survey was conducted, and the name(s) of the surveyor(s). The survey report shall be submitted to Lee County's Department of Community Development. If listed species are determined to be present within the Lee transmission line ROW, SECI shall consult with the Lee County Department of Community Development to determine whether appropriate steps need to be taken to minimize and/or mitigate for any adverse impacts.

XLII. ROAD CROSSINGS CONDITIONS (TPS)

A. All crossings of highways, streets, and roads shall be as nearly perpendicular to, and all transmission line structures shall be as far from, state, county, and city road ROW's as practicable, while still maintaining proper road clearance, in order to allow future widening of those roads.

B. In accordance with Section 403.509(3), Florida Statutes, within 30 days of entry of certification, DOT and cities and counties that are parties to this proceeding shall issue any required permits or other approvals required for use, connection to, or crossing of highways, streets, and roads.

C. For all locations where permits or other approvals to use, cross, or connect to county or city highways, streets, or roads are required generally for transmission lines and access roads, the applicant shall submit the applicable and required information to the county or city engineer 30 days prior to construction so that the county or city may monitor compliance with applicable requirements. The permittee shall comply with all applicable nonprocedural county or city regulations pertaining to roadway crossings or connections by transmission lines and access roads.

D. For all locations where the transmission line will cross state highways, the applicant shall submit the data requested pursuant to the Department of Transportation's (DOT) "Utility Accommodate Guide" to DOT within 30 days prior to starting construction for a particular crossing. The permittee shall comply with the criteria in the Utility Accommodation Guide and with all applicable regulations pertaining to roadway crossings by transmission lines, including these conditions of certification, unless the DOT and the permittee agree to change those requirements for good cause shown.

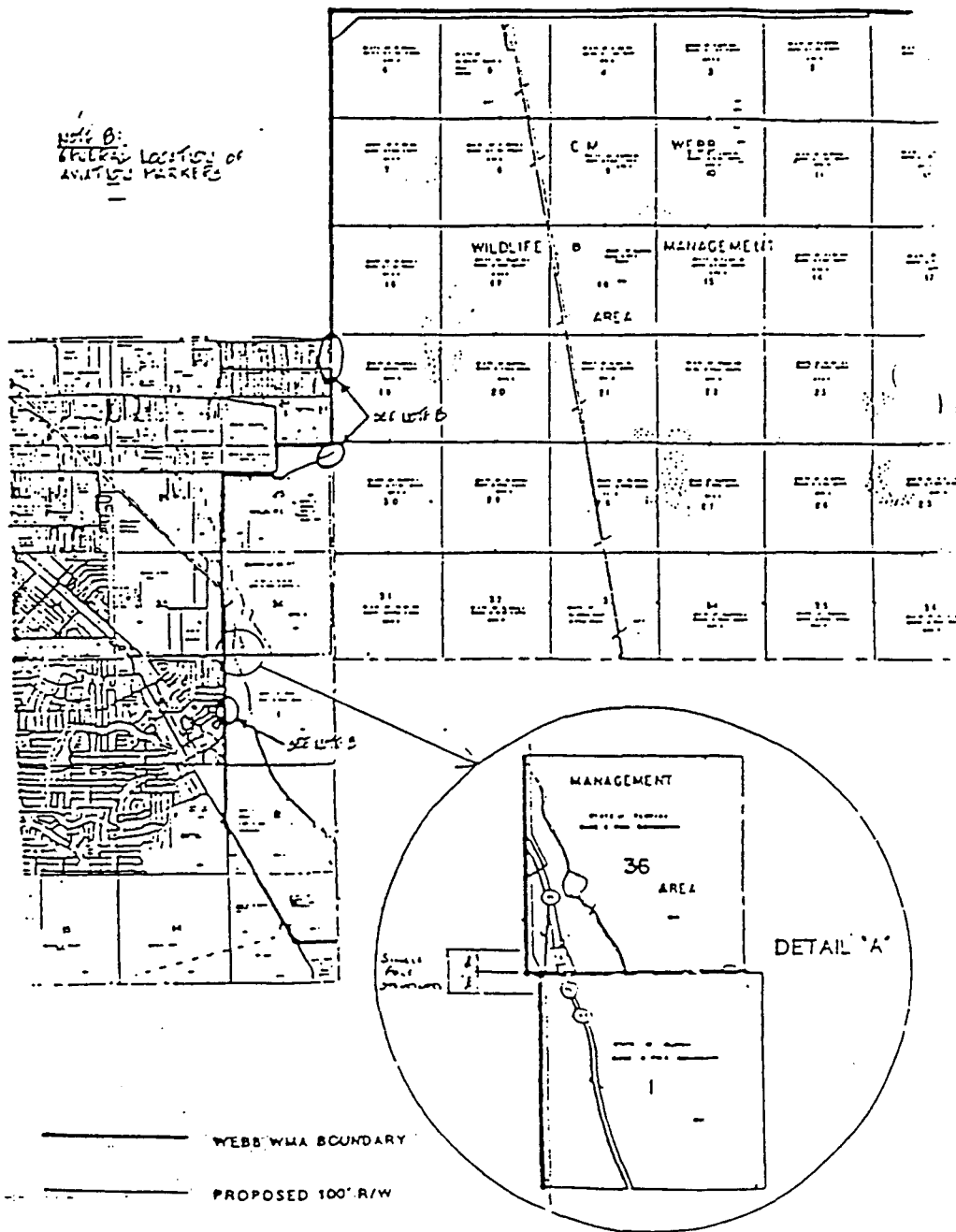
Image Quality

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

EXHIBIT A

TRANSMISSION LINE LOCATION MAP

(NOT TO SCALE)



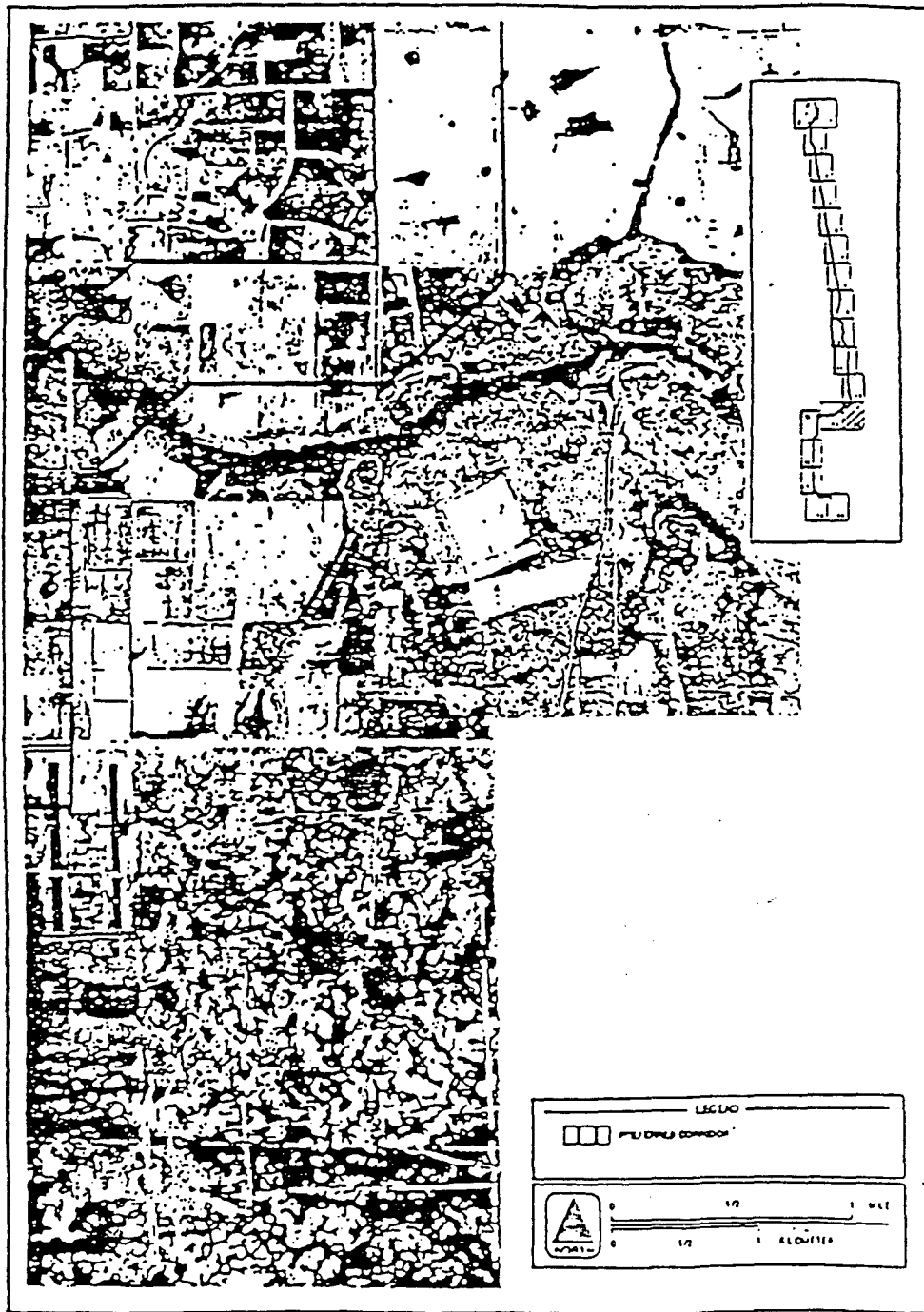
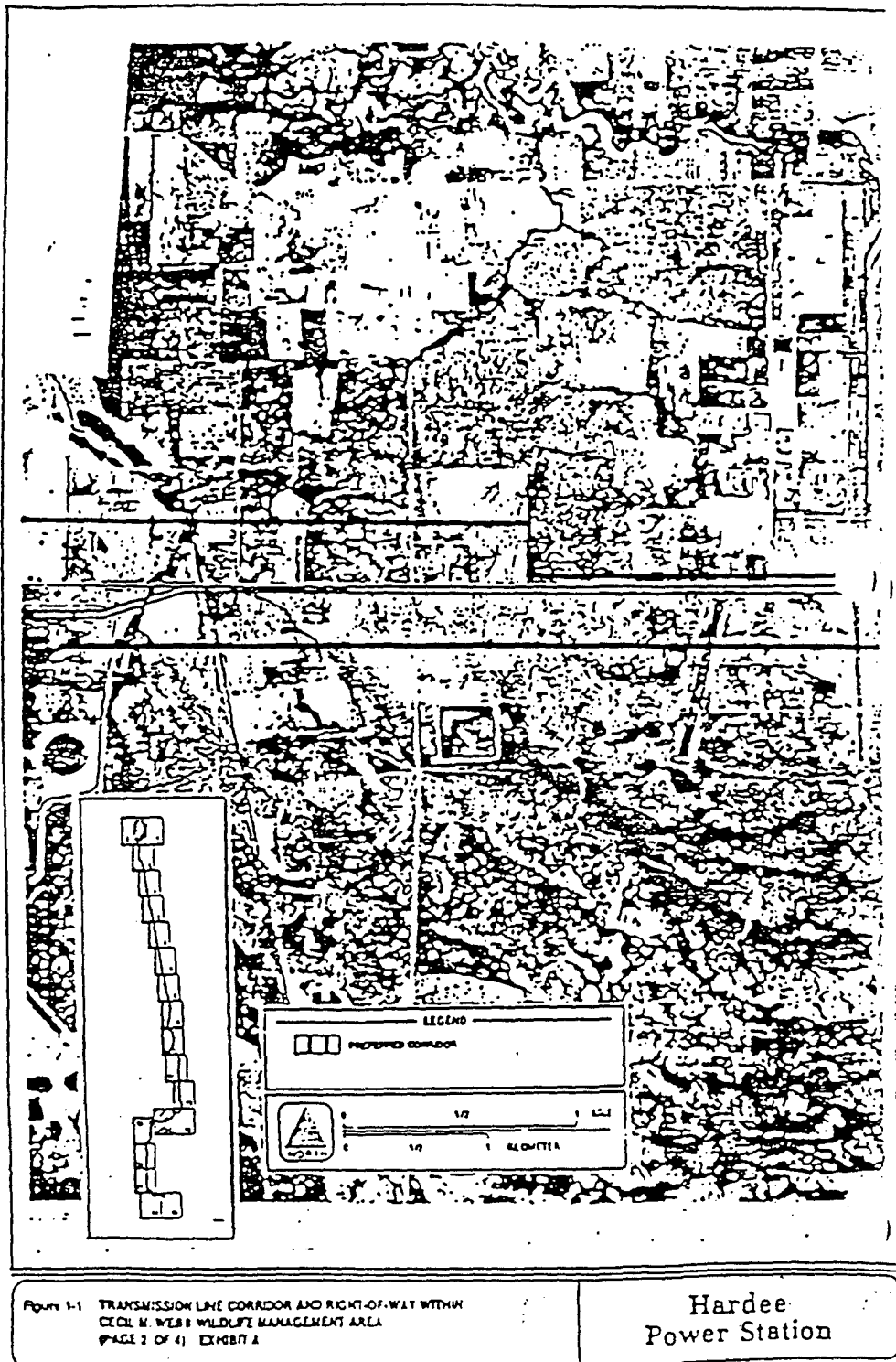
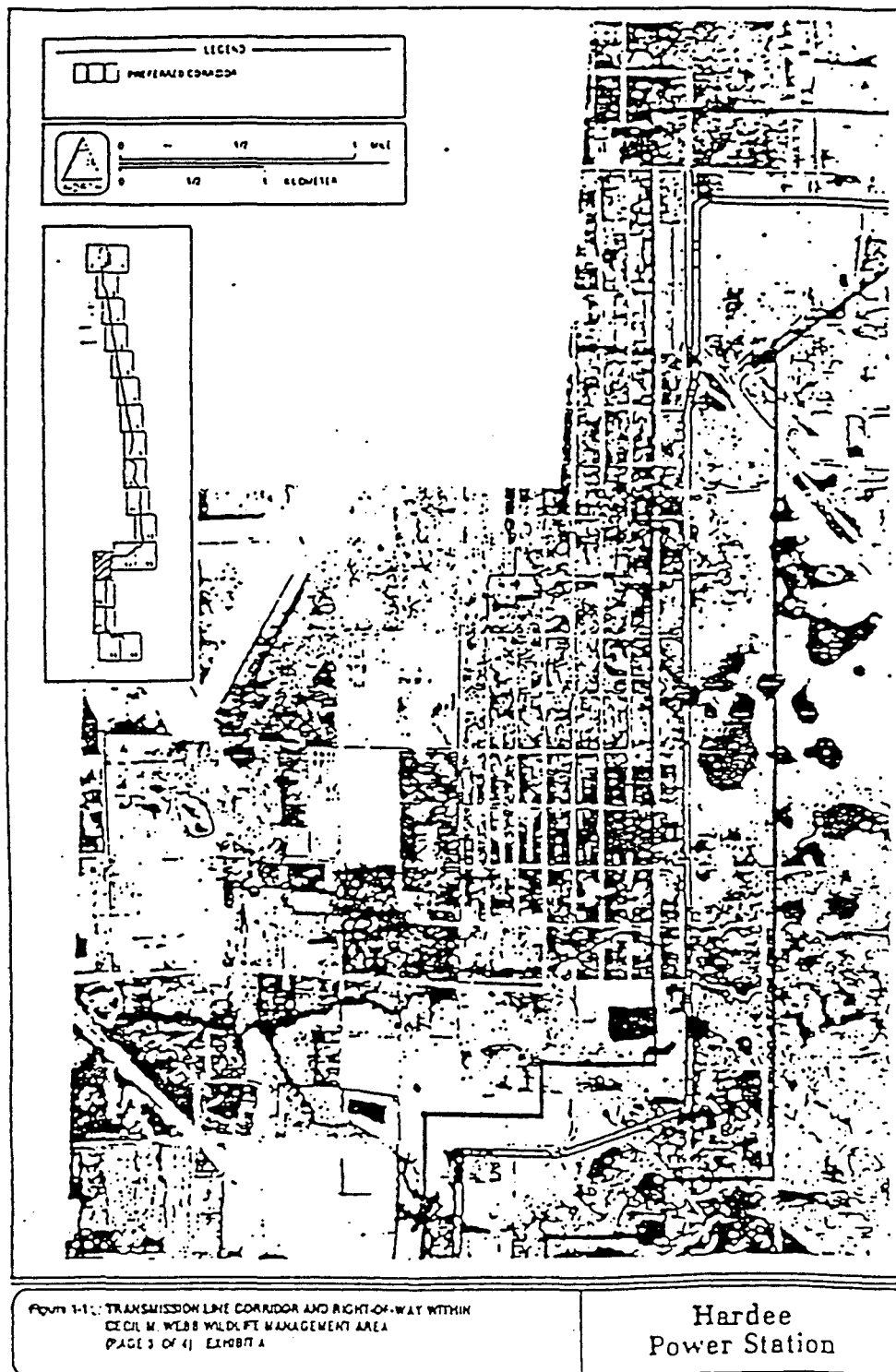


Figure 1-1 TRANSMISSION LINE CORRIDOR AND RIGHT-OF-WAY WITHIN
CECIL M. WEBB WILDLIFE MANAGEMENT AREA
(PAGE 1 OF 41) EXHIBIT A

Hardee





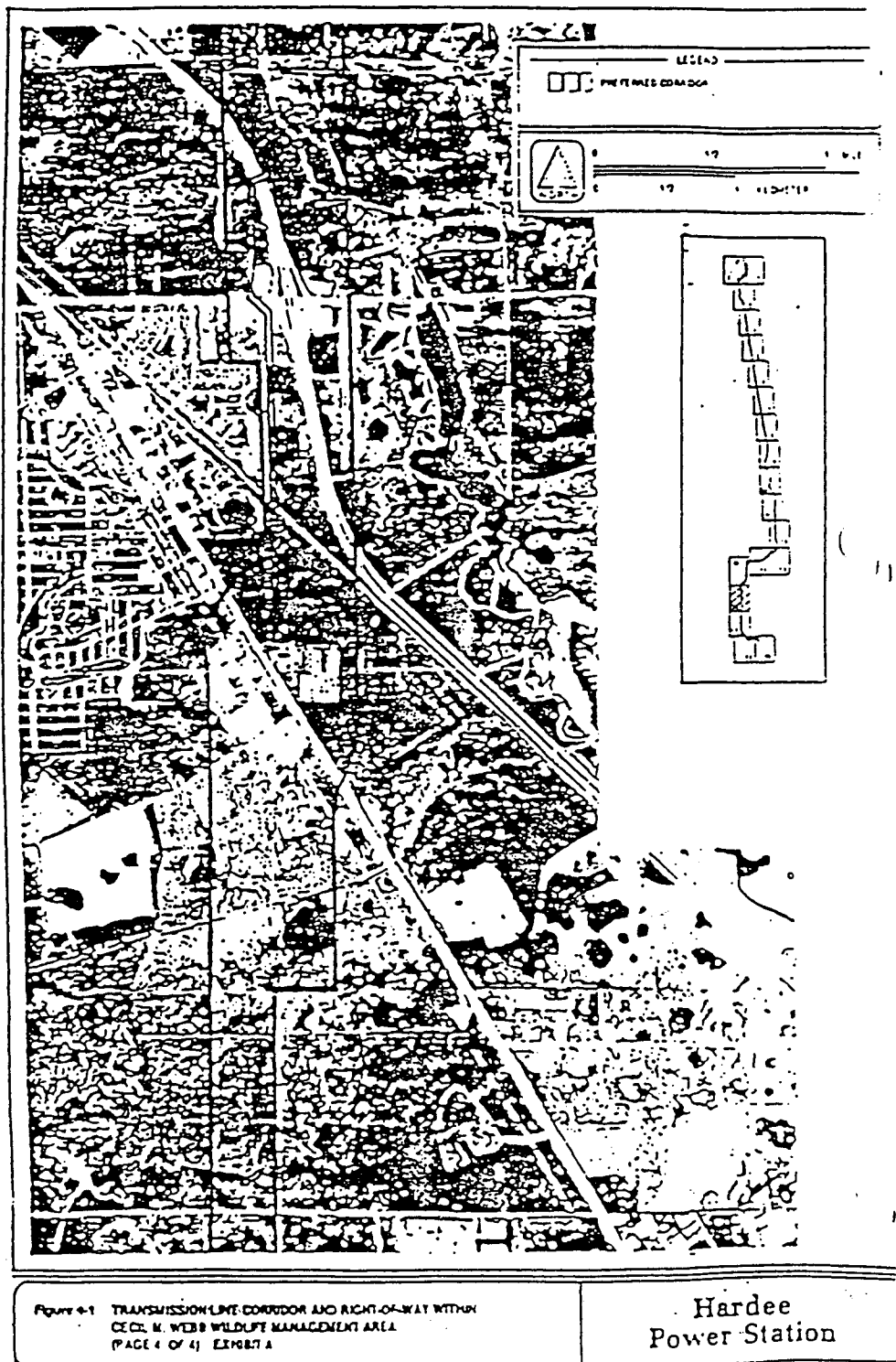
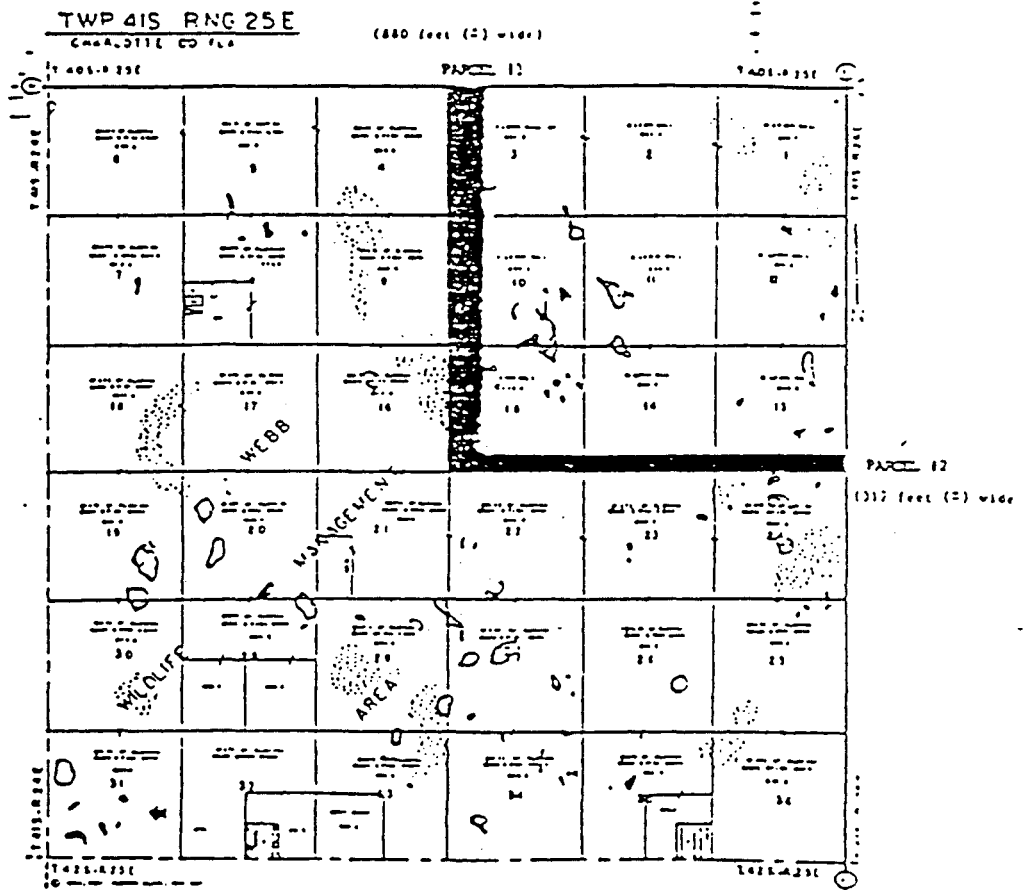


EXHIBIT B

PROPOSED COMPENSATION PROPERTY

(NOT TO SCALE)



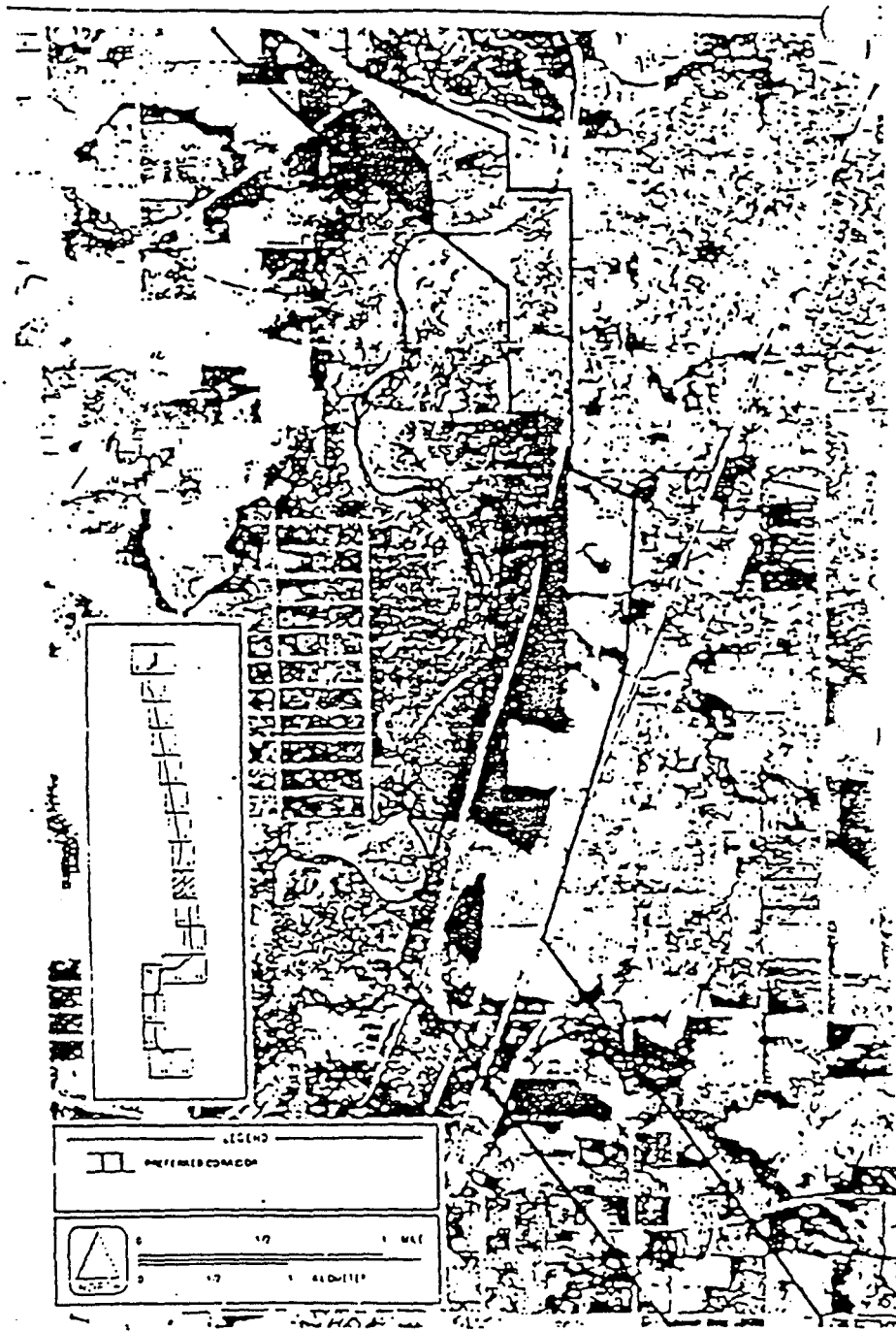


PHOTO 122 AERIAL PHOTOGRAPHS
(PAGE 10 OF 10)

Zone A
Zone B

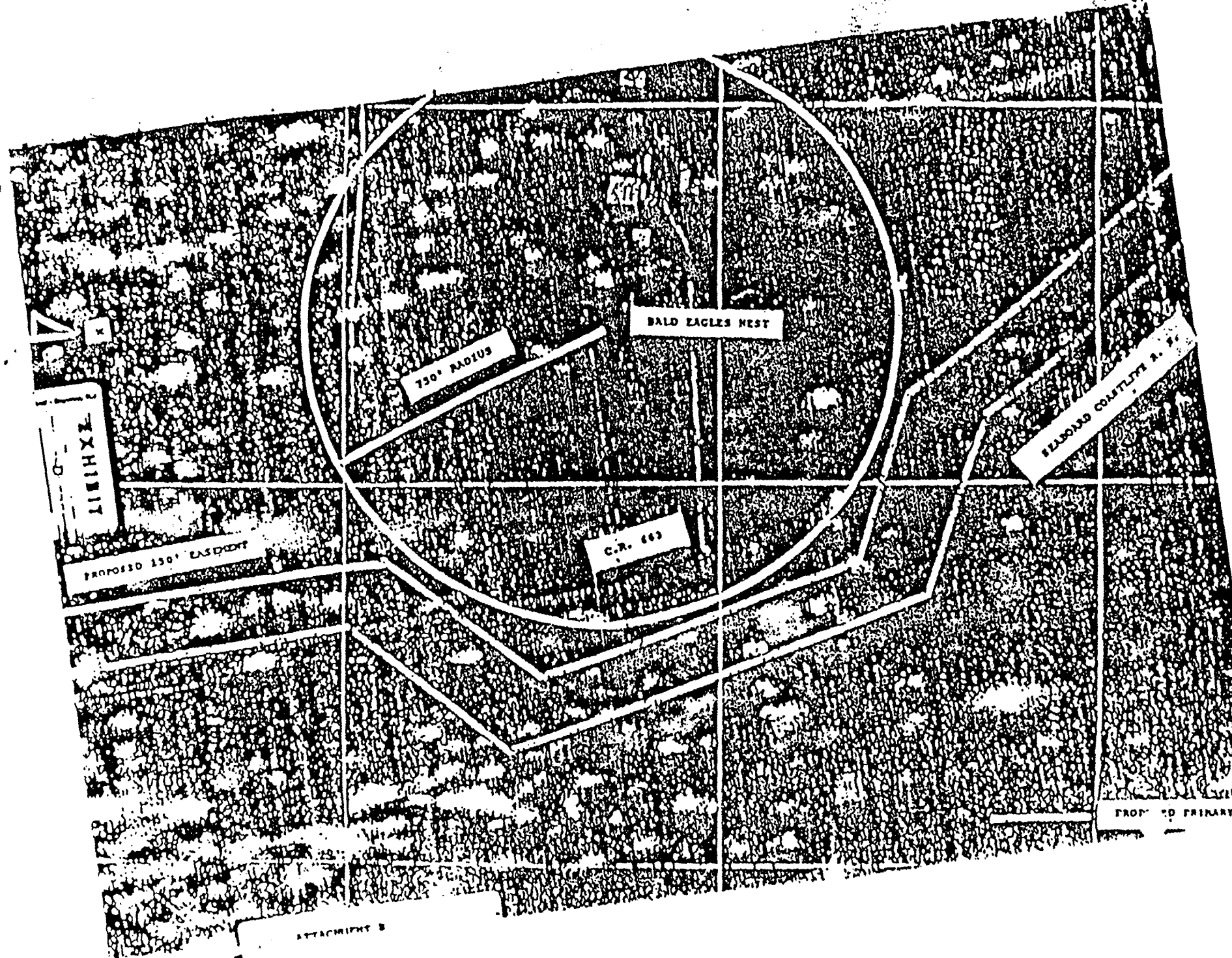
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EXHIBIT

10.4.1-118

10.4.1-119



STATE OF FLORIDA
DIVISION OF ADMINISTRATIVE HEARINGS

IN RE: HARDEE POWER STATION,	)	
POWER PLANT SITE CERTIFICATION	)	
APPLICATION, TECO POWER SERVICES	)	
TAMPA ELECTRIC COMPANY, AND	)	DOAH CASE NO. 89-3560
SEMINOLE ELECTRIC COOPERATIVE, INC.)	)	
PA 89-25	)	
	)	

EXCEPTIONS TO RECOMMENDED ORDER

COMES NOW Intervenor's Slack and Katzen by and through their undersigned attorney take exception to the Recommended Order of Donald D. Conn filed October 15, 1990, in the above style cause as follows:

1. Finding of Fact paragraph 7 indicates that the power generated from the Hardee Power Station will be distributed to the Lee County Substation via a directly associated 230 kv transmission line. This statement of fact is contrary to the testimony and evidence presented in that there is a single transmission line from the Hardee Power Station to Vandola Substation. The Lee line from the Vandola Substation to the Lee County Substation is not directly associated.
(v. 2, p. 92; v. 1, p. 22; v. 1, p. 39)

2. Finding of Fact paragraphs 53 and 55 are false. The Lee transmission line fails to follow existing linear facilities such as other existing transmission lines, roads and railroads nor does the Lee transmission line corridor avoid populated areas, reducing potential visual impacts (v. 1, p. 45; v. 4, p. 396-397; Intervenor's Exhibit 6; v. 4, p. 469; Intervenor's Exhibit 7; Intervenor's Exhibit 2 A, B and C; v. 4, p. 471-472; Game and Fish Exhibit 2; v. 6, p. 731; and p. 734-735)

3. Contrary to the Finding of Fact in paragraph 64, impacts to vegetation along the Lee corridor will not be minimal and the corridor does cross particularly sensitive habitats. Moreover the amount of wetlands impacted has been underestimated.
(v. 2, p. 109-111; v. 3, p. 294; v. 3, p. 299; v. 3, p. 302; v. 3, p. 296-297; v. 3, p. 299; v. 6, p. 670; v. 6, p. 672)

4. Contrary to the assertion in Finding of Fact paragraph 85 that noise levels occur only during and shortly after rainfall and that the sound of the rain which is similar in magnitude and quality will mask the transmission line noise, applicant's expert clearly indicated that masking is as to the measurable noise and

that human perception makes the distinction between the rain and transmission line noise. (v. 2, p. 170)

5. The Conclusions of Law indicate that the Lee transmission line is a directly associated facility and therefore subject to siting under the Electrical Power Plant Siting Act. Intervenor take particular exception to that Conclusion of Law and submit that the Electrical Transmission Line Siting Act is the appropriate Act for that portion of the transmission line from the Vandola Substation to the Lee Substation. Exclusion of evidence concerning alternative routes was erroneous. Such evidence shows that an alternative route is more appropriate, and shows that the proposed corridor does not minimize the impact of the project on human welfare and populations, nor property balance the impacts on the wildlife, water resources and on other natural resources of the state. Intervenor further take exception to the extent that the hearing office did not adopt the conclusions of law and reiterate them herein:

A. The Lee transmission line corridor cannot be certified under the provisions of the Electrical Power Plant Siting Act because that transmission is not a directly associated transmission line required to connect the electrical power plant to an existing transmission network (Section 403.5037, Florida Statutes).

B. The Lee transmission line corridor cannot be certified because it fails to follow existing transmission line and transmission corridor right-of-ways and roadways (Rule 17.17.141(2), Florida Administrative Code)

C. The Lee transmission line corridor cannot be certified because it fails to minimize the impacts upon public lands, particularly concerning "no practicable alternative" as concerns the Cecil M. Webb Wildlife Management Area (Rule 17.17.141(2), Florida Administrative Code).

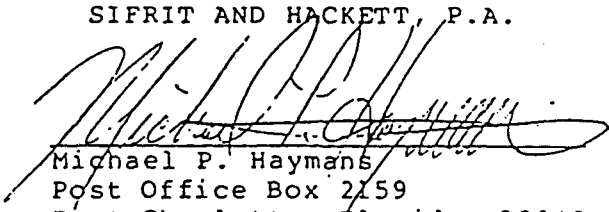
D. The Lee transmission line corridor cannot be certified because it fails to minimize impacts upon human population, the proposed placement analysis of Applicants and Florida Game and Fresh Water Fish Commission raises the concern for expected impacts on wildlife management costs above the risks to human health and impacts upon human visual and auditory perceptions by location of particular right-of-way within the corridor within the Cecil M. Webb Wildlife Management Area (Rule 17.17.141(2), Florida Administrative Code).

E. The electrical power plant certification process in the instance concerning the Lee transmission line corridor rises to the level of denial of due process for property owners impacted by the proposed corridor because of the lack under the Electrical Power Plants Siting Act of consideration of alternative routes and lack of requirements for advertised public hearings concerning the corridor in each county impacted.

F. The Lee transmission line corridor cannot be certified because Applicants failed to consider impacts and underestimated impacts upon the wetlands systems and wildlife including endangered and threatened species, particularly in the Cecil M. Webb Wildlife Management Area and in the southern portion of Charlotte County and northern of Lee County, the Yucca Pen Slough area.

G. In that a portion of the Certification Application cannot be granted, the entire certification must fail and the Hardee Power Plant including the Pebbledale, Vandola and Lee corridors cannot be certified.

FARR, FARR, HAYMANS, EMERICH,
SIFRIT AND HACKETT, P.A.



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Florida Bar No. 364312

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that a true and correct copy of the above and foregoing Preliminary Witness and Statement of Issues in Dispute have been furnished by regular U. S. Mail to the following this 5 day of November, 1990:

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I hereby certify that a true and correct copy of the foregoing Final Order and its attachments have been furnished by U.S. Mail to the following this 28th day of November, 1990:

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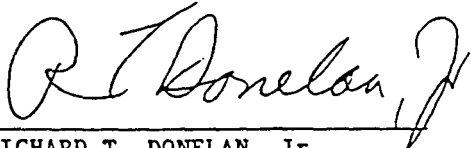
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APPENDIX 10.4.2

**FINAL LAND USE ORDER PA89-25
FOR HARDEE POWER STATION**

BEFORE THE GOVERNOR AND CABINET
OF THE STATE OF FLORIDA

IN RE: HARDEE POWER STATION)
POWER PLANT SITE CERTIFICATION)
APPLICATION, TECO POWER SERVICES,)
TAMPA ELECTRIC COMPANY, AND)
SEMINOLE ELECTRIC COOPERATIVE, INC.)
PA 89-25)

CASE NO. 89-3560

FINAL ORDER

BY THE GOVERNOR AND CABINET

The Governor and Cabinet, sitting as the Siting Board, pursuant to the Florida Electrical Power Plant Siting Act, Sections 403.501-403.519, Florida Statutes (F.S.), having reviewed the Recommended Order, which is attached hereto as Exhibit 1, and otherwise being fully advised herein, issue this Final Order and, therefore, it is

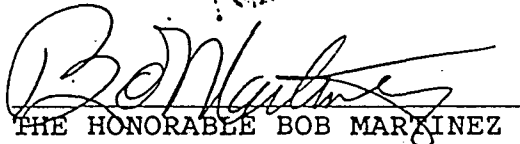
ORDERED:

1. The Recommended Order issued June 6, 1990, by the Hearing Officer pursuant to Section 403.508(2), F.S., is adopted in toto.
2. The Siting Board finds that the proposed site for the TECO Power Services, Tampa Electric Company, and Seminole Electric Cooperative, Inc.'s Hardee Power Station Power Plant

Site is consistent and in compliance with local land use plans and zoning ordinances.

DONE and ENTERED this 14 day of August, 1990, in Tallahassee, Florida pursuant to the vote of the Governor and Cabinet, sitting as the Siting Board, at a duly constituted Cabinet meeting August 14, 1990.

BY THE GOVERNOR AND CABINET
SITTING AS THE SITING BOARD


THE HONORABLE BOB MARTINEZ
GOVERNOR

STATE OF FLORIDA
DIVISION OF ADMINISTRATIVE HEARINGS

IN RE: HARDEE POWER STATION,)
POWER PLANT SITE CERTIFICATION)
APPLICATION, TECO POWER SERVICES,)
TAMPA ELECTRIC COMPANY, AND)
SEMINOLE ELECTRIC COOPERATIVE, INC.)
PA 89-25)
_____)

CASE NO. 89-3560

RECOMMENDED ORDER

The final hearing in this case was held on March 6, 1990, in Wauchula, Florida, and on May 3, 1990, in Bartow, Florida, before Donald D. Conn, Hearing Officer, Division of Administrative Hearings. Appearances entered in this proceeding on behalf of all parties are included in Appendix A to this Recommended Order.

STATEMENT OF THE ISSUE

The issue in this case is whether the proposed site of the Hardee Power Station, including affiliated components and linear facilities, is consistent and in compliance with existing land use plans and zoning ordinances in the Counties of Polk, Hardee, DeSoto, Charlotte and Lee, and in the Cities of Auburndale, Bartow, Polk City and Cape Coral.

PRELIMINARY STATEMENT

At the hearing, the Co-applicants (Tampa Electric Company, Teco Power Services Corporation and Seminole Electric Cooperative, Inc.) called Michael Opalinski, manager of environmental affairs at Seminole Electric, Mike Roddy, senior

environmental engineer at Seminole Electric, George D. Jennings, vice-president of operations and development at Teco Power Services, Gregory M. Nelson, consulting engineer in the environmental planning department at Tampa Electric, Analee Moore, who was accepted as an expert in land use planning, and Paulette Horne, assistant zoning director with the Charlotte County Zoning Department. Co-applicants introduced 38 exhibits, including several composite exhibits.

The Department of Environmental Regulation (Department) did not call any witnesses, but did introduce one exhibit. None of the other parties called any witnesses or introduced any exhibits. Two members of the public, Herbert A. Browns and Lorraine Pollack, testified.

The final volume of the transcript of the final hearing was filed on May 9, 1990, and the parties were allowed ten days thereafter within which to file proposed recommended orders. The Co-applicants and the Department filed a joint proposed recommended order, and a ruling on their proposed findings of fact is included in Appendix B to this Recommended Order.

FINDINGS OF FACT

1. The site for the proposed Hardee Power Station electric generating plant is a 1,300 acre site located in both Polk and Hardee Counties, approximately 9 miles northwest of the City of Wauchula, which is located in Hardee County. The Hardee Power Station electrical generating structures will be located primarily in Hardee County, but a major portion of the 570 acre cooling reservoir is located in Polk County.

2. The Co-applicants have proposed in their Site Certification Application an ultimate nominal capacity of 660 megawatts, and seek certification of the electric generating equipment, associated cooling reservoir, associated natural gas pipeline, and three associated transmission lines, described in paragraphs 4 through 9, below.

3. In March of 1989, the Florida Public Service Commission (PSC) issued an initial need order based on Seminole Electric Cooperative, Inc.'s (SECI's) application for a need determination for construction of two 220 megawatt combined cycle facilities. The PSC order confirmed the following: 1) SECI's need for 450 megawatts of back-up generation capacity; 2) the three interconnection points for the three 230 kV transmission lines; and 3) that a combined cycle plant was SECI's least costly alternative to constructing this electric generation capacity. Thereafter, SECI contracted with Teco Power Services Corporation for, among other things, the construction of the combined cycling units. In December of 1989, the PSC issued a final need order.

4. The Co-applicants propose to construct and operate a combined cycle power plant, associated transmission lines and natural gas pipeline facilities, a generalized depiction of the location of which is shown in Appendix C. The record in this case contains a detailed identification of the specific site of the proposed power plant, and associated transmission lines and pipeline facilities. The Hardee Power Station project will consist of combined cycle electric generating facilities with an ultimate nominal capacity of 660 megawatts to be constructed in

two phases. In phase 1-A, one 220 megawatt (nominal) combined cycle unit will be built along with one 75 megawatt (nominal) combustion turbine, resulting in a total of 295 megawatts (nominal), to begin commercial operation in January of 1993. In phase 1-B of the project, an additional 75 megawatt (nominal) combustion turbine, and a 70 megawatt (nominal) heat recovery steam generator will be added to the facility resulting in an additional 145 (nominal) megawatt combined cycle facility, the capacity of which is scheduled to be on line in January of 2003. Phase 2 of the project is the addition of a third 220 megawatt (nominal) combined cycle facility at an unspecified future date.

5. Associated with the Hardee Power Station electrical generating plant will be a cooling reservoir to cool the steam in the heat recovery steam generator so that water can be reused in the system. The cooling water will be returned to the reservoir which is designed to discharge water under conditions in excess of the 10-year, 24-hour storm event. The Hardee Power Station will also have associated oil storage and handling facilities, water treatment facilities, a control building and warehouse, and an administrative building.

6. Power generated from the Hardee Power Plant will be distributed to the Pebbledale, Vandolah and Lee County substations via three 230 kV transmission lines. One line, owned by Tampa Electric Company, heads north from the plant site and terminates at the Pebbledale substation. A preferred corridor and an alternate corridor have been proposed for this line. The other two transmission lines, owned by SECI, will head south from

the Hardee Power Station facility and follow their respective corridors, one terminating at the Vandolah substation and the other at the Lee County substation.

7. The corridors running north from the plant site to the Pebbledale substation are approximately 16 miles in length, with an average corridor width of approximately 1/2 mile but varying in sections from 1/4 of a mile to 1 mile. The transmission line heading south from the plant site to the Vandolah substation will be approximately 8 miles in length, and generally 1/2 mile in width with variations from 1/2 mile to 3/4 of a mile. The transmission line running south from the plant site to the Lee County substation will be approximately 78 miles in length, with a width generally of 1/2 mile but varying from 150 feet to approximately 1 mile. The transmission line structures will encompass only the rights-of-way within the corridors. The right-of-way for a typical H frame structure ranges from 100 to 150 feet, while the right-of-way for a single pole structure ranges from 75 feet to 100 feet.

8. The H-frame structures consist of two vertical poles having a typical out-of-ground height of approximately 65 feet with cross-arm assemblies holding porcelain insulators. The single pole structure consists of a single vertical structure with a typical out-of-ground height of 95 feet, and with insulator sets holding the conductors in place. Construction and maintenance activities with respect to these structures will require the construction of access roads.

9. The proposed power plant facility will include a natural gas pipeline which will connect with the existing Florida Gas Transmission pipeline system north of Polk City. The pipeline will route south past Polk City, Auburndale, and Bartow to State Road 60. The pipeline will then continue past Pierce and Bradley Junction until it meets County Road 630 where the pipeline heads east until it reaches County Road 663 where it turns south to the plant site. The natural gas pipeline will be an 18-inch diameter pipe which will be buried three feet underground, with a length of approximately 49 miles. The purpose of the pipeline is to transport natural gas, the primary fuel for the facility, to the plant site.

10. The Department published notices of the March 6, 1990 land use hearing in the Herald-Advocate (Hardee County) on January 18, 1990, in the Tampa Tribune, the Mulberry Press (Polk County), and the Ledger (Polk County) on January 15, 1990, and in the DeSoto County Times on January 17, 1990. Notice of the March 6, 1990 hearing was also published in the Florida Administrative Weekly on January 19, 1990. Co-applicants published notice of the May 3, 1990 continuance of the March 6, 1990 land use hearing in the April 18, 1990 editions of the Lakeland Ledger, the Tampa Tribune, the DeSoto County Times, the Ft. Myers News-Press (Lee County), the Cape Coral Daily Breeze, the Bradenton Herald, and the Charlotte Sun/Herald-News. On April 18, 1990, the Hearing Officer reviewed Co-applicants' Notice of Resumption of Land Use and Zoning Hearing and found it sufficient to provide notice to all parties and the public of the continuation of the land use hearing.

Polk County

11. Aspects of the Hardee Power Station and associated facilities, including preferred and alternative corridors, to be located in Polk County include: (a) a portion of the cooling reservoir; (b) a 230 kV transmission line extending from the plant to the Pebbledale substation; (c) a natural gas pipeline extending from the plant to Florida Gas Transmission Company's main gas line north of Polk City; and (d) miscellaneous appurtenances and accessories, including access roads.

12. The land use plan that governs the Hardee Power Station and associated linear facilities located in Polk County is the Polk County Comprehensive Plan, as adopted by the Board of County Commissioners on June 26, 1979. The applicable zoning regulation is the 1983 Polk County zoning ordinance.

13. Polk County has not adopted a land-use plan map, and thus, there are no land use plan designations applicable to the site or its associated facilities in Polk County. With respect to Polk County's Comprehensive Plan, the Polk County Chief of Current Planning, Ron Borchers, on January 20, 1989, confirmed that the cooling reservoir, transmission line, and natural gas pipeline complied with Polk County's Comprehensive Plan. Expert testimony also demonstrated that the proposed project is consistent and in compliance with the zoning ordinance and land use plan of Polk County.

14. The Polk County zoning category for the Hardee Power Station generating facility site and the cooling reservoir site is RC (rural conservation). The transmission line corridor

crosses four zoning categories in Polk County: RC (rural conservation district); GI (general industrial district); R3 (rural residential district); and R2 (rural residential district). The gas pipeline corridor crosses the following zoning categories within Polk County: R1, R2, and R3 (residence districts); RE1 and RE2 (rural estates districts); SF1 (single family district); SF1M (single family district); RC and RC2 (rural conservation districts); C2 (commercial district for a multi-neighborhood commercial); C3 (commercial district for regional commercial); C4 (commercial district for heavy commercial); GI (general industrial district); and PUD (planned unit development district). In Polk County, gas pipelines are classified as Class I essential services and are permitted in all zoning districts. By letter dated January 24, 1989, Zoning Administrator Gerald Martin confirmed that the plant site and associated facilities are in compliance with the Polk County Zoning Ordinance, stating:

Specifically, transmission lines and gas pipelines are Class I essential services; and the power plant's cooling reservoir is a Class II essential service. Class I essential services are permitted in all zoning districts. The site of the proposed cooling reservoir in Polk County is zoned Rural Conservation (RC) which permits Class II essential services. Therefore, these proposed facilities are in compliance with the Polk County Zoning Ordinance.

15. Expert testimony also demonstrated that the power plant site and associated linear facilities are in compliance and consistent with Polk County's Zoning Ordinance.

16. Co-applicants have entered into a stipulation with Polk County in which the County confirms that the site of the power plant and associated facilities, including preferred and alternative corridors, to be located in Polk County are consistent and in compliance with Polk County's existing Land Use Plan and Zoning Ordinance.

Hardee County

17. Aspects of the Hardee Power Station and associated facilities, including preferred and alternative corridors, to be located in Hardee County include: (a) the power plant facility; (b) a portion of the cooling reservoir; (c) a portion of the 230 kV transmission line extending from the plant to the Pebbledale substation in Polk County; (d) a 230 kV transmission line from the plant to the Vandolah substation in Hardee County; (e) a 230 kV transmission line extending from the power plant to the Lee County substation; (f) a portion of the natural gas pipeline extending to Florida Gas Transmission Company's main gas line north of the power plant in Polk County; and (g) miscellaneous appurtenances and accessories including access roads.

18. The land use plan that governs the Hardee Power Station in Hardee County for purposes of this hearing is the future land use plan element of the Hardee County Comprehensive Plan. The applicable zoning regulation is Hardee County Zoning Ordinance No. 82-2 as codified in the Hardee County Land Development Code.

19. The zoning category for the site of the Hardee Power Station generating facility located within Hardee County is

I-1 (light industrial). The light industrial district, as described in the Hardee County zoning ordinance, includes "public and semi-public plants" in an enumeration of authorized "principle uses and structures", and authorizes the proposed power plant. The Hardee County Board of County Commissioners rezoned the planned location of the plant site to I-1 on May 11, 1989 to authorize construction of the plant.

20. The transmission line corridors cross the following zoning categories in Hardee County: I-1 (light industrial); A-1 (agricultural); C-2 (general commercial); FR (farm residential); and C-1 (neighborhood commercial). These linear facilities are authorized uses in all districts pursuant to Section 2.3G of the Hardee County zoning ordinance, which states that "local public utility distributing and collecting structures such as pipes and transmission lines" are "permitted in all zoning districts".

21. Hardee County has not adopted a land use plan map, and thus, there are no land-use plan designations affected by the site or associated facilities. The Hardee County Building and Zoning Department staff report on the application to rezone the planned location of the plant confirms that the proposed power plant is in compliance with Hardee County's Comprehensive Plan.

22. Expert testimony was presented demonstrating that the proposed Hardee Power Station is consistent and in compliance with Hardee County's land use plan and zoning ordinance.

23. On November 2, 1989, Co-applicants and Hardee County entered into a stipulation in which the County confirmed

that the proposed site of the power plant and associated facilities, including preferred and alternate corridors, are consistent and in compliance with Hardee County's existing land use plan and zoning ordinance. This stipulation was authorized by the Hardee County Board of County Commissioners on September 21, 1989.

DeSoto County

24. The associated linear facility located in DeSoto County is an approximately 23 mile portion of a 230 kV transmission line, including miscellaneous appurtenances and accessories, extending from the plant to an existing substation in Lee County.

25. The land use plan that governs the proposed linear facility is DeSoto County Ordinance No. 81-3, adopted on June 25, 1981. The applicable zoning regulations are contained in DeSoto County Zoning Ordinance No. 81-10.

26. DeSoto County has not adopted a land-use plan map, and thus, there are no land use categories crossed by the transmission line corridor in DeSoto County. Expert testimony demonstrated that the proposed transmission line corridor associated with the Hardee Power Station does not contravene the policies or objectives of the DeSoto County Comprehensive Plan.

27. The transmission line corridor crosses the following zoning categories in DeSoto County: A-5 (rural agriculture); A-10 (agriculture district); E (estate district); IL (industrial light district); CG (commercial general district); RSF-3 (residential single family district); COS (conservation

open space district); TTRVC (travel trailer recreational vehicle and campground district); RMF (mixed use district); HI (industrial heavy district); MHC (mobile home conventional district); and RMF-6 (residential multifamily district). Section 8-8 of the DeSoto County zoning ordinance provides that "electric cables" are "permitted uses" and "allowed as a matter of right" in all zoning districts. Thus, the proposed transmission line corridor does not contravene the DeSoto County zoning ordinance.

28. On November 2, 1989, a stipulation was entered into between DeSoto County and the Co-applicants confirming that the zoning officials of DeSoto County have reviewed the Co-applicants' site certification application, are familiar with the proposed site of the associated linear facility, and that the proposed facility is consistent and in compliance with DeSoto County's existing land use plan and zoning ordinance. This stipulation was authorized by the DeSoto County Board of County Commissioners on September 12, 1989.

Charlotte County

29. The associated linear facility located in Charlotte County includes approximately 22 miles of a 230 kV transmission line, including miscellaneous appurtenances and accessories, extending from the plant to an existing substation in Lee County.

30. The land use plan that governs the associated linear facility to be located in Charlotte County is the future land use element of the December 16, 1988 Charlotte County/City of Punta Gorda Comprehensive Plan. The applicable zoning

regulations are contained in the Charlotte County zoning regulations adopted by the Board of County Commissioners on December 8, 1981, including the June 30, 1989 amendments to the Charlotte County zoning regulations enacted pursuant to Ordinance No. 89-34.

31. In Charlotte County, the transmission line corridor crosses the following land use plan categories: agriculture 1 and 2; agriculture conservation; preservation; public; semi-public; commercial; residential estates; mobile home; and low density residential. The transmission line corridor also crosses two overlay districts which include surface water protection districts for Alligator Creek, Prairie Creek, and Shell Creek. The Charlotte County land use plan does not specifically address placement of electric transmission lines. The Charlotte County Comprehensive Plan includes the objectives of ensuring the availability of suitable land for utility facilities necessary to support development, identifying appropriately located environmentally suitable land to meet those needs, and acquiring land suitable for utility facilities necessary to support future development. The land use plan provides that development is permissible in preservation areas "as may be provided within the land development regulations". Thus, to the extent that such development is permitted within preservation areas under the zoning ordinance, it similarly is authorized under the land use plan.

32. In Charlotte County, the transmission line corridor crosses the following zoning categories: AE

(agriculture estate); AG (agriculture general); CG (commercial general); CI (commercial intensive); ES (environmentally sensitive); MHC (mobile home conventional); MHP (mobile home park); PD (planned development); RE-5 (residential estate); RMF-10 (residential multi-family); RSF-3.5 (residential single family); and RE-1 (residential estate). The Charlotte County zoning ordinance traditionally has been applied as authorizing transmission lines without the requirement of obtaining a special exception permit. Unrebutted expert testimony confirmed that this interpretation comports with the language of the zoning ordinance.

33. Charlotte County has entered into a stipulation in this proceeding confirming that the proposed site of the associated linear facility is consistent and in compliance with Charlotte County's existing land use plan and zoning ordinance. This stipulation was authorized by the Charlotte County Board of County Commissioners on September 26, 1989.

Lee County

34. The associated linear facility located in unincorporated Lee County is a five mile length of a 230 kV transmission line, including miscellaneous appurtenances and accessories, extending from the plant to an existing substation in Lee County.

35. The land use plan that governs the linear facility to be located in Lee County is Section A of the Lee County Comprehensive Plan, adopted by the Lee County Board of County Commissioners on January 31, 1989. The applicable zoning

regulations are Lee County's Official Zoning Ordinance (Ordinance 86-17), and amendments thereto.

36. In Lee County, the transmission line corridor crosses four land-use plan categories which include open lands, resource protection transition zones, rural, and central urban. Expert testimony demonstrated that the associated linear facility does not contravene any of the policies or objectives contained in the Lee County land use plan.

37. The transmission line corridor crosses the following zoning categories in Lee County: AG-2 (agricultural district); C-2 (commercial district); MH-1 (residential uses); and MH-2 (residential uses). The associated linear facility is an "essential service facility" under Sections 1001.13 and 202.12 of the Lee County zoning ordinance, and is permitted in all zoning districts within Lee County.

38. Lee County has entered into a stipulation in this proceeding confirming that the proposed site of the associated linear facility is consistent and in compliance with Lee County's land use plan and zoning ordinance. This stipulation was authorized by the Lee County Board of County Commissioners on February 7, 1990.

City of Cape Coral

39. The associated linear facility located in the City of Cape Coral is an approximately 3.2 mile portion of a 230 kV transmission line, including miscellaneous appurtenances and accessories, extending from the plant to an existing substation in Lee County, located east of the City of Cape Coral.

40. The land use plan that governs the proposed linear facility in Cape Coral is the February 13, 1989 City of Cape Coral Comprehensive Plan. The applicable zoning regulations are the City of Cape Coral Land Development Regulations, as amended in February, 1990 by Ordinance No. 7-90.

41. The transmission line corridor crosses three land-use plan categories: mixed use; parks and recreation; and single family. There are no references to transmission line corridors in the Cape Coral land use plan. However, expert testimony was presented that the proposed transmission line corridor does not contravene the City of Cape Coral's land use plan.

42. The transmission line corridor primarily crosses the agricultural (AG) zoning category in the City of Cape Coral. The outer portion of the corridor where it enters the City of Cape Coral briefly intersects with lands zoned R1 (single family residential district). On February 12, 1990, the City of Cape Coral amended its zoning ordinance to provide, among other things, that the transmission line was a permitted use in areas zoned "agricultural". To the extent a transmission line structure intersects with the R-1 district, it would be authorized under Section 2.7.1 of the zoning ordinance. Expert testimony demonstrated that the proposed transmission line is an authorized use under the City of Cape Coral's zoning ordinance.

43. On February 16, 1990, Co-applicants and the City of Cape Coral entered into a stipulation in which the City confirmed that the Co-applicants' proposed transmission line corridor traverses through an area of the City of Cape Coral that

is zoned agricultural, and that, therefore, the transmission line is an authorized use under the City of Cape Coral zoning ordinance. Further, the City stipulated that the proposed site of the transmission line is consistent and in compliance with the City of Cape Coral's land use plan.

City of Auburndale

44. The associated linear facility to be located in the City of Auburndale is a portion of a natural gas pipeline that extends from approximately one mile north of Polk City where it interconnects with the existing Florida Gas Transmission 18 inch St. Petersburg lateral, and continues south to the Hardee Power Station.

45. The land use plan that governs the proposed corridor of the natural gas pipeline through the City of Auburndale is the June 1977, City of Auburndale Comprehensive Plan. The applicable zoning regulation is the City of Auburndale's zoning ordinance codified in Chapter 25 of the City of Auburndale Code.

46. There are two future land use maps for the City of Auburndale contained in its comprehensive plan. One of these land use plan maps covers an area where the pipeline corridor crosses three land use plan categories: agricultural; medium-density residential; and low-density residential. The City of Auburndale Comprehensive Plan does not mention gas pipelines. Expert testimony demonstrated that the proposed pipeline corridor does not contravene the land use plan of the City of Auburndale.

47. Within the City of Auburndale, the proposed gas pipeline corridor crosses the zoning category CH (commercial highway). The City of Auburndale's zoning ordinance defines essential services to include gas facilities, and indicates they can be located in any zoning district after review and approval by the City Commission. That review and approval occurred on April 2, 1990, as reflected by resolution of the City Commission.

48. On May 3, 1990, the City of Auburndale entered into a stipulation with Co-applicants whereby the City confirmed that the proposed natural gas pipeline corridor is consistent and in compliance with the City of Auburndale's existing land use plan and zoning ordinance.

City of Bartow

49. The associated linear facility located in the City of Bartow is a portion of a natural gas pipeline that extends from approximately one mile north of Polk City where it interconnects with the existing Florida Gas Transmission 18 inch St. Petersburg lateral, and continues south to the Hardee Power Station.

50. The land use plan that governs the proposed natural gas pipeline associated with the Hardee Power Station is the 1979 City of Bartow Comprehensive Plan. The applicable zoning regulations are the City of Bartow's zoning ordinance, Ordinance No. 981-A.

51. The City of Bartow has not adopted a land use plan map so there are no land use plan categories crossed by the pipeline corridor in the City of Bartow. The City of Bartow's

comprehensive plan does not mention gas pipelines. Expert testimony demonstrated that the proposed natural gas pipeline will be consistent and in compliance with the City of Bartow's land use plan.

52. In the City of Bartow, the proposed pipeline crosses the following zoning categories: R1 and R1A (residential districts); C3 (highway commercial); P1 (professional office); and I-1 and I-2 (industrial districts). The City of Bartow's zoning ordinance defines gas pipelines as public service structures which are permitted in all zoning districts after review by the Zoning Commission. That review occurred on March 22, 1990 when the Zoning Commission recommended approval of the proposed gas pipeline. The recommendation was subsequently adopted by the City Commission.

53. On May 3, 1990, the City of Bartow and the Co-operators entered into a stipulation in which the City confirmed that the proposed natural gas pipeline corridor is consistent and in compliance with the City of Bartow's existing land use plan and zoning ordinance (Ordinance No. 981-A, as amended).

City of Polk City

54. The associated linear facility to be located in Polk City is a portion of a natural gas pipeline that extends approximately one mile north of Polk City where it connects with the existing Florida Gas Transmission 18 inch lateral, and continues south to the Hardee Power

55. The land use plan that governs the proposed natural gas pipeline associated with the Hardee Power Station is Polk City's Comprehensive Plan, adopted by the City Commission on September 4, 1980. The applicable zoning regulations are contained in Polk City Ordinance 89-11.

56. In Polk City, the pipeline crosses two land-use categories; commercial and agricultural. The Polk City Comprehensive Plan does not mention natural gas pipelines. Expert testimony demonstrated that the natural gas pipeline corridor will be consistent and in compliance with Polk City's land use plan.

57. Within Polk City, the proposed natural gas pipeline corridor crosses one zoning category, C1 (commercial restricted). The Polk City zoning ordinance is silent on the matter of gas pipelines. However, the City Commission in Polk City, pursuant to a request by the Co-applicants, approved the proposed natural gas pipeline as an allowable use under the City's zoning ordinance.

58. On May 3, 1990, Co-applicants and Polk City entered into a stipulation whereby the City confirmed that the proposed natural gas pipeline corridor is consistent and in compliance with Polk City's existing land use plan and zoning ordinance (Ordinance No. 89-11, as amended).

CONCLUSIONS OF LAW

The Division of Administrative Hearings has jurisdiction over the parties to, and the subject matter of, these proceedings. Section 120.57(1) and 403.508(1), Florida Statutes.

Section 403.508(2), Florida Statutes, provides, in pertinent part, as follows:

The sole issue for determination at the land use hearing shall be whether or not the proposed site is consistent and in compliance with existing land use plans and zoning ordinances. The designated hearing officer's recommended order shall be issued within 30 days of completion of the hearing and shall be reviewed by the board within 45 days of receipt of the recommended order by the board. If it is determined by the board that the proposed site does conform with existing land use plans and zoning ordinances in effect as of the date of the application, the responsible zoning or planning authority shall not thereafter change such land use plans or zoning ordinances so as to affect the proposed site unless certification is subsequently denied. ...

As used in Section 403.508, Florida Statutes, the term "board" means the Governor and Cabinet sitting as the Siting Board. See Section 403.503, Florida Statutes.

It has been established by competent substantial evidence that the proposed site of the Hardee Power Station, including electrical generating facilities, cooling reservoir and other appurtenances is consistent and in compliance with the 1979 Polk County Comprehensive Plan and Polk County Zoning Ordinance No. 83-2, the 1982 Hardee County Land Development Code adopted pursuant to Ordinance 82-2, and the Hardee County Comprehensive

Plan. Further, competent substantial evidence establishes that the site of the associated natural gas pipeline is consistent and in compliance with the 1979 Polk County Comprehensive Plan and Zoning Ordinance 83-2, the 1982 Hardee County Land Development Code and the Hardee County Comprehensive Plan, the City of Auburndale Zoning Ordinance and Comprehensive Plan, Polk City's 1980 Comprehensive Plan and Zoning Ordinance 89-11, and the City of Bartow's 1979 Comprehensive Plan and Zoning Ordinance No. 981-A. Finally, it was shown by competent substantial evidence that the corridors for the three transmission lines directly associated with the proposed Hardee Power Station are consistent and in compliance with the 1979 Polk County Comprehensive Plan and Zoning Ordinance No. 83-2, the 1982 Hardee County Land Development Code and the 1981 Hardee County Comprehensive Plan, the 1981 DeSoto County Comprehensive Plan and Zoning Ordinance No. 81-10, the 1988 Charlotte County/City of Punta Gorda Comprehensive Plan, the Charlotte County zoning regulations and amendments thereto, the 1989 Lee County Comprehensive Plan and Zoning Ordinance 86-17, and the City of Cape Coral 1989 Comprehensive Plan and 1990 Land Development Regulations.

RECOMMENDATION

Based upon the foregoing findings of fact and conclusions of law, it is recommended that the Governor and Cabinet, sitting as the Siting Board, enter a Final Order finding that the site of the Hardee Power Station electric generating facilities and cooling reservoir, the site of the associated natural gas pipeline, and the site of the corridors for the directly associated transmission lines, as proposed in the Site Certification Application, are consistent and in compliance with existing land use plans and zoning ordinances.

DONE AND ENTERED this 6th day of June, 1990 in Tallahassee, Florida.



DONALD D. CONN
Hearing Officer
Division of Administrative Hearings
The DeSoto Building
1230 Apalachee Parkway
Tallahassee, Florida 32399-1550

Filed with the Clerk of the
Division of Administrative Hearings
this 6th day of June, 1990.

Copies furnished to all
persons shown in Appendix A

APPENDIX A

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APPENDIX B

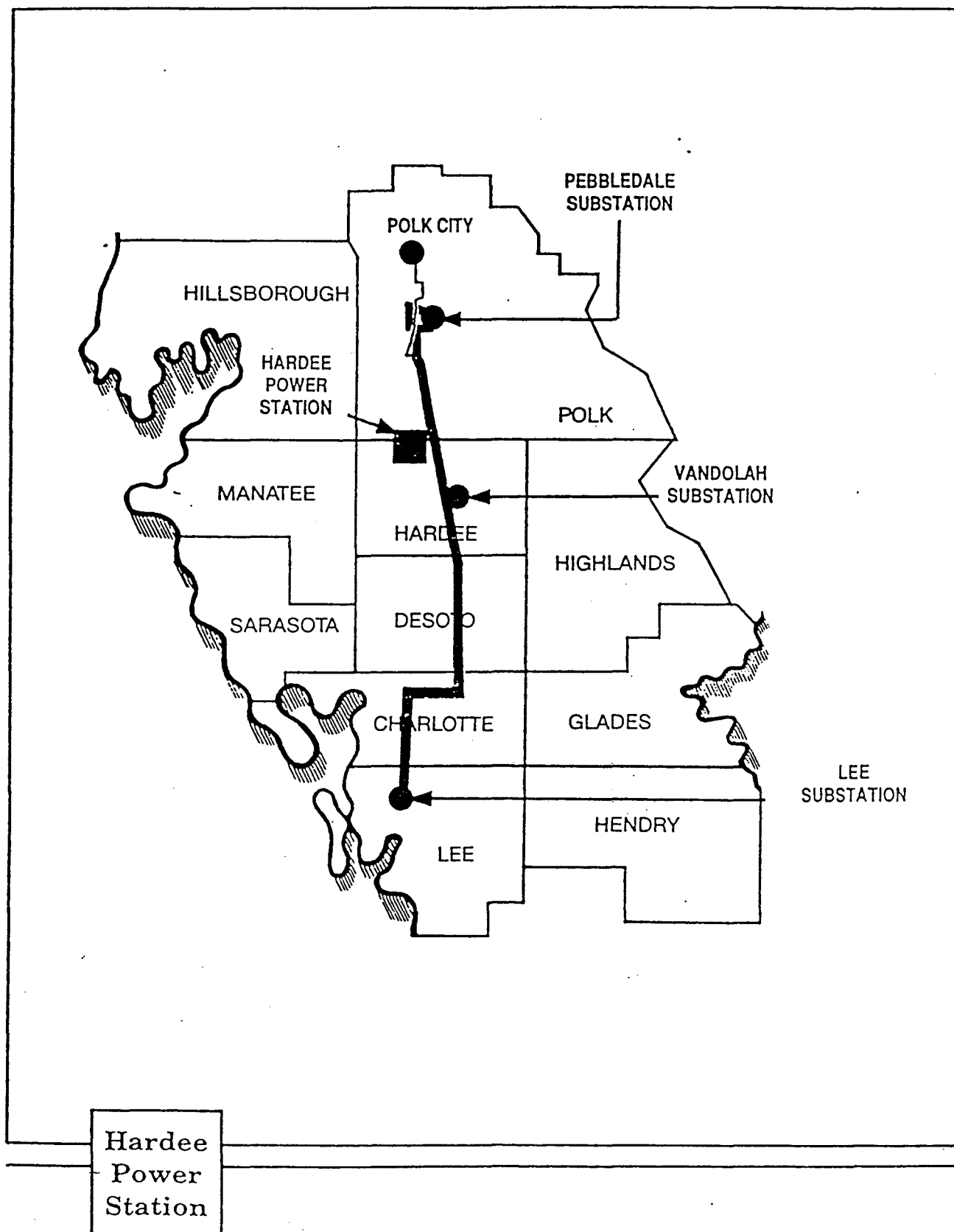
RULINGS ON PROPOSED FINDINGS OF FACT

The following rulings are made on proposed findings of fact contained in the Joint Proposed Recommended Order filed on behalf of the Co-applicants and the Department:

1. Adopted in Finding 10.
2. Adopted in Finding 4.
3. Adopted in Finding 5.
4. Adopted in Finding 6.
5. Adopted in Finding 7.
6. Adopted in Finding 8.
7. Adopted in Finding 9.
8. Adopted in Finding 1.
9. Adopted in Finding 2.
10. Adopted in Finding 3.
- 11-58. Adopted in Findings 11-58.

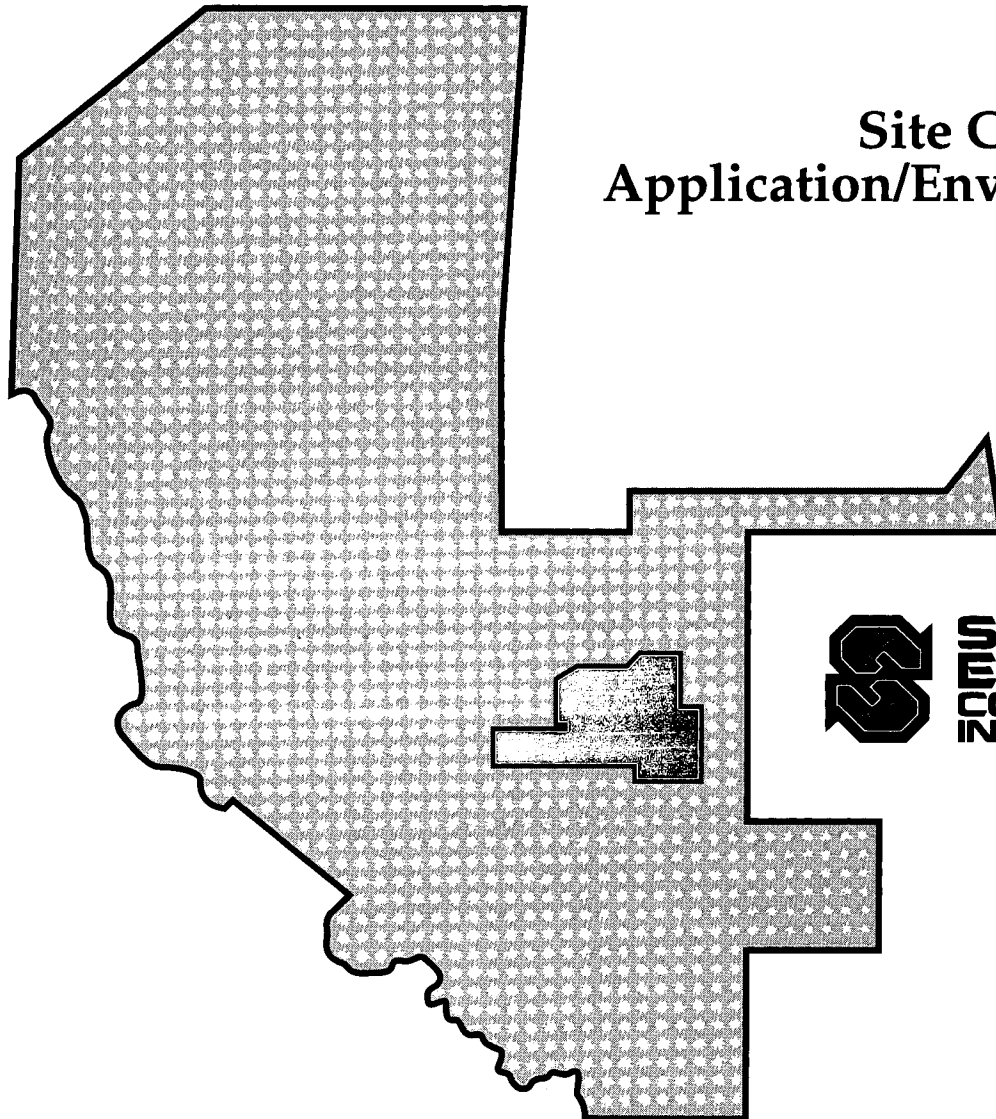
APPENDIX C

GENERALIZED DEPICTION



HARDEE UNIT 3

Site Certification
Application/Environmental
Analysis



**SEMINOLE
ELECTRIC
COOPERATIVE
INCORPORATED**

Appendix 10.5

APPENDIX 10.5
MONITORING PROGRAMS

APPENDIX 10.5.1

NOISE

NOISE

The noise monitoring presented in Section 2.3.8.2 was performed with equipment meeting the specifications in this appendix. Prior to these measurements, preliminary surveys were performed using a Computer Engineering Limited (CEL) impulse sound level meter and analyzer (Model CEL-228) and CEL calibrator.

EQUIPMENT SPECIFICATIONS

SPECIFICATION FOR BRUEL & KJAER SOUND LEVEL CALBRATOR

Summarized Specifications Type 4155

The 4155 satisfies the requirements for frequency response given in IEC 651 for Type 1. Nominal specifications are summarized below:

Open Circuit Sensitivity: -25 dB re 1 V/Pa. equivalent to 50 mV/Pa

Frequency Response Characteristic: Frequency ranges for flat 0°-incidence free field response (ref. 250 Hz)

6 Hz - 5 kHz: flat within ± 1 dB

4 Hz - 16 kHz: flat within ± 2 dB

Lower Limiting Frequency (-3 dB): 1 - 3 Hz (vent exposed to sound field)

Pressure Equalization Time Constant: 0.16 - 0.053 s. The cartridge is back-vented

Diaphragm Resonance Frequency: 14 kHz (90° phase shift)

Cartridge Thermal Noise: 1.2×10^{-4} Pa/ $\sqrt{\text{Hz}}$, 14.5 dB(A), 15.5 dB(Lin)

Upper Limit of Dynamic Range: 146 dB SPL (dist. < 3% at 100 Hz). Safety limit: 160 dB (peak)

Polarized Cartridge Capacitance: 15 pF at 250 Hz with the external polarization voltage of 0 V applied

Equivalent Air Volume: 40 mm³ at 250 Hz, 1013 mbar

Ambient Pressure Coefficient: -0.001 dB/mbar at 250 Hz, 1013 mbar

Ambient Temperature Coefficient: -0.006 dB/°C at 250 Hz between -10° and +50°C

Humidity Coefficient: 0.004 dB/%R.H. at 250 Hz, 23°C

Long Term Stability: >400 years/dB at 20°C

Diaphragm Protection: Quartz

Typical Gain with B & K Preamplifiers or input stages of Sound Level Meters

1/2" Microphones (app. 17 pF)	2230	2233	2614 2615	2619 Serial no. up to 761075	2619 Serial no. from 751077	2539 2545	2560 -0 dB
G (approx.)	0.0 dB	0.0 dB	-2.2 dB	-0.4 dB	-0.2 dB	-0.05 dB	-0.1 dB

To obtain the overall correction factor, K, subtract G from the open-circuit correction factor, K_0 , given on the face side of this chart. The K-factor is used when calibrating B & K Measuring Amplifiers and Analyzers which have an internal reference voltage.

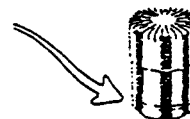
$$K = K_0 - G$$

For example, if K_0 is +0.5 dB and G is -0.2 dB (for a 4155 with a 2619 preamp.), then the correction factor is calculated as follows:

$$K = +0.5 \text{ dB} - (-0.2 \text{ dB}) = -1.0 \text{ dB}$$

Polarization: The two grooves engraved on the microphone cartridge indicate that the microphone is prepolarized. For measurements complying with calibration data on this chart the polarization circuit of the measuring system should be set to "0 V" (or grounded). See relevant B & K literature.

Caution: When mounting a prepolarized microphone on input terminals which are not designed for it, there is a risk that the charge-carrying element of the cartridge could be damaged if static electricity is stored on the person or on the measuring set-up. Prevention is easy - Either the user or the cartridge housing must always touch the preamplifier housing (or sound level meter case) before the centre terminal of the cartridge makes contact.



Dimensions:

Diameter with protecting grid: 13.2 mm (0.52")
Diameter without protecting grid: 12.7 mm (0.50")
Height with protecting grid: 17.3 mm (0.68")
Height without protecting grid: 16.2 mm (0.64")
Thread for coupler/grid mounting: 12.7 - 50 UNS
Thread for Preamp mounting: 11.7 - 60 UNS

**SPECIFICATION FOR BRUEL & KJAER MICROPHONE PREAMPLIFIER AND
PREPOLARIZED CONDENSER MICROPHONE**

Specifications 4230

Sound Pressure Level: 94 dB re 2×10^{-5} Pa (or 1 Pa) Accuracy of SPL: At 1013 mbar when loaded with $1,333 \text{ cm}^3$ (corresponding to B & K microphones with protecting grid, and their respective adaptors) $\pm 0,3 \text{ dB}$ at $23^\circ\text{C} \pm 3^\circ\text{C}$ (68 to 79°F) $\pm 0,4 \text{ dB}$ between 10 and 40°C (50 to 104°F) $\pm 0,5 \text{ dB}$ between 0 and 50°C (32 to 122°F) Frequency: 1000 Hz $\pm 1,5\%$ Equivalent Coupler Volume: $V > 140 \text{ cm}^3$ at 23°C ($73,4^\circ\text{F}$) $V > 70 \text{ cm}^3$ between 10 and 40°C (50 to 104°F) $V > 35 \text{ cm}^3$ between 0 and 50°C (32 to 122°F)	Distortion: < 1% Influence of Static Pressure: $\pm 0,05 \text{ dB}/100 \text{ mbar}$ from 500 mbar to 1100 mbar Long Term Stability: Better than $\pm 0,1 \text{ dB}/\text{year}$ (expected for normal field use) Microphone Types: 1" directly 1/2" with supplied adaptor Power Supply: Internal supply from 1 x 9 V transistor (IEC 6LF22, NEDA 1604) battery Operation: With a new battery the signal will last for up to one minute after contact is released	Battery Check: As long as the signal continues for a few seconds after the contact is released the change in SPL is less than 0,05 dB Dimensions: (Including leather case) Length: 115 mm (4,5") Diameter: 44 mm (1,7") Weight: (Including leather case) 260 g (0,57 lb) Accessories Included: Adaptor for 1/2" microphones DB 0311 Leather case KE 0065 Battery 9 V transistor IEC 6LF22 (B & K order No. QB 0016) Accessories Available: 1/2" to 1/4" Adaptor DB 0310 1/2" to 1/8" Adaptor DB 0352
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SPECIFICATION FOR BRUEL & KJAER OCTAVE BAND FILTER SET

Specifications 1624 and 1625

Filter Set Type	1624 Octave	1625 Third-Octave and Octave
Frequency Range		
Selective	22 Hz to 22 kHz	18 Hz to 22 kHz (1/3 oct.), 14 Hz to 28 kHz (1/1 oct.)
Linear	Typical 5 Hz to 75 kHz (-1 dB)	Typical 3 Hz to 75 kHz (-1 dB)
Band-Pass Filters	10 active 6-pole Butterworth octave filters	31 active 6-pole Butterworth third-octave filters and 31 overlapping 1/3 oct. filters at 1/3 oct. intervals covering 11 octaves
In accordance with standard	IEC R 225-1966, DIN 45 651 and ANSI S 1.11-1966, Class II	IEC R 225-1966, DIN 45 652, DIN 45 651 and ANSI S1.11-1966, Class II & III
Centre Frequencies	31,5 Hz to 16 kHz	20 Hz to 20 kHz
Attenuation at Centre Frequency	0 dB ± 0,5 dB	0 dB ± 0,5 dB
Peak-to-valley Ripple	< 0,5 dB	< 0,5 dB
Attenuation outside Pass Band	See Fig.2 & 3, > 60 dB at 8 f ₀ and 1/8 f ₀	See Fig.6, > 75 dB at 5 f ₀ and 1/5 f ₀ (1/3 oct.) > 60 dB at 8 f ₀ and 1/8 f ₀ (1/1 oct.)
Filter Shift	Slider switch Green lamp indicates time for filter switching when used with Level Recorder	Manual or Automatic with Level Recorder. 1/3 oct. or 1/1 Oct. steps for 1/1 oct. analysis
Remote Control	Semi automatic of Level Recorders Types 2317 and 2309 via cable AQ 0034	Automatic to/from Level Recorders Types 2317 and 2309 via cable AQ 0034
Input Impedance	10 kΩ in series with 5 μF	10 kΩ in series with 15 μF
Input Terminating Impedance	≤ 100 Ω	≤ 100 Ω
Input Voltage	Max. 2 V sinus (2,8 V peak)	Max. 2 V sinus (2,8 V peak)
Output Impedance	< 5 Ω in series with 15 μF	< 5 Ω in series with 2,2 μF
Output Terminating Impedance	≥ 10 kΩ // 1 nF	≥ 10 kΩ // 1 nF
Inherent Noise	f ₀ Hz 31,5 Hz 63 Hz-16 kHz Lin max. μV 200 (typ. 140) 150 (typ. 70) 250 (typ. 120)	f ₀ Hz (oct. or 1/3 oct.) 20 Hz-40 kHz 50 Hz-10 kHz 12,5 kHz-20 kHz Lin max. μV 250 (typ. 170) 150 (typ. 80) 200 (typ. 110) 250 (typ. 120)
Magnetic Sensitivity (50 Hz)	Approximately 1 mV output for 100 A/m field strength	
Operating Temperature	-10 to + 50°C (+ 14 to +122°F)	
Storage Temperature	-20 to +50°C (-4 to +122°F) Batteries Removed	
Influence of Temperature on Attenuation	< 0,5 dB (-10 to +50°C)	
Influence of Humidity on Attenuation	< 0,5 dB for 0 to 90% relative humidity at ≤ 40°C without condensation	
Batteries	4 x 1,5 V IEC Type LR6 (QB 0013). Batteries used as extra supply for SLM	
Dimensions	Length 105 mm (4,1 in) - Width 85 mm (3,3 in) - Height 47 mm (1,8 in)	
Weight	450 g (1 lb) including batteries	
Accessories Included	4 Alkaline batteries 1 Plug	QB 0013 JP 0802
Accessories Available	1,5m control cable Mains Power Supply and Charger	AQ 0034 ZG 0254

T00517062

SPECIFICATION FOR BRUEL & KJAER
PRECISION INTEGRATING SOUND LEVEL METER

Specifications 2230

MEASURING RANGE:

Measuring Range			
FSD ¹	Lower limit for S/N ratio > 5 dB (A-weighting)	Max. peak level ²	Upper limit for signals of crest factor = 10 (20 dB) ³
70	24	83	83
80	24	93	73
90	30	103	83
100	40	113	93
110	50	123	103
120	60	133	113
130	70	143	123
140	80	153	133

¹ FSD on quasi analogue display

² Only with attenuator ZF0020 employed

³ Values may diverge slightly from nominal value depending on microphone K₀ factor

FREQUENCY RESPONSE:

See Figs.3 and 4

FREQUENCY WEIGHTING:

A, C weighting to IEC 651 Type 1
Linear (20 Hz -20 kHz)
All-pass (10 Hz -50 kHz)

DETECTOR:

Characteristics: RMS, peak
Linearity range: 70 dB
Pulse range: 73 dB
Crest factor capability: 13 dB at FSD

TIME WEIGHTING CHARACTERISTICS:

"1": to IEC 651 Type 1
"F": to IEC 651 Type 1
"S": to IEC 651 Type 1
"Peak": rise time <50 µs
Max. Hold decay rate: 0 dB/s (digital)

L_{eq} RESPONSE TIME FOR CONSTANT INPUT SIGNAL:

1 s after reset

MAXIMUM MEASUREMENT PERIOD:

Only limited by battery life

DISPLAY:

Digital: 4 digits 7 segments, liquid crystal, 8 mm high, resolution 0,1 dB
Quasi-analogue: 60 dB scale with 2 dB resolution for monitoring current SPL

Additional functions:

Overload occurring: †
Overload has occurred: ^
Battery near low level: BAT flashing
Battery low level: BAT (flash.) † (non-reset.)
Illegal setting: †

AC OUTPUT:

1 V RMS for full scale, output impedance <120 Ω, short circuit protected, mini-jack socket

DC OUTPUT:

3 V for full scale, 0 V bottom scale, 50 mV/dB, output impedance <500 Ω, short circuit protected, mini-jack socket

RESET FUNCTION:

Automatic reset all occurs when changing FSD setting.
Reset all: Max./min. detectors, L_{eq}, L_{EA,T} and overload detector are reset
Reset max./min.: Only max./min detectors are reset

MICROPHONE:

Type: 1/2 inch B & K Prepolarized Condenser Microphone Type 4155
Sensitivity: 50 mV/Pa
Capacitance: 15 pF
Windscreen effect: <0,9 dB up to 10 kHz

CALIBRATION:

Acoustical: With Sound Level Calibrator Type 4230 or Pistonphone Type 4220 by potentiometer adjustment
Electrical: With internal reference source by potentiometer adjustment

REFERENCE CONDITIONS FOR ACOUSTICAL CALIBRATION WITH TYPE 4230:

Type of Sound Field: Free
Reference Incidence Direction: Perpendicular to microphone diaphragm
Reference SPL: 94 dB (re 20 µPa)
Reference Frequency: 1 kHz
Reference Temperature: 20°C
Reference Measuring Range: 110 dB FSD

WARM-UP TIME:

<5 s for 0,5 dB; <10 s for 0,1 dB

EFFECT OF HUMIDITY (AT 40°C AND 1000 Hz):

<0,5 dB for 30% < RH < 90%

EFFECT OF TEMPERATURE:

Microphone: -0,008 dB/°C typically
Complete instrument:
<0,5 dB -10 to +50°C
Operating range: -10 to +50°C (+14 to 122°F)
Storage without batteries: -20 to +70°C (-4 to 158°F)

EFFECT OF MAGNETIC FIELD:

80 A/m (1 Ørsted) at 50 Hz gives:
<25 dB (A) or <44 dB (Lin)

VIBRATION SENSITIVITY: 72 dB max. at 40 Hz and 1 ms⁻².

BATTERIES:

Type: Four 1,5 V Alkaline cells IEC type LR 6 (B&K order No. QB 0013)
Life: approx. 8 hours

OVERALL DIMENSIONS AND WEIGHT:

370 x 85 x 47 mm (14,7 x 3,3 x 1,8 in)
860 g (1,9 lb) with batteries

ACCESSORIES INCLUDED:

Half-Inch Prepolarized Condenser Microphone Type 4155
2,5 mm mini-jack plug (x2) JP 0213
Windscreen UA 0237
Input Adaptor JJ 2614
Screwdriver QA 0001
Cells (x4) QB 0013
20 dB Attenuator ZF 0020

ACCESSORIES AVAILABLE:

Carrying case KE 0226
Tripod UA 0801
Sound Level Calibrator Type 4230
Level Recorder Cable AO 0173
3 m Microphone Extension cable AO 0134
Mains Power Supply and Charger ZG 0254

APPENDIX 10.5.2

GROUNDWATER

**GROUNDWATER MONITORING PLAN
HARDEE UNIT 3
SEMINOLE ELECTRIC COOPERATIVE INCORPORATED**

Information presented within this SCA document addresses the required contents for a groundwater monitoring plan application in accordance with Chapter 17-522, F.A.C. The location of site-specific and regional information previously presented in this document is provided for the items listed in Form 17-522.900(1), *Application for Monitoring Plan Approval*, as follows:

- 1. Hydrogeological, physical and chemical data for the site, including:**
 - a. Direction and rate of ground water flow, and background ground water quality;**
SCA Section 2.3.2 -- Subsurface Hydrology
 - b. Porosity, horizontal and vertical permeability for the aquifer(s) and depth to, and lithology of, the first confining bed(s);**
SCA Section 2.3.2 -- Subsurface Hydrology
 - c. Vertical permeability, thickness, and extent of any confining beds;**
SCA Section 2.3.2 -- Subsurface Hydrology
 - d. Topography, soil information and surface water drainage systems surrounding the site;**
SCA Section 2.3.1 -- Geohydrology
SCA Section 2.3.4 -- Surficial Hydrology
- 2. Water disposal rate and frequency, chemical composition, method of discharge, pond volume, spray-field dimension, or other applicable site specific information;**
SCA Section 3.5 -- Plant Water Use
SCA Section 3.6 -- Chemical and Biocide Waste
SCA Section 3.7 -- Solid and Hazardous Waste
- 3. Toxicity of waste;**
SCA Section 3.6 -- Chemical and Biocide Waste
SCA Section 3.7 -- Solid and Hazardous Waste

- 4. Present and anticipated wastewater volume, seepage rate to the receiving ground water, physical, chemical, microbiological (whichever is applicable) characteristics of the leachate;**

SCA Section 5.2 -- Effects of Chemical and Biocide Discharges

- 5. Disposal system water balance;**

SCA Section 5.1 -- Effects of Operation of the Heat Dissipation System

SCA Section 5.5 -- Sanitary and Other Waste Discharge

- 6. Present and reasonably expected future pollution sources located within one mile radius of the site;**

- Phosphate mining, processing and reclamation
- Clay settling ponds
- Agricultural operations

- 7. Inventory depth, construction details, and cones of depression of water supply wells and monitor wells located within one mile radius of the site or potentially affected by the discharge;**

SCA Section 2.3.3 -- Site Water Budget and Area Users

- 8. Site specific economic and feasibility considerations;**

SCA Section 7.0 -- Economic and Social Effects of Plant Construction and Operation

SCA Section 8.0 -- Site and Design Alternatives

- 9. Chronological information on water levels in the monitor wells and water quality data on water supplies collected from the water supply and monitor wells;**

SCA Section 2.3.2 -- Subsurface Hydrology

SCA Section 5.3.2 -- Impact to Water Supplies, Groundwater

- 10. Type and number of waste disposal facilities within the installation;**

SCA Section 5.4 -- Solid/Hazardous Waste Disposal Impacts

- 11. Chronological information on surface water flows and water quality upstream and downstream from the site;**

SCA Section 2.3.4 -- Surficial Hydrology

- 12. Construction and operation details of disposal facilities;**

SCA Section 5.2 -- Effects of Chemical and Biocide Discharges

SCA Section 5.4 -- Solid/Hazardous Waste Disposal Impacts

SCA Section 5.5 -- Sanitary and Other Waste Discharges

13. History of construction and land development in the vicinity of the site.

SCA Section 2.3.5 -- Vegetation/Land Use

SCA Section 10.0 -- Hardee Power Station Project and Site Reclamation Requirements
Amendments

MONITORING PROGRAM

Groundwater monitoring is currently being conducted at the HPS site in association with the previously certified HPS existing units. Groundwater samples are currently being collected on a quarterly basis for analysis of a specified list of parameters. Activities related to collection, transportation, and analysis of the groundwater samples are performed in accordance with protocols acceptable to the Florida Department of Environmental Protection. Six wells installed in the surficial aquifer at selected locations around the existing facilities comprise the current monitoring program, as summarized below:

- HPS-1 Shallow well, upgradient from the cooling pond.
- HPS-2 Shallow well, downgradient from the cooling pond.
- HPS-3 Deep well, downgradient from the cooling pond.
- HPS-4 Shallow well, downgradient from the cooling pond.
- HPS-5 Shallow well, upgradient from the detention pond.
- HPS-6 Shallow well, downgradient from the detention pond.

For the proposed Hardee Unit 3 site, groundwater monitoring will be conducted in a manner consistent with the current activities. Proposed monitor well locations are presented below:

- HU3-1 Shallow well, upgradient location representing background conditions.
- HU3-2 Shallow well, upgradient from the detention pond.
- HU3-3 Shallow well, downgradient from the detention pond.
- HU3-4 Shallow well, downgradient from the Hardee Unit 3 power block area and upgradient from the HPS existing facilities.

Existing and proposed monitor well locations are presented in Figure 1.

Construction of the proposed monitor wells for the Hardee Unit 3 site will be similar to the existing monitor wells at the HPS site and are intended to monitor groundwater quality in the uppermost water-bearing unit of the surficial aquifer. It is proposed that the four monitor wells be constructed of 2-inch diameter, flush threaded, schedule 40 polyvinyl chloride (PVC) casing

and slotted screen. It is anticipated that the well depths will range between 20 and 30 feet below final grade. The wells will be installed at the selected locations by means of hollow stem augers without the use of drilling fluids. When the desired depth is reached with the soil boring, the PVC well screen and riser assembly will be set inside the auger stems. As the auger flights are gradually removed, the annular space around the well assembly will be filled with graded quartz sand to a level approximately 6 inches above the top of the screen, followed by at least 6 inches of pelletized bentonite. The balance of the annular space will be filled with neat cement. The wells will be finished at land surface with a concrete pad and aboveground protective steel casing with locking cap.

Field measurements to be conducted as an indication of water sample stabilization during monitor well purging will include specific conductivity, pH, and temperature. These field measurements will be recorded during the withdrawal of the calculated casing volumes to ensure collection of representative groundwater samples. It is also proposed that the concentration of sulfite be measured in the field at the end of well purging.

It is proposed that groundwater samples collected from the Hardee Unit 3 site be analyzed for the list of parameters currently being conducted for at the HPS existing facilities. It is proposed that grab samples be collected from the four proposed well locations on a quarterly basis for laboratory analysis of the following parameters:

- Total metals -- aluminum, arsenic, beryllium, cadmium, chromium, copper, iron, lead, mercury, nickel, selenium, zinc.
- Total and dissolved radionuclides -- gross alpha, radium 226.
- Other parameters -- chloride, color (apparent), color (true), oxidation-reduction potential, sulfate, total dissolved solids, conductivity, and pH.

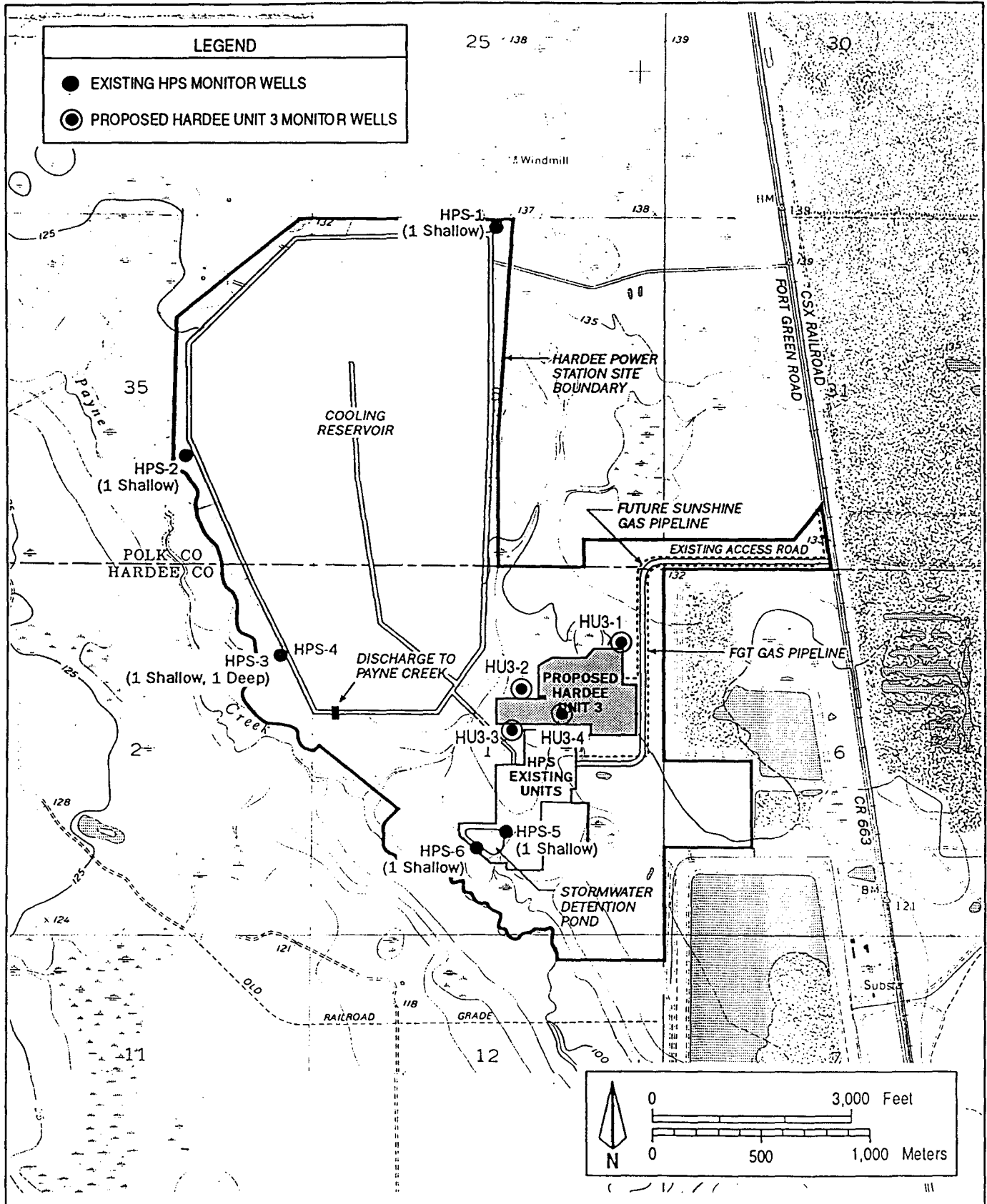
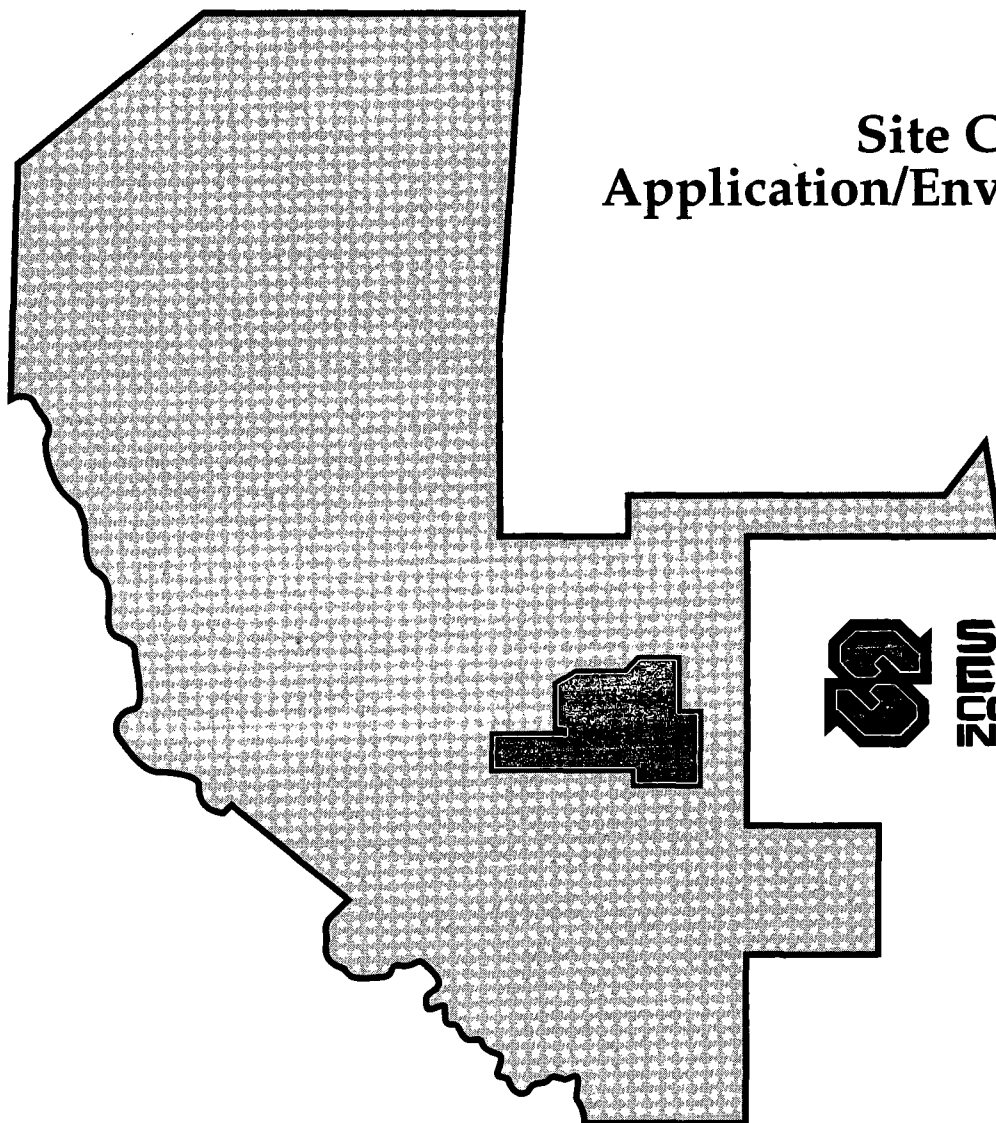


Figure 1
Existing and Proposed Monitor Well Locations

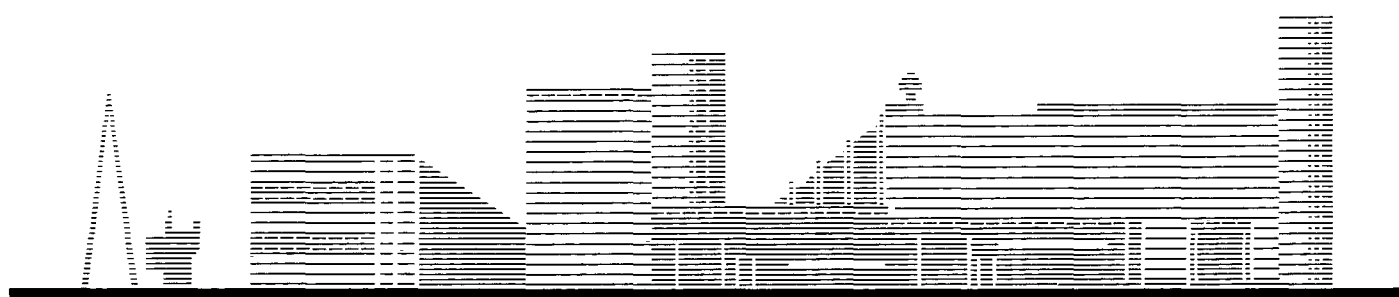


HARDEE UNIT 3

Site Certification
Application/Environmental
Analysis



**SEMINOLE
ELECTRIC
COOPERATIVE
INCORPORATED**



APPENDIX 10.6

FLORIDA DEPARTMENT OF HISTORICAL RESOURCES OPINION LETTER



FLORIDA DEPARTMENT OF STATE

Jim Smith
Secretary of State

DIVISION OF HISTORICAL RESOURCES

R.A. Gray Building
500 South Bronough
Tallahassee, Florida 32399-0250

Director's Office Telecopier Number (FAX)
(904) 488-1480 (904) 488-3353

February 10, 1994

Mr. Roy D. Zwolak
KBN Engineering & Applied Sciences
5405 West Cypress Street
Suite 215
Tampa, FL 33607

In Reply Refer To:
Laura A. Kammerer
Historic Preservationist
Supervisor
(904) 487-2333
Project File No. 940432

RE: SECI Hardee Unit 3 - Cultural Resource Assessment

Dear Mr. Zwolak:

In accordance with the provisions of the National Historic Preservation Act of 1966, as amended, which are implemented by the procedures contained in 36 CFR, Part 800; as well as the provisions contained within the applicable sections of Florida Statutes, we have reviewed the above referenced project for possible impact to archaeological and historic sites or properties listed, or eligible for listing, in the National Register of Historic Places, or otherwise architectural, historical or archaeological significance.

A review of the Florida Master Site File indicates that no significant archaeological or historical sites are recorded for or considered likely to be present within the project area. Furthermore, it is the opinion of this agency that because of the project location and nature it is considered unlikely that any such sites will be affected. Therefore, it is the opinion of this office that the proposed project will have no effect on historic properties. The project may proceed without further involvement with this agency, unless the plans are changed to include areas outside the existing plant site.

If you have any questions concerning our comments, please do not hesitate to contact us. Your interest in protecting Florida's historic properties is appreciated.

Sincerely,

Laura A. Kammerer

for

George W. Percy, Director
Division of Historical Resources
and
State Historic Preservation Officer

GWP/Klk

Archaeological Research
(904) 487-2299

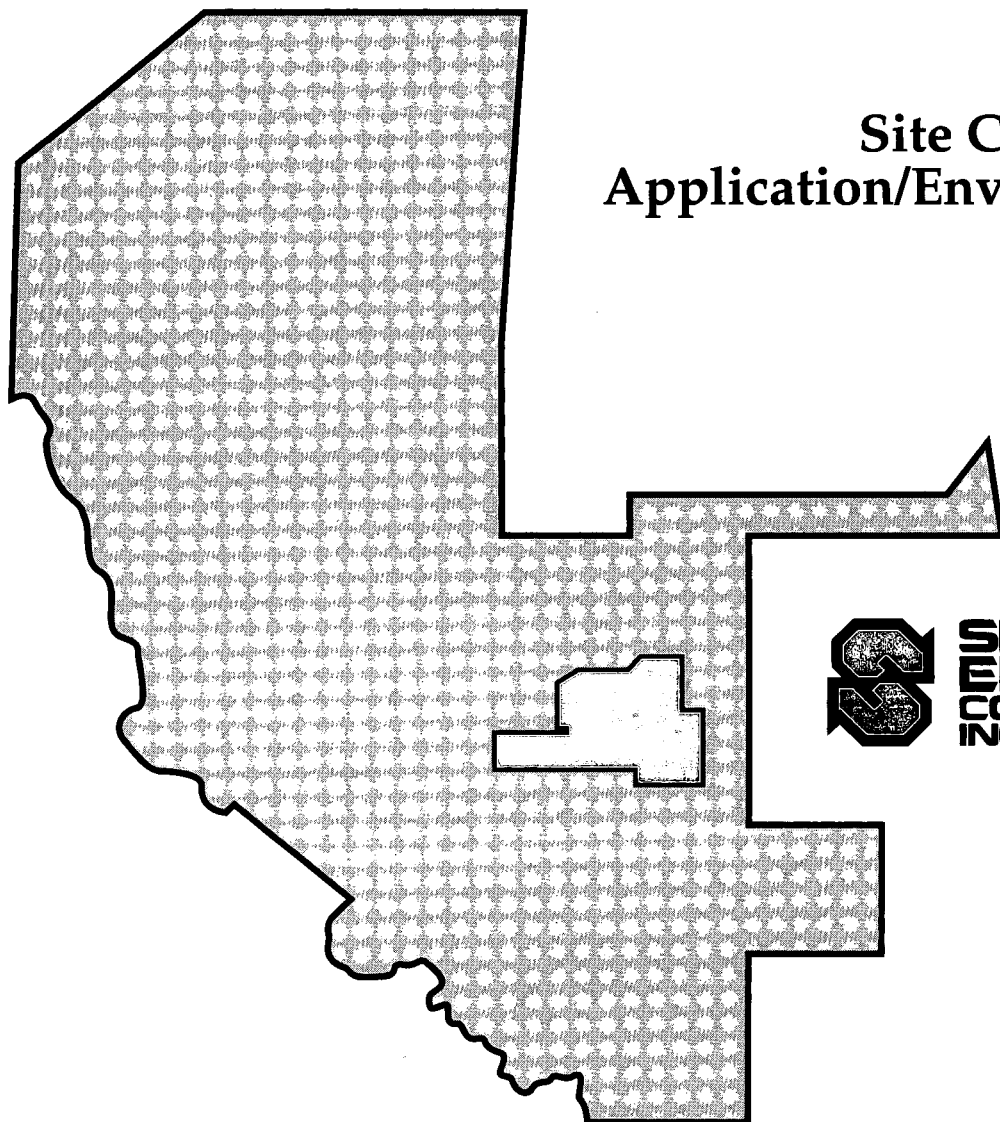
Florida Folklife Programs
(904) 397-2192

Historic Preservation
(904) 487-2333

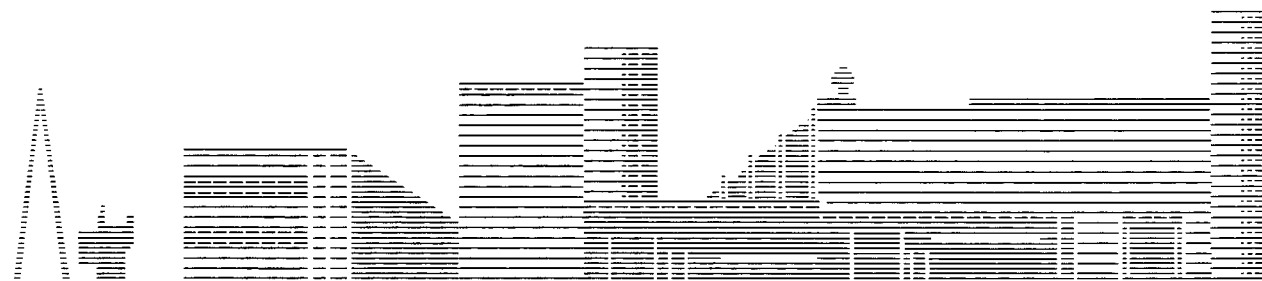
Museum of Florida History
(904) 488-1484

HARDEE UNIT 3

**Site Certification
Application/Environmental
Analysis**



**SEMINOLE
ELECTRIC
COOPERATIVE
INCORPORATED**



APPENDIX 10.7

SUPPORTING GEOHYDROLOGICAL INFORMATION

APPENDIX 10.7.1

**PRELIMINARY GEOTECHNICAL AND FOUNDATION
ENGINEERING STUDY FOR
HARDEE UNIT 3 SITE**



atlanta testing
& engineering

6604 harney road / suite j / tampa, florida 33610 / (813) 623-6646 / fax (813) 623-3795



**PRELIMINARY
GEOTECHNICAL AND FOUNDATION
ENGINEERING STUDY
HARDEE POWER STATION
HARDEE COUNTY, FLORIDA**

Prepared For:

Mr. Joe Welborn, P.E.
Seminole Electric Cooperative, Inc.
P. O. Box 272000
16313 North Dale Mabry Highway
Tampa, Florida 33688-2000

Prepared By:

ATLANTA TESTING AND ENGINEERING
6604 HARNEY ROAD, SUITE J
TAMPA, FLORIDA 33610

May 21, 1993
AT&E Report No. 9767-1



atlanta testing
& engineering

6604 harney road / suite j / tampa, florida 33610 / (813) 623-6646 / fax (813) 623-3795



Mr. Joe Welborn, P.E.
Project Manager
Seminole Electric Cooperative, Inc.
P. O. Box 272000
Tampa, Florida 33688-2000

May 21, 1993
AT&E Report No. 9767-1

**RE: Preliminary Geotechnical and Foundation Engineering Study
Hardee Power Station
Hardee County, Florida**

Dear Mr. Welborn:

Atlanta Testing & Engineering, Inc., (AT&E) has performed a preliminary subsurface soil exploration and foundation study for the proposed Hardee Power Station plant expansion in Hardee County, Florida. The study was authorized by Mr. Richard D. Rich, Director of Procurement for Seminole Electric Cooperative, Inc. (SECI), on April 14, 1993.

The study included soil test borings, field testing and engineering evaluation. Portions of the results have been transmitted to your engineers during the course of our study. This report presents the findings and preliminary recommendations of our study for your foundation and pavement design and site preparation activities.

We appreciate the opportunity to be of service for this project. If you have any questions concerning this report or if we may be of further assistance on this or other projects, please do not hesitate to call.

Sincerely,

ATLANTA TESTING & ENGINEERING, INC.

Darrell Hanecki, P.E.
Senior Geotechnical Engineer
Fla. Reg. No. 40143

C. Rees Nickerson, P.E.
Principal Consultant
Fla.Reg. No. 35792

DH:cc

Copies Submitted: (3)

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ASFE INFORMATIONAL PAGES**A P P E N D I X**

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Test Boring Records	
Pile Capacity Analysis	
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SUMMARY

Scope

A preliminary geotechnical and foundation engineering study has been performed at the site of the Hardee Power Station in northwestern Hardee County, Florida. The purposes of this study were to explore the subsurface soil conditions across the site, perform laboratory and field tests on obtained soil samples, evaluate these conditions with respect to the proposed project, and make preliminary recommendations for foundation design, on-grade construction and site preparation.

Subsurface Conditions

Fourteen (14) Standard Penetration Test (SPT) borings were performed at the site. The SPT borings extended to depths of 30 to 90 feet below the existing ground surface. The soils in the main study area typically consisted of clean to slightly silty or slightly clayey fine sand extending from the ground surface to depths of two to 13 feet. These sands were generally underlain by clayey sands which graded to sandy clays and clays to the boring termination depths. Although somewhat variable, the soils at the site had N-values ranging from two blows to greater than 100 blows per foot of penetration. Typical values in the upper 30 feet were between eight and 40 blows per foot. Below approximately 30 feet, the soils generally increased in relative density with N-values frequently above 30 blows per foot. Two significant exceptions to the above soil profile were observed. These occurred in borings B-14 and B-15, which were performed along a proposed entrance road extending from the existing plant access road west to the eastern edge of the main study area. These borings appeared to be performed within an area which had been previously mined for phosphates. The soils in the upper 30 to 40 feet of these borings had relative densities much looser or softer than those encountered in other borings. Typical N-values were below ten blows per foot to depths of 30 to 40 feet. Boring B-14 encountered predominantly clean and slightly clayey fine sands to 28 feet. These sands were underlain by clayey sand and clay to the boring termination depth. Boring B-15 encountered sands to 13 feet underlain by very soft clay to 18 feet. This soft clay may represent phosphatic slime, which is a by-product of the phosphate mining operations. From 18 to 33 feet, the soils consisted of clayey sand and clay, which had typical N-values between three and four blows per foot. Below 33 feet, the soils typically consisted of clayey sand and clay to the termination depth, with N-values above ten blows per foot. The groundwater table at the time of our study was generally less than two feet below the existing ground surface. The seasonal high groundwater table is estimated to be at the existing ground surface for much of the project site.

Evaluations and Conclusions

The subsurface soil conditions generally appear suitable for support of the proposed steam boiler and oil tank structures on mat foundation systems. High contact pressures may preclude the use of spread footings. Alternately, deep foundation systems also appear suitable for use if the arrangement of the structures results in the potential for excessive differential settlement. Detailed discussion of foundation alternatives are included in the text of this report. The proposed access road will cross what appears to be a previously mined area of the site. Structural fill will be required to raise the roadway above seasonal high groundwater levels. Settlement may result from the addition of fill loads as well as traffic loads. Therefore, special pavement design may be necessary. Detailed pavement discussion is also included in the body of this report.

INTRODUCTION

We understand that the Seminole Electric Cooperative, Inc. (SECI), is planning to construct a steam boiler, an oil tank and an access road as part of an expansion to the existing Hardee Power Station facilities. The expansion is planned for the north side of the existing plant. The steam boiler has anticipated loads of two million pounds distributed over a 31 foot x 32 foot area. The oil tank will have an approximate 140 foot diameter with an expected load of 50 million pounds. The locations of the proposed structures had not been determined at the time of this study. This study was intended to provide subsurface soil data which will be used to site the facilities on the property.

The site of this study is located in the northwest portion of Hardee County, Florida. The plant is in an unincorporated area, which is primarily utilized for phosphate mining. The job site is located approximately 3 1/2 miles north of State Road 62 on the west side of County Road 663. At the time of our site visit, the site was unimproved with plan dimensions of approximately 1,000 feet by 750 feet. The southern line of borings was located approximately 450 feet north of the existing plant. Site topography was relatively flat and sloping gently downward to the west and northwest. Elevation differences across the study area varied by approximately 12 feet. Vegetation consists of tall grass and weeds and scattered pine tree saplings.

SUBSURFACE EXPLORATION

Field Exploration

Fourteen (14) Standard Penetration Test (SPT) were performed at the project site. Originally, 15 SPT borings were planned. However, boring B-1 located at the northwest corner of the study area was eliminated at the direction of Mr. Joe Welborn of SECI because the boring was located in approximately 18 inches of standing surface water. The borings extended to depths of 30 to 90 feet below the existing ground surface.

The SPT borings were advanced by means of an all-terrain vehicle mounted drill rig employing wet rotary drilling techniques. At periodic intervals, the soils were tested and sampled by means of the Standard Penetration Test (SPT). A brief description of the sampling technique is as follows:

The borings were performed in general compliance with ASTM's procedure for standard field penetration tests (D-1586). After drilling to the sampling depth and cleaning the bore hole, the standard two inch O.D. split-barrel sampler was seated by driving it six inches into the undisturbed soil. Then the sampler was driven an additional 12 inches by a 140 pound hammer falling 30 inches. The number of blows required to produce the last 12 inches of penetration is recorded as the penetration resistance (N). The sampling in the upper ten feet was performed utilizing a 24 inch split spoon. The split spoon was driven 24 inches with the number of blows required to produce the middle 12 inches of penetration recorded as the N-value. These values are plotted on the right side of the Test Boring Records which appear in the Appendix of this report.

The SPT tests were performed continuously to 10 feet and at 5 foot intervals thereafter. The soil samples obtained were classified in the field by our engineer, placed in sealed containers, and returned to our laboratory for further examination by our project engineer. The locations of the borings were determined by SECI and were staked in the field by a registered surveyor in accordance with the locations described on the attached Boring Location Plan in the Appendix. The elevation of the ground surface at each boring location was also established during the surveying and is indicated in the table in the Appendix of this report. Boring B-4 was off-set to avoid standing surface water. The off-set location was approved by Mr. Joe Welborn and was off-set 12 feet north and three feet east of the original staked location. The elevation of the new boring location was 1.0 feet higher than the originally staked location.

Subsurface Conditions

Fourteen (14) Standard Penetration Test (SPT) borings were performed at the site. The SPT borings extended to depths of 30 to 90 feet below the existing ground surface. The soils in the main study area typically consisted of clean to slightly silty or slightly clayey fine sand

extending from the ground surface to depths of two to 13 feet. These sands were generally underlain by clayey sands which graded to sandy clays and clays to the boring termination depths. Although somewhat variable, the soils at the site had N-values ranging from two blows to greater than 100 blows per foot of penetration. Typical values in the upper 30 feet were between eight and 40 blows per foot. Below approximately 30 feet, the soils generally increased in relative density with N-values frequently above 30 blows per foot. Two significant exceptions occurred to the above soil profile. These occurred in borings B-14 and B-15, which were performed along a proposed entrance road extending from the existing plant access road west to the eastern edge of the main study area. These borings appeared to be performed within an area which had been previously mined for phosphates. The soils in the upper 30 to 40 feet of these borings encountered soils with relative densities much looser or softer than those encountered in other borings. Typical N-values were below ten blows per foot to depths of 30 to 40 feet. Boring B-14 encountered predominantly clean and slightly clayey fine sands to 28 feet. These sands were underlain by clayey sand and clay to the boring termination depth. Boring B-15 encountered sands to 13 feet underlain by very soft clay to 18 feet. This soft clay may represent phosphatic slime, which is a by-product of the phosphate mining operations. From 18 to 33 feet, the soils consisted of clayey sand and clay, which had typical N-values between three and four blows per foot. Below 33 feet, the soils typically consisted of clayey sand and clay to the termination depth, with N-values above ten blows per foot. Detailed descriptions of the subsurface conditions are included in the Test Boring Records in the Appendix.

Groundwater Table

Groundwater levels were measured at each boring location by initially advancing an auger boring adjacent to the SPT boring until the groundwater table was encountered. Groundwater levels were measured at the time of drilling and upon completion of drilling. All boreholes were grouted from the bottom to the ground surface prior to abandoning each drill site. As previously mentioned, some areas of the site had standing water. The location of boring B-1 had approximately 18 inches of water above the ground surface. The original location of

boring B-4 had approximately six inches of water at the ground surface. Based on our observations of the subsurface conditions, we estimate that the seasonal high groundwater table will generally be encountered between the ground surface and one foot below the ground surface. Some areas of the project site may have ponded surface waters. Significant fluctuations in groundwater table levels should be expected due to variations in rainfall, run-off and other site specific factors. We anticipate that the groundwater will have a major impact on earthwork activities at this site. Dewatering will likely be necessary during fill placement or excavations for foundations or utilities.

Laboratory and Field Test Results

Several samples recovered from the SPT borings were retained for laboratory testing. The laboratory tests primarily consisted of natural moisture content, percent of material passing a No. 200 Sieve, and Atterberg Limits. These tests are used to evaluate the behavioral characteristics of the soils under the anticipated structural loads. Results of tests performed on individual soil samples are reflected on the Test Boring Records below the soil description of the samples tested. Discussion of test procedures are included in the Appendix of this report.

EVALUATIONS AND RECOMMENDATIONS

General Considerations

Based on the data obtained from the SPT borings performed at this site, we have concluded that the eastern portion of the project site may have previously been mined for phosphates or substantially disturbed by earthwork activities. We understand from SECI that mining was known to have occurred in this area and that the property was subsequently reclaimed. The western portion of the project site does not appear to have been mined and the subsurface conditions are fairly consistent across the site. The borings located in areas which appear to have been impacted by mining include borings B-3, B-8, B-14 and B-15. These borings have noticeably looser or softer soil conditions and/or the soil profiles deviate from other borings



performed at the project site. Borings B-3 and B-8 may be on the fringe area of the mining because the soils only appear to be disturbed to depths of 10 to 15 feet.

The subsurface soil conditions in the western portion of the site are generally suitable for support of heavy foundation loads on mat and shallow footing foundations. The major factors influencing construction and foundation support is the presence of loose sands in the upper 5 to 10 feet of the soil profile and shallow groundwater table conditions over substantial portions of the site. For light equipment loads, shallow footing foundations will provide adequate support. Large equipment such as the steam generator and oil tank, however, supported on shallow mat foundations may experience significant total and differential settlement. Alternately, deep foundation systems can be used to support structures which may be sensitive to settlement. For the purpose of discussion in this report, a mat foundation system is considered to be a conventional mat, a thickened edge monolithic slab, or combination slab and footing system. Deep foundation systems include driven piles, auger cast (cast-in-place piles) and drilled piers.

At the time of this study, the orientation and position of structures on the site was undetermined, however, we assume that the general location will likely be in the western portion of the main study area based on the soil conditions encountered in this study. Unknown conditions such as structural constraints on mat foundation thickness and steel reinforcing requirements, positioning and number of piles which may be required for support, and other factors which are dependant on the foundation system selected, limit the accuracy by which foundation option costs may be compared. Therefore, generalizations and assumptions were necessary to preliminarily compare costs associated with foundation and site preparation alternatives. However, based on the available, preliminary structural data and the subsurface soil conditions encountered during our studies, three foundation options were determined to be economically suitable for use. The foundation options are:

- 1) Use of steel reinforced, pre-stressed, concrete pile foundations, or
- 2) Use of auger cast piles or drilled piers, or

- 3) Use of a shallow, steel reinforced, mat foundations in combination with special site preparation.

The foundation alternatives including advantages, disadvantages, and relative costs are discussed in detail in the following sections.

Mat Foundations

Mat foundations are shallow foundations which distribute structure loads to shallow soils. These loads are subsequently distributed through the underlying soil strata with the stress typically dissipating with increasing depth below the foundation.

The benefits of mat foundations include lower costs than deep foundations and potentially faster construction, depending on mat geometry and thickness. Since mat foundations distribute loads relatively uniformly, subtle variations in subsurface conditions are not detrimental, however, moderate and severe variations in subsurface conditions may adversely affect foundation performance. Variations in groundwater levels can affect settlement of shallow foundations. If groundwater levels are lowered substantially (as a result of nearby mining operations, for example) then settlement could be substantially increased. Costs associated with construction of shallow foundations are typically less than those of deep foundation systems.

Construction of mat foundations on the western portion of the property may be performed in conjunction with special site preparation work. Prior to constructing the foundation, the site should be stripped of vegetation and the upper soils compacted by surface rolling with a drum compactor. Large area dewatering may be necessary depending on the proposed bearing depth of the foundation. If the foundation will bear in structural fill, then site preparation will consist of compacting the surface soils followed by placement and compaction of structural fill. If the foundation bearing level will be at or below the existing ground surface, then

groundwater control during foundation construction will almost certainly be necessary. This can add substantially to the cost of a shallow foundation system.

Settlement

The primary concern with the heavy structures supported on shallow foundations is the potential for excessive settlement. If the proposed structures are supported on shallow mat foundations on the western portion of the property (west of borings B-3, B-8, B-14 and B-15), then total settlement is estimated at one-half to one inch for the steam boiler and two to three inches for the oil tank. Differential settlement is expected to approximately half of the total settlement. If the structures are constructed on the eastern portion of the property, preliminary settlement computations indicate total settlement on the order of two to four inches for the steam boiler and five to eight inches for the oil tank. These estimates assume that the structures will be supported on mat foundations which distribute the structural loads uniformly across the mat area and bear at the existing ground surface. Placement of structural fill will increase the total settlement estimates discussed above. If the structures are placed in close proximity to each other (within 50 feet or less), then the differential settlement may be increased because of overlapping stress envelopes in the soils below the structures.

The eastern portion of the project site likely has highly variable soil conditions resulting from mining operations. If conditions fluctuate substantially or are significantly worse in other areas than those conditions encountered in borings B-14 and B-15, then differential and total settlement may be higher than the estimates provided above.

Allowable Bearing Pressure

Based on the information obtained during our exploration, shallow foundations may be designed for allowable soil bearing pressures of 2000 to 3500 psf where they bear on properly prepared and compacted in-place soils or structural fill. Allowable soil bearing pressures on the western portion of the site will likely range between 2500 and 3500 psf.

Allowable bearing pressures on the eastern portion of the site will likely range between 2000 and 2500 psf. The allowable soil bearing pressure is a function of footing embedment depth and dimensions. Consequently, more accurate allowable soil bearing pressures can be determined when foundation types and locations are more definitive.

Pile Foundations

Deep foundation systems transfer structural loads to deep soil strata which are generally capable of bearing higher loads. A pile foundation system transfers loads to deep soil strata which distribute the load via frictional forces along the skin of the pile and in bearing to the pile tip. The pile tip would likely bear on the very hard clay and/or rock layer at depths of approximately 50 to 65 feet below the existing ground surface.

Deep foundations, such as piles, do not require a dewatering system during installation. The lack of foundation details for equipment and structures limited the evaluation of the suitability of this foundation system. From the perspective of technical suitability, piles represent an acceptable foundation alternative. However, the number and location of piles will have to be established to allow accurate estimation of costs. In general, deep foundations are more expensive than shallow foundations. Factors such as dewatering could drive up the cost of site preparation for shallow foundations making deep foundations more economical.

Driven Pile Foundations

For, driven, steel reinforced, pre-stressed, square concrete piles, we estimate allowable pile capacities of 50 to 80 tons for a 12 inch pile and 100 to 150 tons for 18 inch piles located on the western portion of the study area. Piles supported in the soils exposed to mining activities will have substantially lower capacities because of looser soil conditions and down-drag load reductions resulting from consolidation settlement or clay soils. Piles are expected to bear at depths of 55 to 65 feet below the existing ground surface. Pile capacities should be confirmed with field testing by either static pile load tests or Pile Dynamic Analyzer (PDA) testing. Dewatering is also not required during pile installation.

Pile foundations have several advantages over shallow foundations. Variations in shallow soil conditions (upper 10 to 15 feet) typically do not have a significant impact on the pile capacity or installation methods. Since loads are transferred to deep soils, stress envelopes which are present below shallow foundations are eliminated and overlap of soil stress envelopes between structures will not occur. Therefore, structures may be more closely spaced without affecting settlement. Future development and long term lowering of groundwater are less likely to impact deep foundation performance.

Drilled Pile Foundations

Drilled pile foundations include auger cast (cast-in-place) piles and for the purposes of this report, drilled piers. Drilled in-place piles may be utilized for foundation support. Allowable capacities of drilled piles will likely be comparable to the range of allowable capacities identified for driven piles. However, this is not true in the eastern (mined) portion of the site. Cast-in-place piles usually have a somewhat variable cross section, dependant on the density and composition of the soils. In very loose or soft soils as observed on the eastern portion of the project site, the pile cross section may be slightly increased as these soils displace more during pile construction. Consequently, more skin friction may be developed. Since the soils on the eastern portion of the site may have been mined, recently deposited, and are very loose and soft in the upper strata, continued consolidation may be occur. Consolidation of the soils can apply down-drag forces on piles resulting in decreased capacity. Driven piles would likely have an allowable capacity advantage over drilled piles on the eastern portion of the site.

The advantages of drilled, cast-in-place type piles are similar to driven piles. In addition, pile length can be altered during installation. If conditions during installation dictate the use of a longer or shorter pile than planned, the boring depth may be lengthened or shortened easily. Driven, pre-cast piles are ordered at a fixed length and difficult to splice if additional length is required. If necessary, extra cast-in-place piles can be installed without delays associated with waiting for the pre-cast yard to manufacture additional piles. Cast-in-place piles offer

more flexibility in the field than do pre-cast driven piles. Under variable soil conditions, the use of cast-in-place piles can translate into significant cost savings.

The quality of drilled piles is very dependent on construction and installation methods. It is essential that pile construction be performed by an experienced contractor and strict quality control maintained during installation.

Regardless of the pile type installed, load tests are necessary to confirm that the designed allowable pile capacity is achieved. For driven piles, the Pile Dynamic Analyzer is recommended to test the pile capacity during installation. Drilled piles should be tested by the Pile Integrity Tester to insure a uniform cross-section has been achieved. Static load testing should also be performed to confirm the available capacity.

PAVEMENT DESIGN

The conditions most likely to affect roadway construction are the presence of variable subsurface soils and shallow groundwater levels. Settlement of the roadway could be excessive through the previously mined portion of the site, especially if fill is placed to raise the roadway grade. We would recommend that fill placement to raise grades be kept to a minimum to limit post construction settlement. We advise that the bottom of the roadway base be constructed at least 12 inches above the seasonal high groundwater table. If constructed less than 24 inches above the seasonal high groundwater table, then a recycled concrete base, asphaltic base course, or other non-moisture sensitive base material be utilized. An additional soil study should be performed along the proposed roadway route. We recommend that borings be spaced on approximate 200 foot centers and drilled to minimum depths of 10 feet. If the additional study indicates that soft clay soils or other potentially detrimental soils are not present within the upper five feet of the soil profile and if structural fill to raise the roadway will not induce excessive settlement, then a typical flexible pavement section will likely be suitable for roadway construction. A typical section capable of

supporting heavy equipment loads would likely consist of a 2 to 3 inch asphaltic surface course underlain by an 8 to 10 inch thick base of recycled concrete, soil-cement, or asphalt, underlain by a clean sand subbase.

CONCLUSIONS

The western portion of the study area has more consistent and overall better soil conditions than the eastern portion of the site which appears to have been previously mined. Borings B-3 and B-8 appear to be located near the western limit of mining activities. Borings B-14 and B-15 are located well within the area disturbed by mining operations. Three foundation alternatives, deep driven piles, deep drilled piles, or a shallow mat, appear well suited for support of heavily loaded equipment and structures for this project. All of these major equipment foundation systems have advantages and disadvantages. The costs of these foundation systems will be substantially impacted by location of facilities, soil conditions, finish grade elevations, and fill placement. In general, the shallow foundation systems are less expensive than deep foundation systems. We recommend that site grading and preliminary structure locations be determined using the soil condition information contained in this report. Then, following preliminary structure siting and site grading design, the specific location of the structures should be explored with additional borings on more closely spaced centers. We would recommend at least four borings at the tank location and two borings at the steam generator when their position on the site has been more definitively established. Based on the results of the site specific borings, cost comparisons of foundation alternatives can be assessed.

LIMITATIONS

Our evaluations of the site conditions have been based upon the above, preliminary construction information and on data obtained in our explorations. We have used previous

correlations between penetration resistances and foundation bearing pressures observed in soil conditions similar to those at your site.

Soil samples obtained in this exploration will be stored in our laboratory for a period of 60 days unless otherwise requested. After this period, they will be discarded.

This report has been prepared for the exclusive use of Seminole Electric Cooperative, Inc. and their agents for the specific project and purpose described herein and was prepared in accordance with generally accepted geotechnical and engineering practice. No other warranty expressed or implied is made. Any conclusions or recommendations made by others based on the data contained herein are not our responsibility unless we have been given the opportunity to review those conclusions and recommendations.

This engineering report is based on the data obtained from the exploratory borings shown on the attached boring location plan. Variations in the soil strata which may occur between the individual boring locations are not reflected, except as may be discussed elsewhere in this report. The nature and extent of such variations may not become evident until the construction begins. If such variations do occur, it will be necessary that we be made aware of them so we can reevaluate and modify, if necessary, any recommendations presented in this report.

ASFE INFORMATIONAL PAGES

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, due in large measure to programs and publications of ASFE/ The Association of Engineering Firms Practicing in the Geosciences.

The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include: the general nature of the structure involved, its size and configuration; the location of the structure on the site and its orientation; physical concomitants such as access roads, parking lots, and underground utilities, and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program. To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of the report may affect its recommendations.

Unless your consulting geotechnical engineer indicates otherwise, *your geotechnical engineering report should not be used:*

- When the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership, or
- for application to an adjacent site.

Geotechnical engineers cannot accept responsibility for problems which may develop if they are not consulted after factors considered in their report's development have changed.

MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by geo-

technical engineers who then render an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those inferred to exist, because no geotechnical engineer, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact.* For this reason, *most experienced owners retain their geotechnical consultants through the construction stage, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.*

SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions may be modified by constantly-changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time.* Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Geotechnical engineers' reports are prepared to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor, or even some other consulting civil engineer. Unless indicated otherwise, this report was prepared expressly for the client involved and expressly for purposes indicated by the client. Use by any other persons for any purpose, or by the client for a different purpose, may result in problems. *No individual other than the client should apply this report for its intended purpose without first conferring with the geotechnical engineer. No person should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer.*

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professionals to explain relevant geotechnical findings and to review the adequacy of their plans and specifications relative to geotechnical issues.

BORING LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

Final boring logs are developed by geotechnical engineers based upon their interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples. Only final boring logs customarily are included in geotechnical engineering reports. *These logs should not under any circumstances be redrawn* for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result.

To minimize the likelihood of boring log misinterpretation, *give contractors ready access to the complete geotechnical engineering report* prepared or authorized for their use. Those who do not provide such access may proceed un-

der the *mistaken* impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes which aggravate them to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical consultants. To help prevent this problem, geotechnical engineers have developed model clauses for use in written transmittals. These are *not* exculpatory clauses designed to foist geotechnical engineers' liabilities onto someone else. Rather, they are definitive clauses which identify where geotechnical engineers' responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report, and you are encouraged to read them closely. Your geotechnical engineer will be pleased to give full and frank answers to your questions.

OTHER STEPS YOU CAN TAKE TO REDUCE RISK

Your consulting geotechnical engineer will be pleased to discuss other techniques which can be employed to mitigate risk. In addition, ASFE has developed a variety of materials which may be beneficial. Contact ASFE for a complimentary copy of its publications directory.

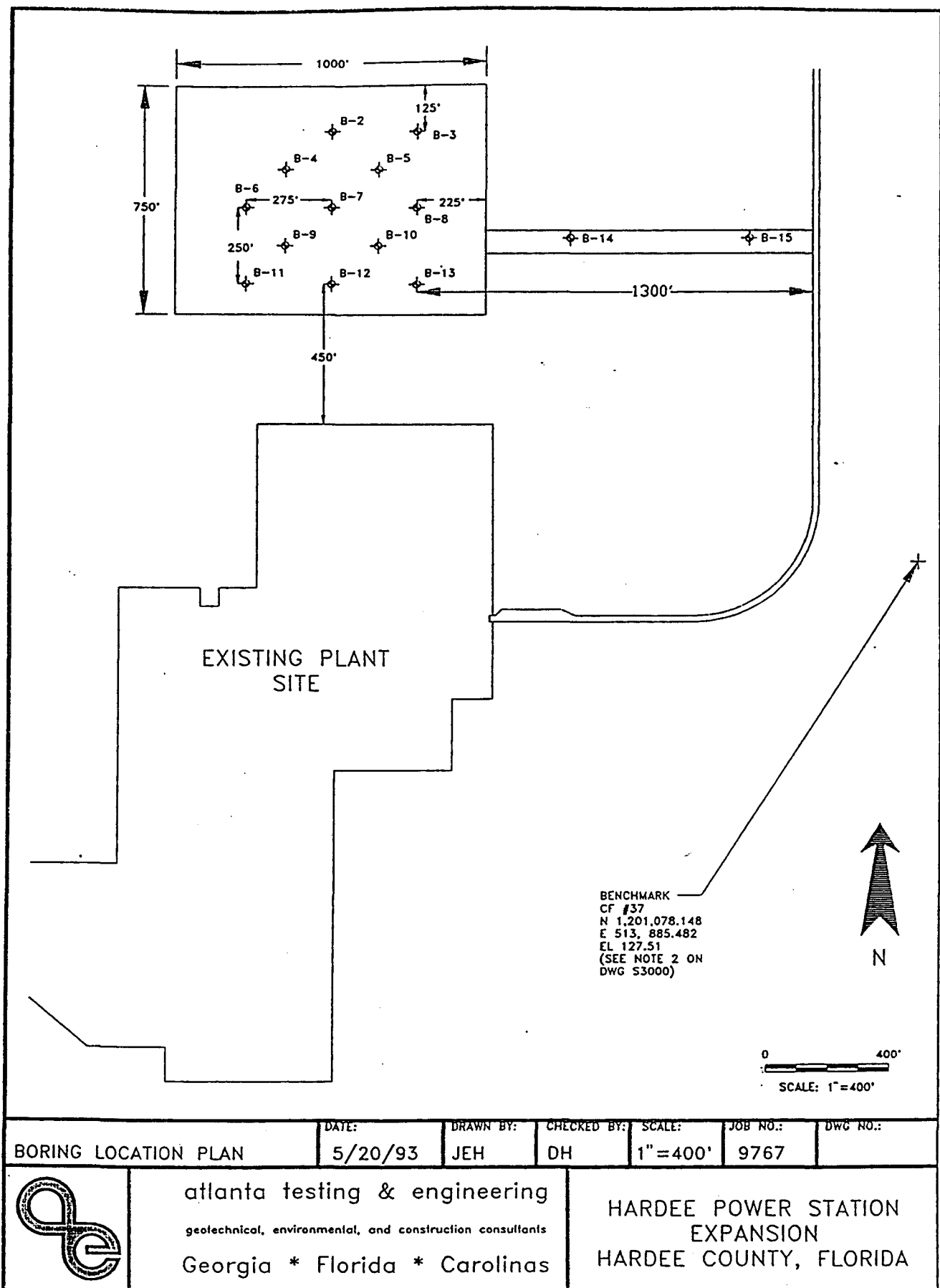
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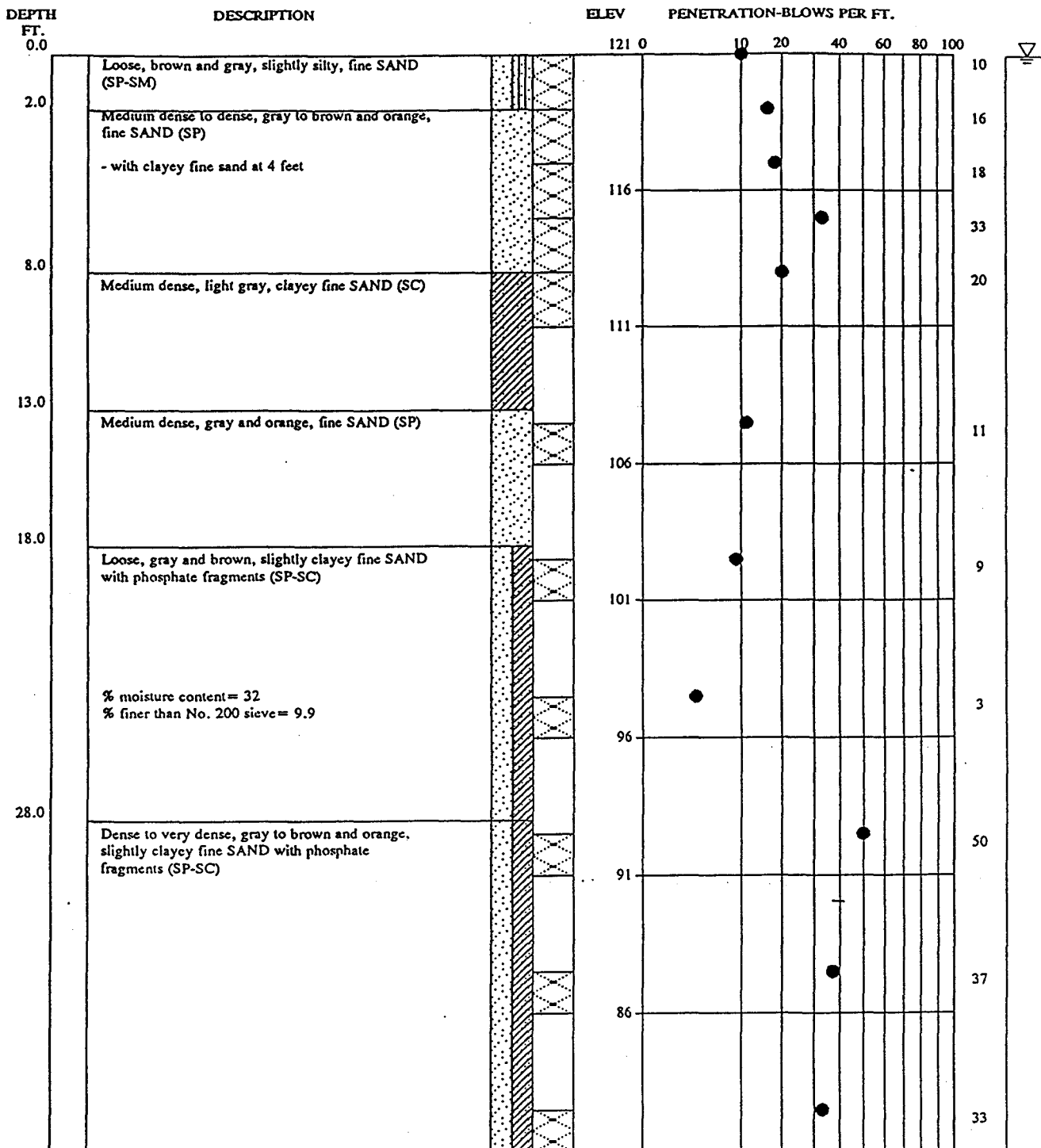
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APPENDIX





TEST
BORING
RECORDS



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BORING AND SAMPLING - ASTM D-1586
CORE DRILLING - ASTM D-2113

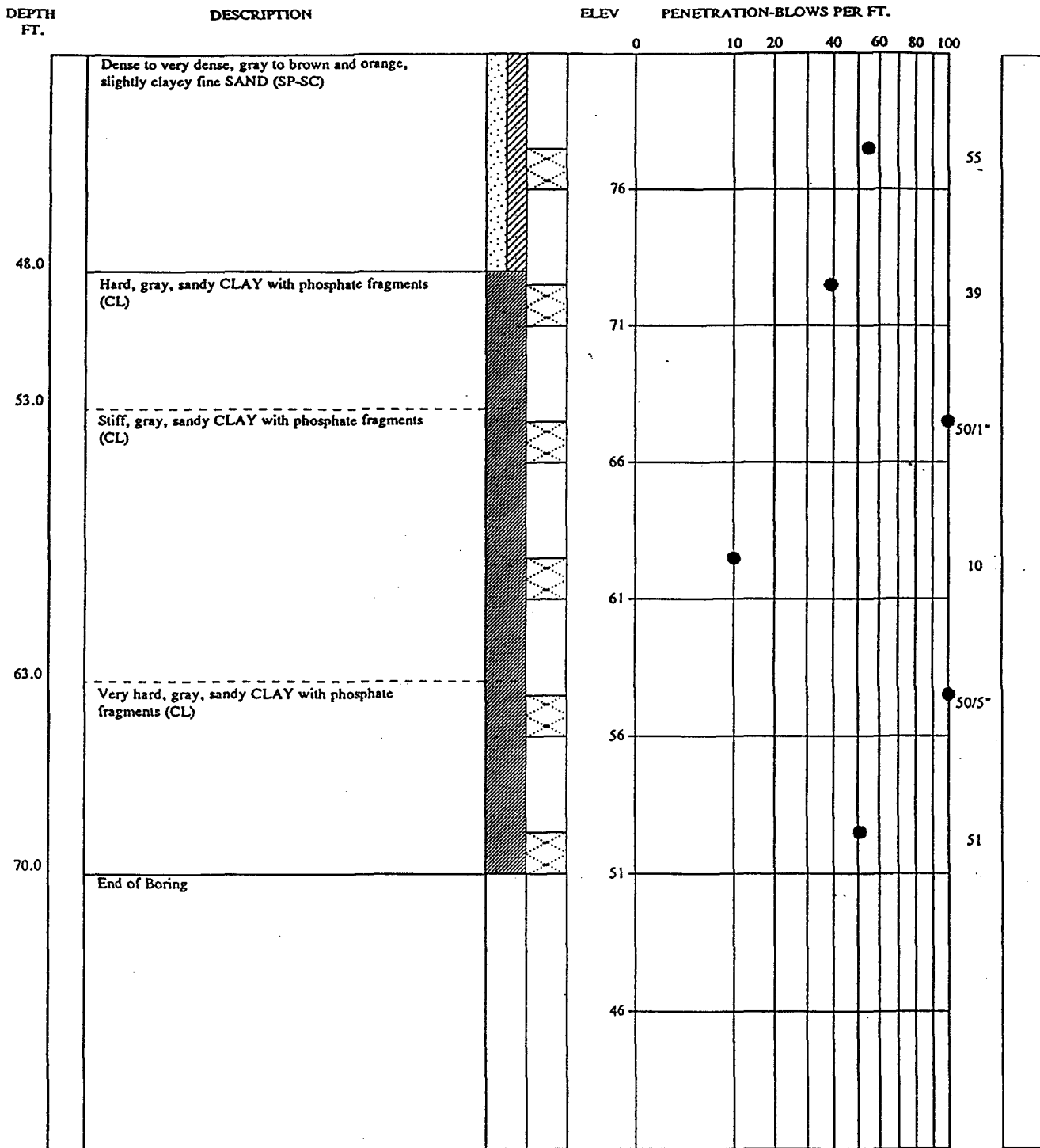
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FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
50% % ROCK CORE RECOVERY

WATER TABLE 24 HR.
WATER TABLE, T.O.D.
LOSS OF DRILLING WATER

TEST BORING RECORD

BORING NO. B-2 (pg. 1 of 2)
DATE DRILLED 4-27-93
REPORT NO. 9767-1
JOB NO. 9767



BORING AND SAMPLING - ASTM D-1586
CORE DRILLING - ASTM D-2113

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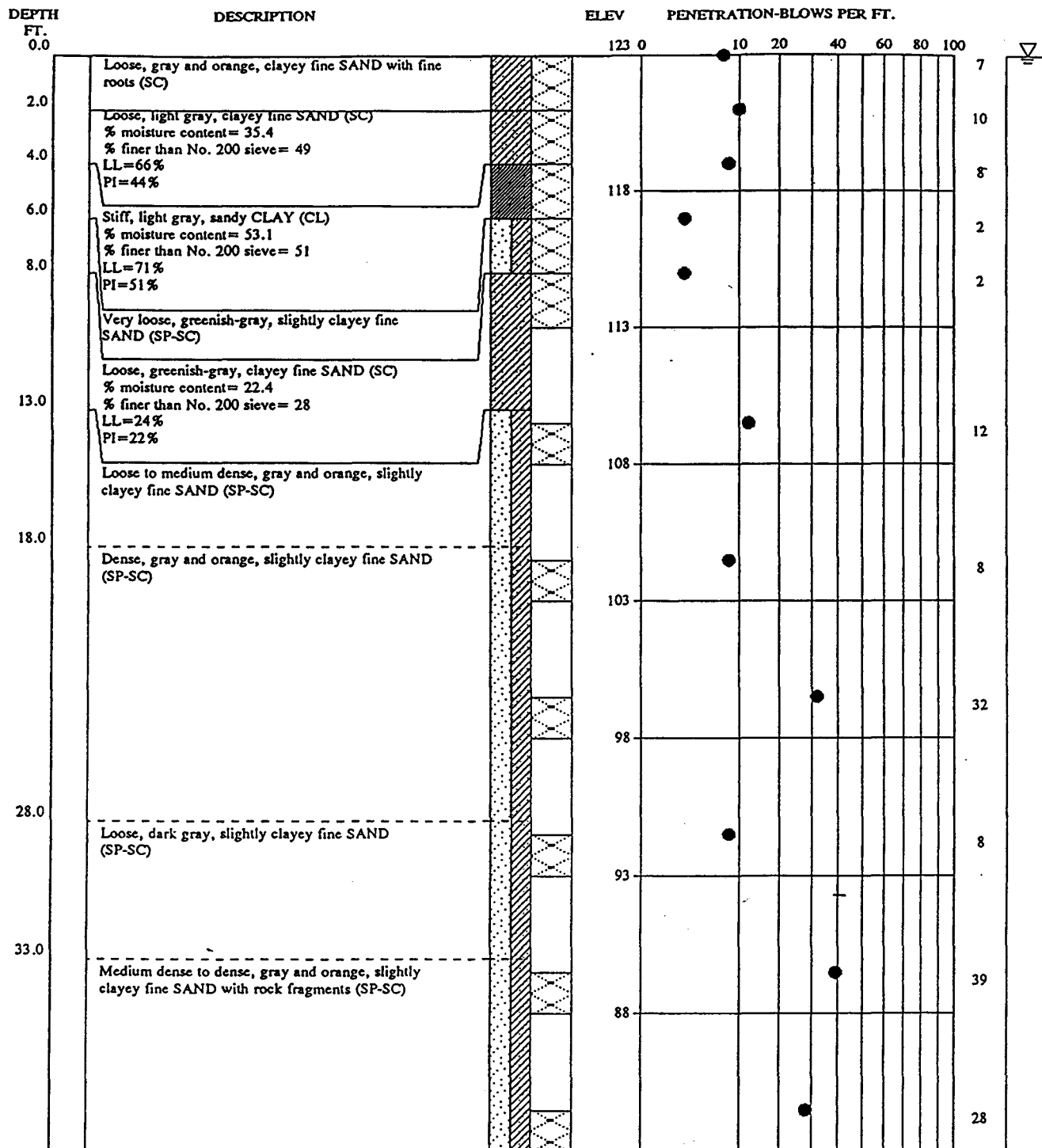
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WATER TABLE, T.O.D.
LOSS OF DRILLING WATER

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TEST BORING RECORD

BORING NO. B-2 (pg. 2 of 2)
DATE DRILLED 4-27-93
REPORT NO. 9767-1
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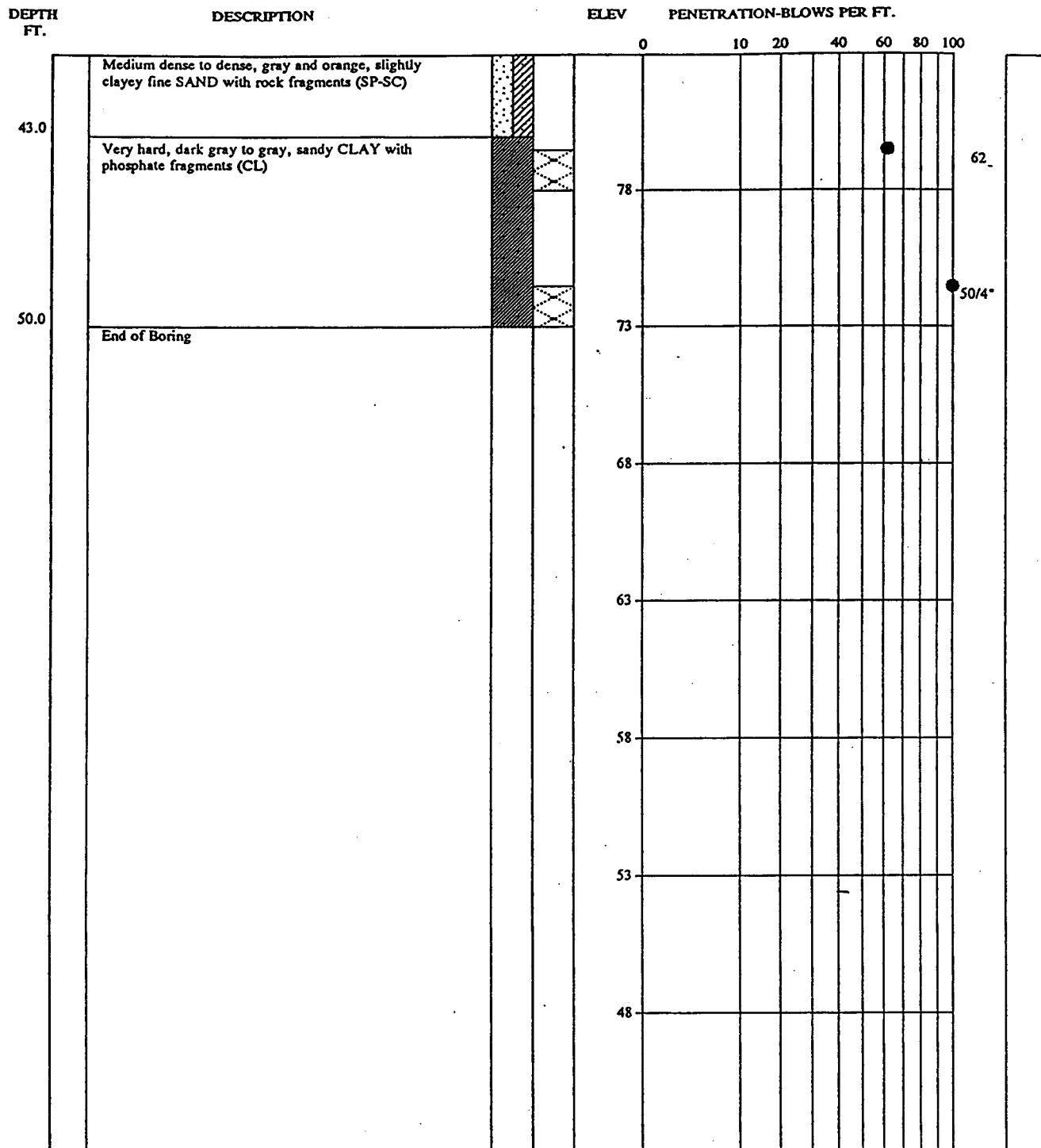
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WATER TABLE 24 HR.
WATER TABLE, T.O.D.
LOSS OF DRILLING WATER

TEST BORING RECORD

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DATE DRILLED 4-27-93
REPORT NO. 9767-1
JOB NO. 9767



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50% % ROCK CORE RECOVERY

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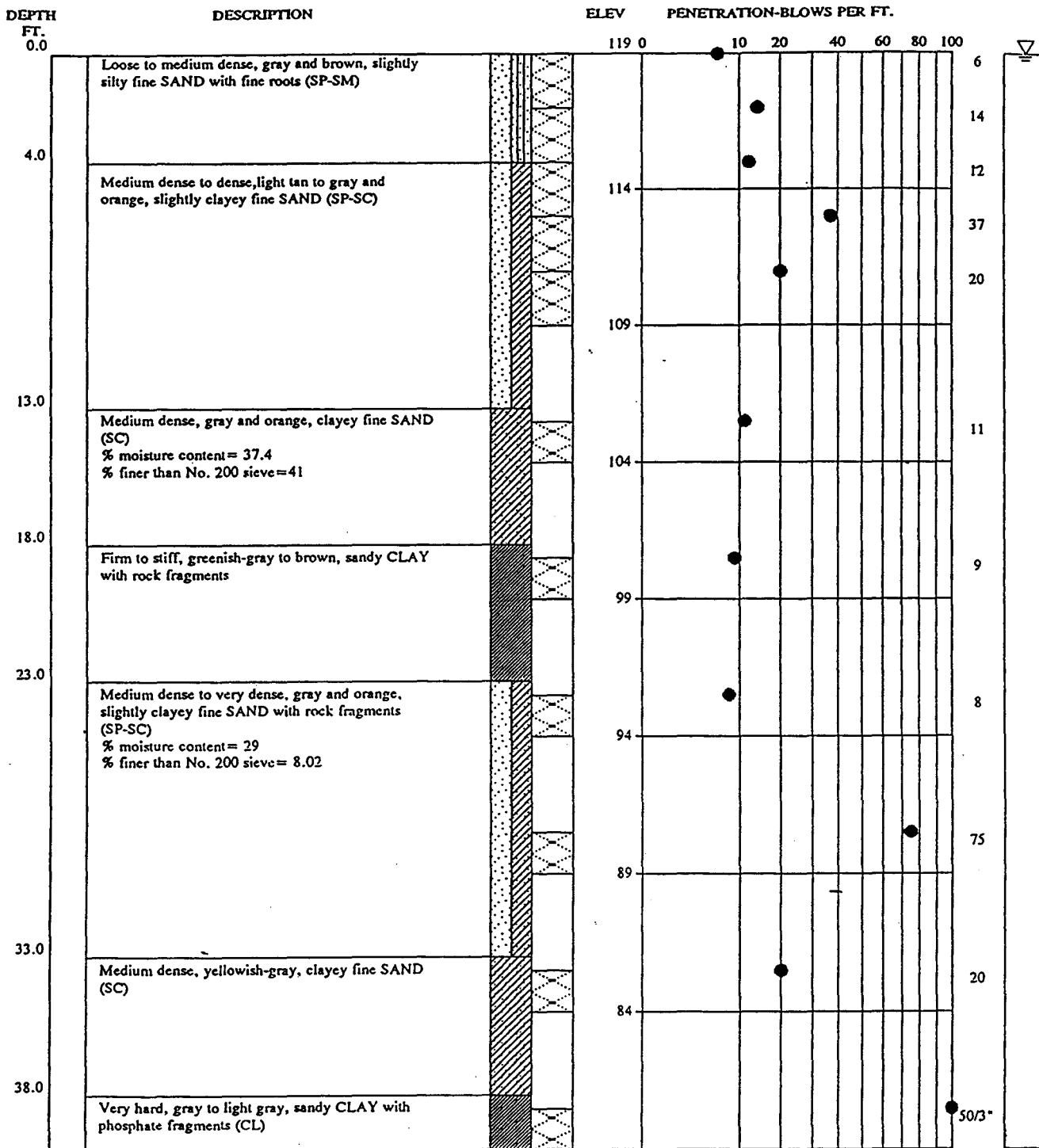
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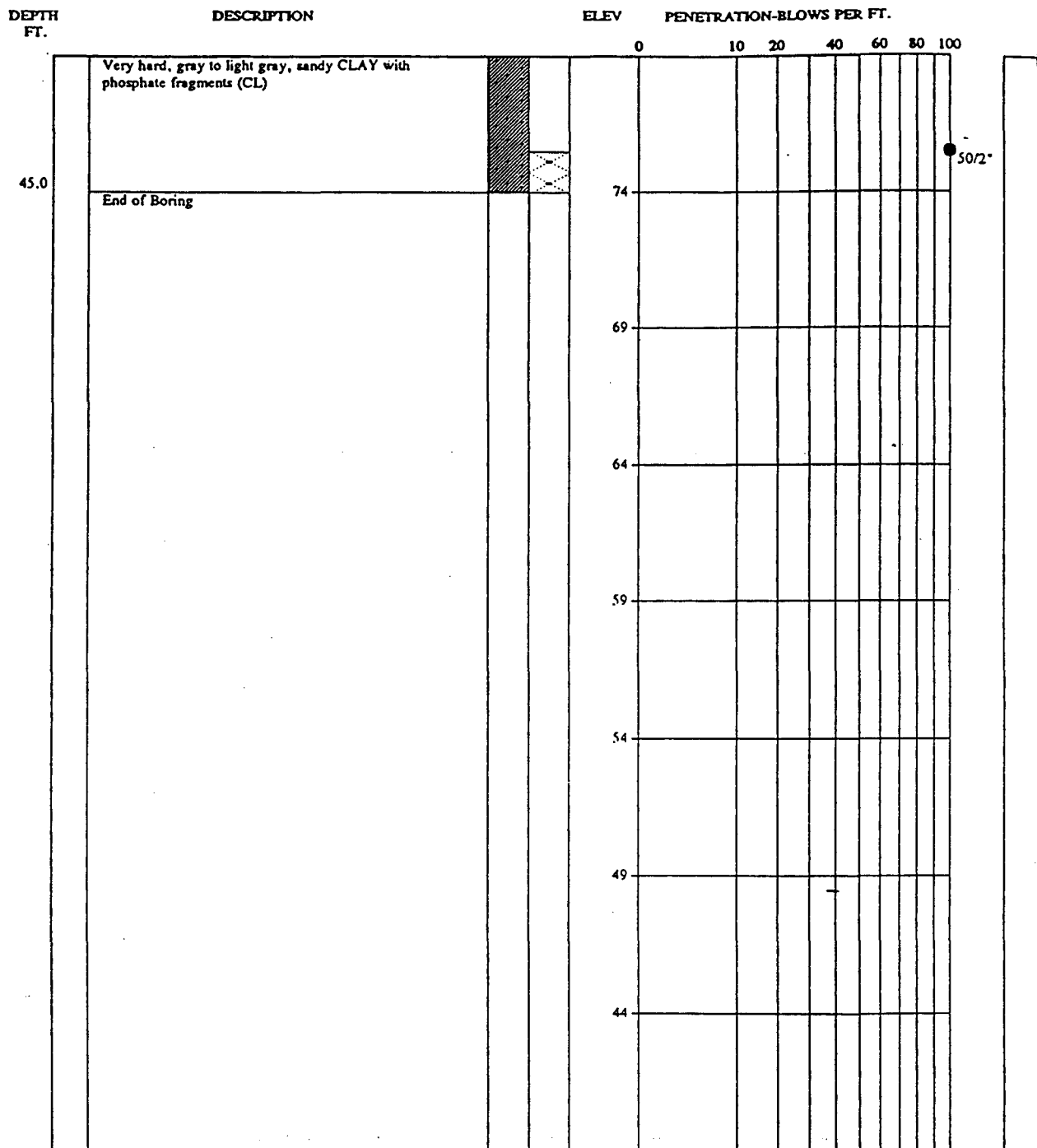
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LOSS OF DRILLING WATER

TEST BORING RECORD

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DATE DRILLED 4-28-93
REPORT NO. 9767-1
JOB NO. 9767



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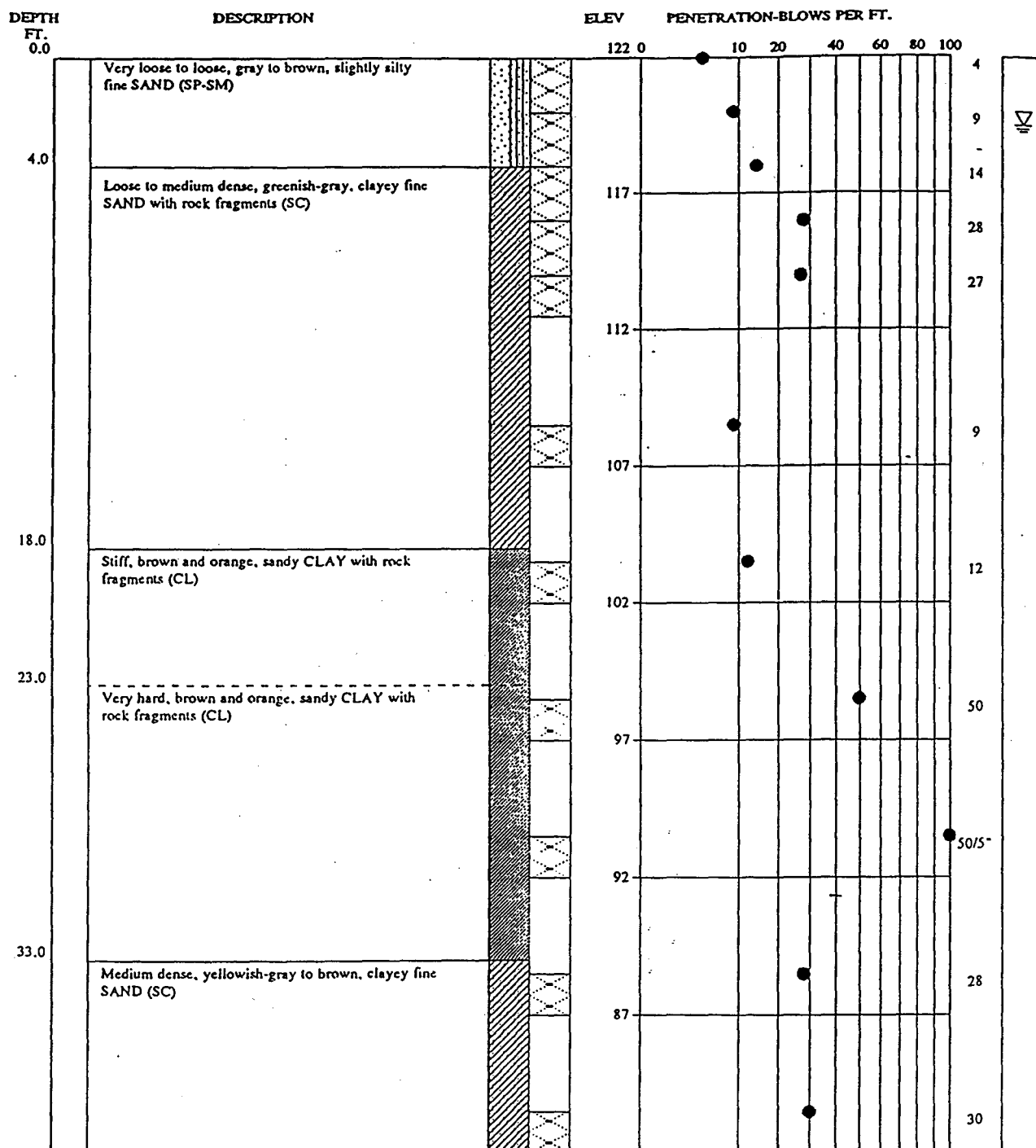
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50% % ROCK CORE RECOVERY

WATER TABLE 24 HR.
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LOSS OF DRILLING WATER

TEST BORING RECORD

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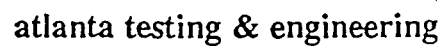
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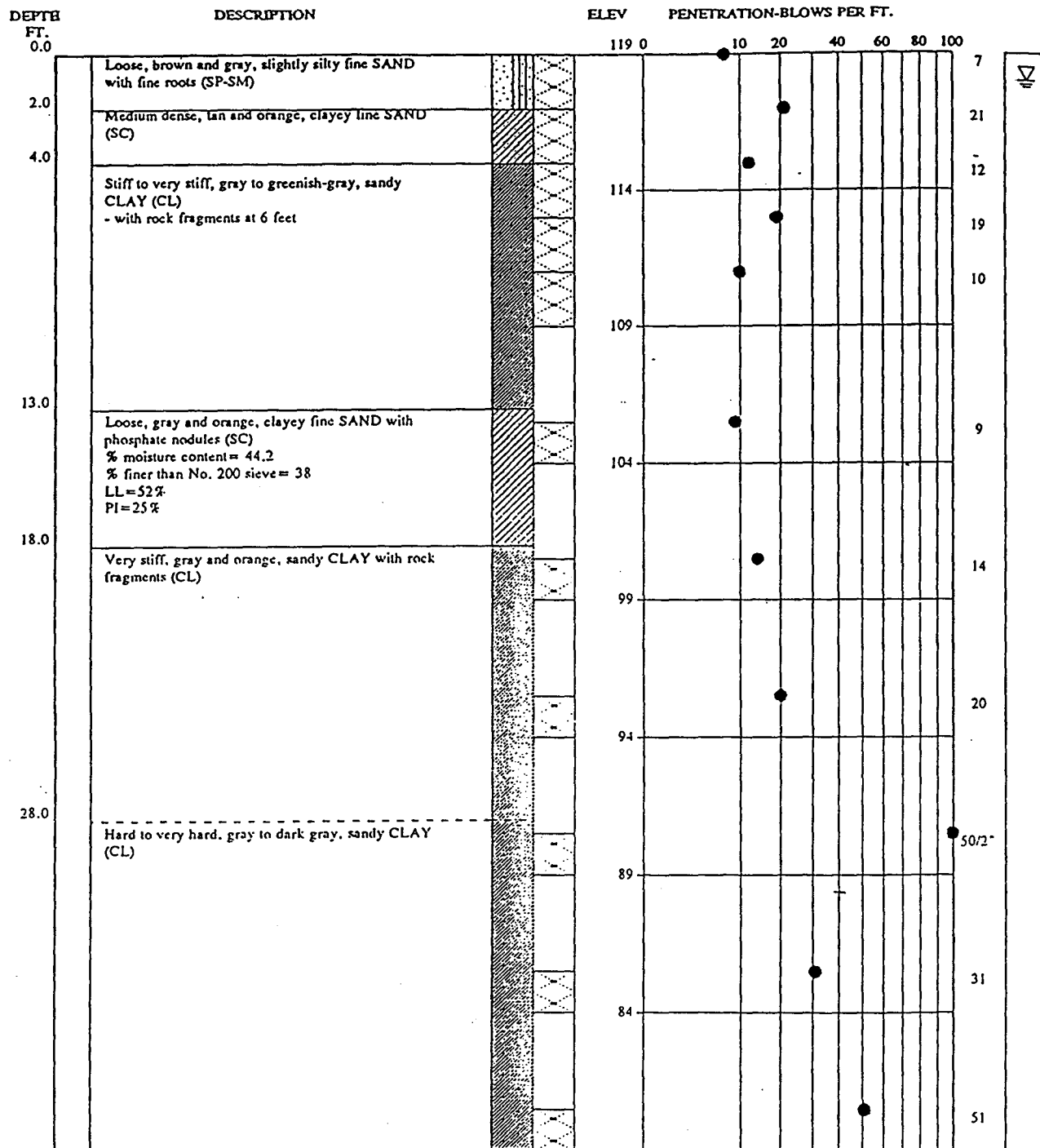
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WATER TABLE, T.O.D.
LOSS OF DRILLING WATER

TEST BORING RECORD

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DATE DRILLED 4-29-93
REPORT NO. 9767-1
JOB NO. 9767





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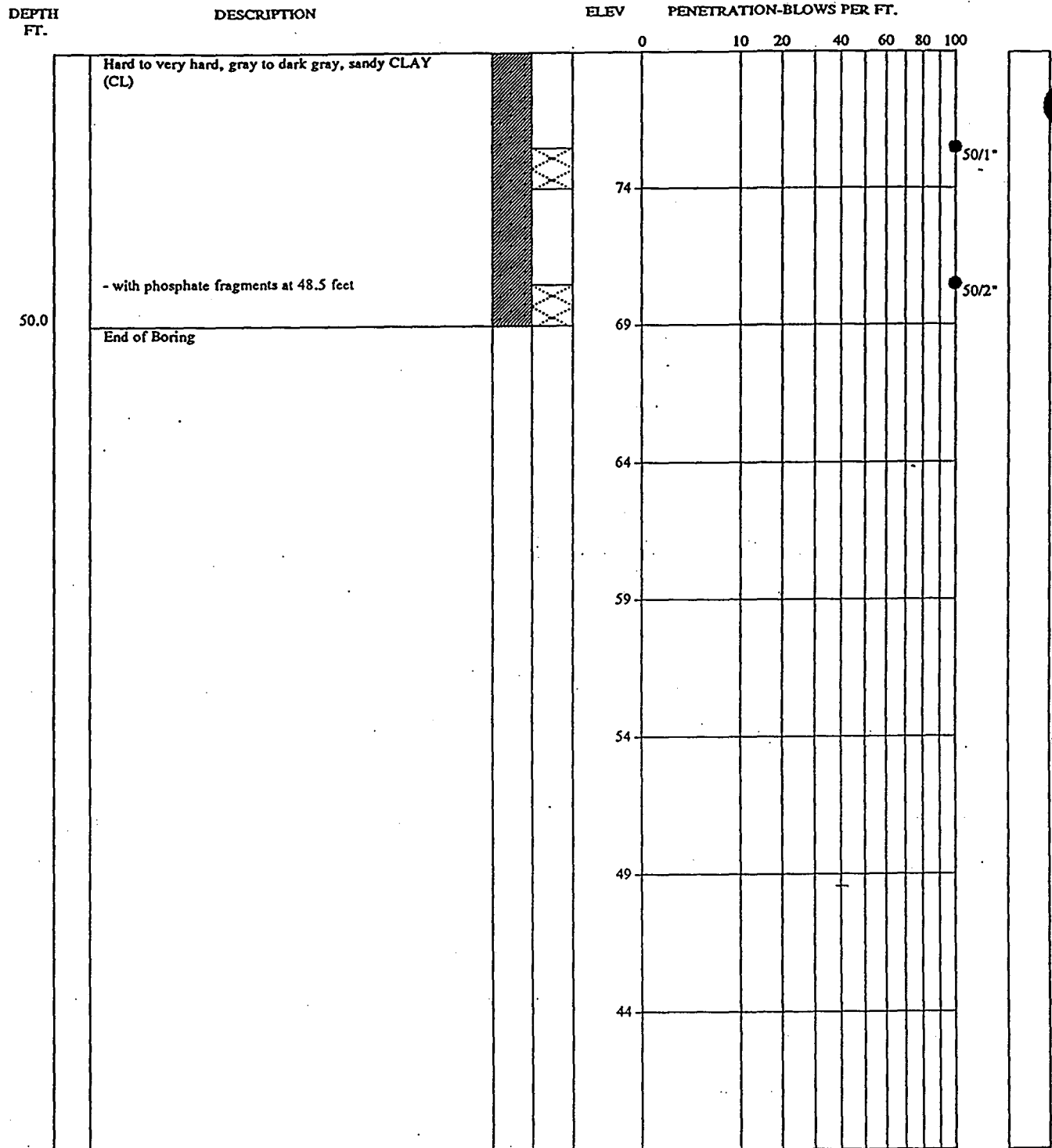
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WATER TABLE 24 HR.
WATER TABLE, T.O.D.
LOSS OF DRILLING WATER

TEST BORING RECORD

BORING NO. B-6 (pg. 1 of 2)
DATE DRILLED 4-26-93
REPORT NO. 9767-1
JOB NO. 9767



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CORE DRILLING - ASTM D-2113

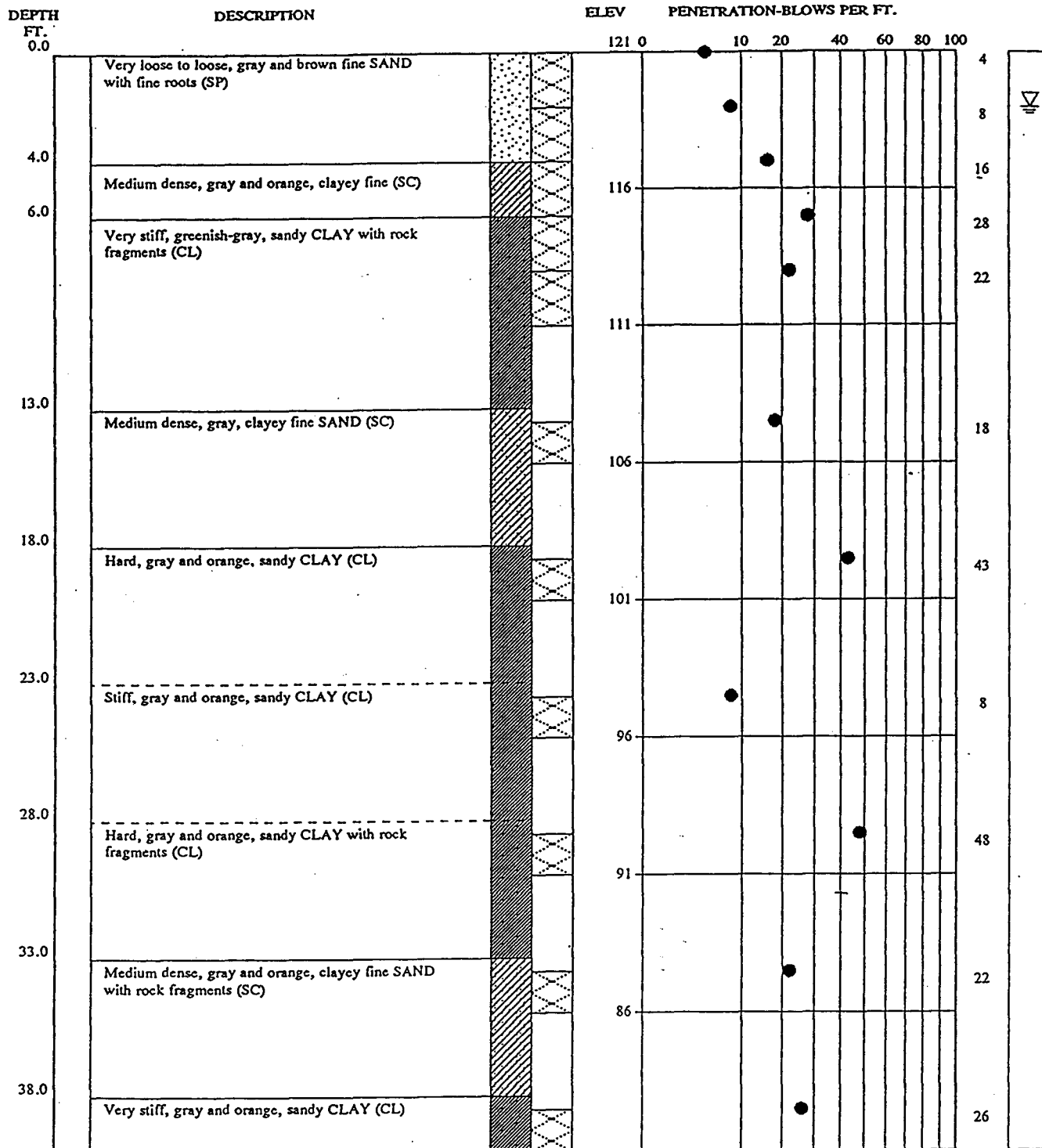
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■ UNDISTURBED SAMPLE
 50% % ROCK CORE RECOVERY

▼ WATER TABLE 24 HR.
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 ◀ LOSS OF DRILLING WATER

TEST BORING RECORD

BORING NO. B-6 (pg. 2 of 2)
 DATE DRILLED 4-26-93
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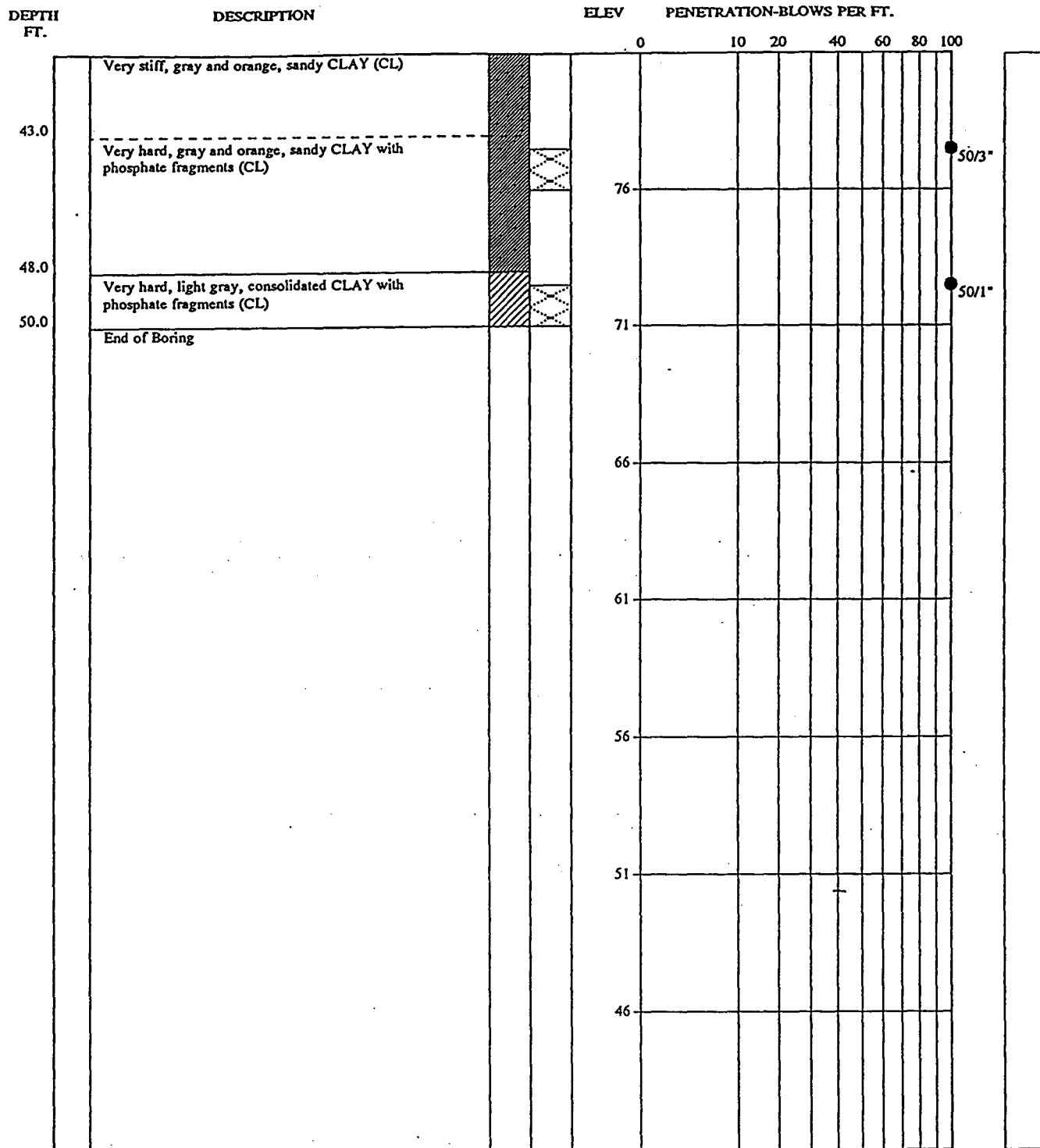
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50% % ROCK CORE RECOVERY

WATER TABLE 24 HR.
WATER TABLE, T.O.D.
LOSS OF DRILLING WATER

TEST BORING RECORD

BORING NO. B-7 (pg. 1 of 2)
DATE DRILLED 4-23-93
REPORT NO. 9767-1
JOB NO. 9767



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CORE DRILLING - ASTM D-2113

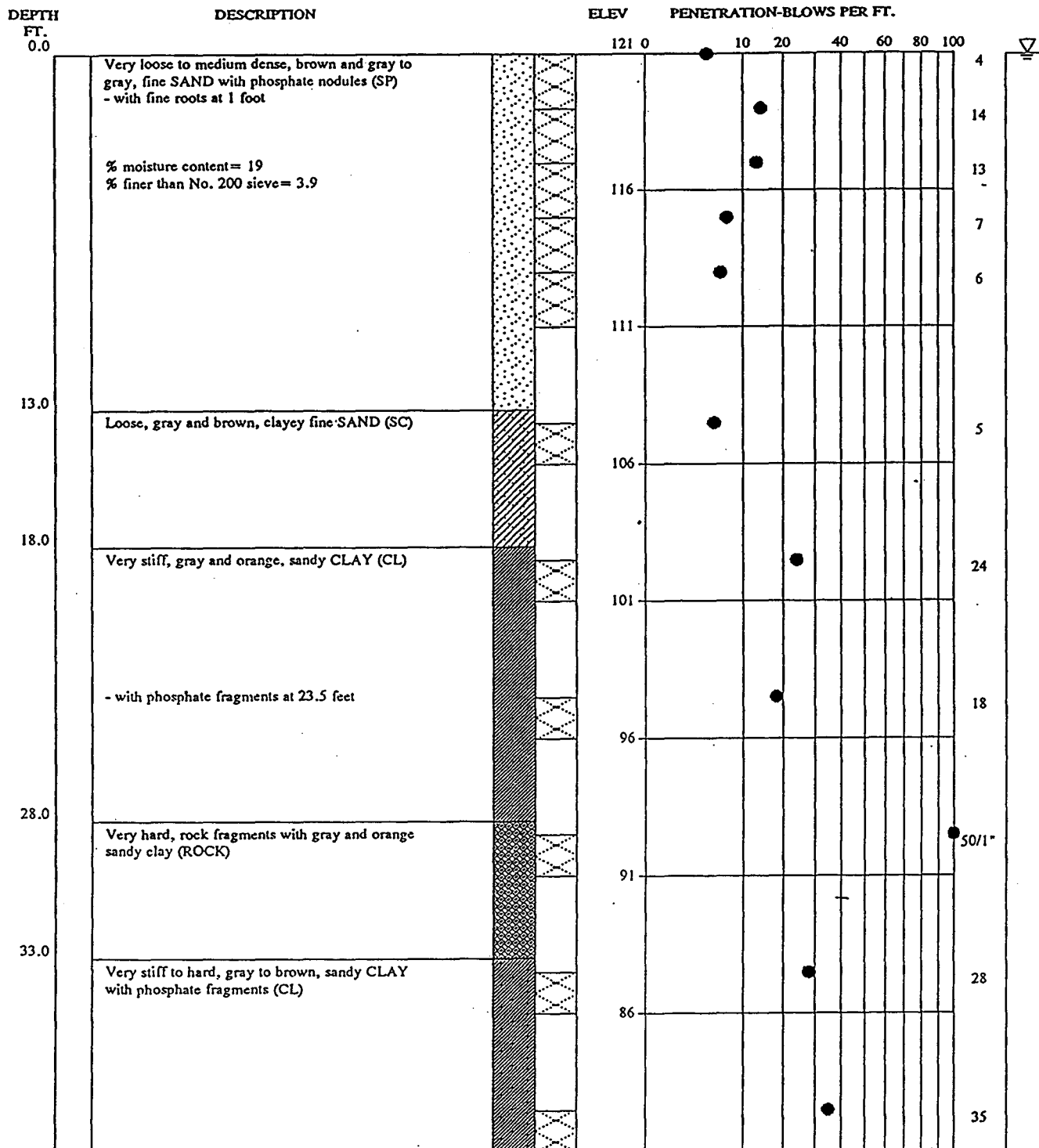
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UNDISTURBED SAMPLE
50% % ROCK CORE RECOVERY

WATER TABLE 24 HR.
WATER TABLE, T.O.D.
LOSS OF DRILLING WATER

TEST BORING RECORD

BORING NO. B-7 (pg. 2 of 2)
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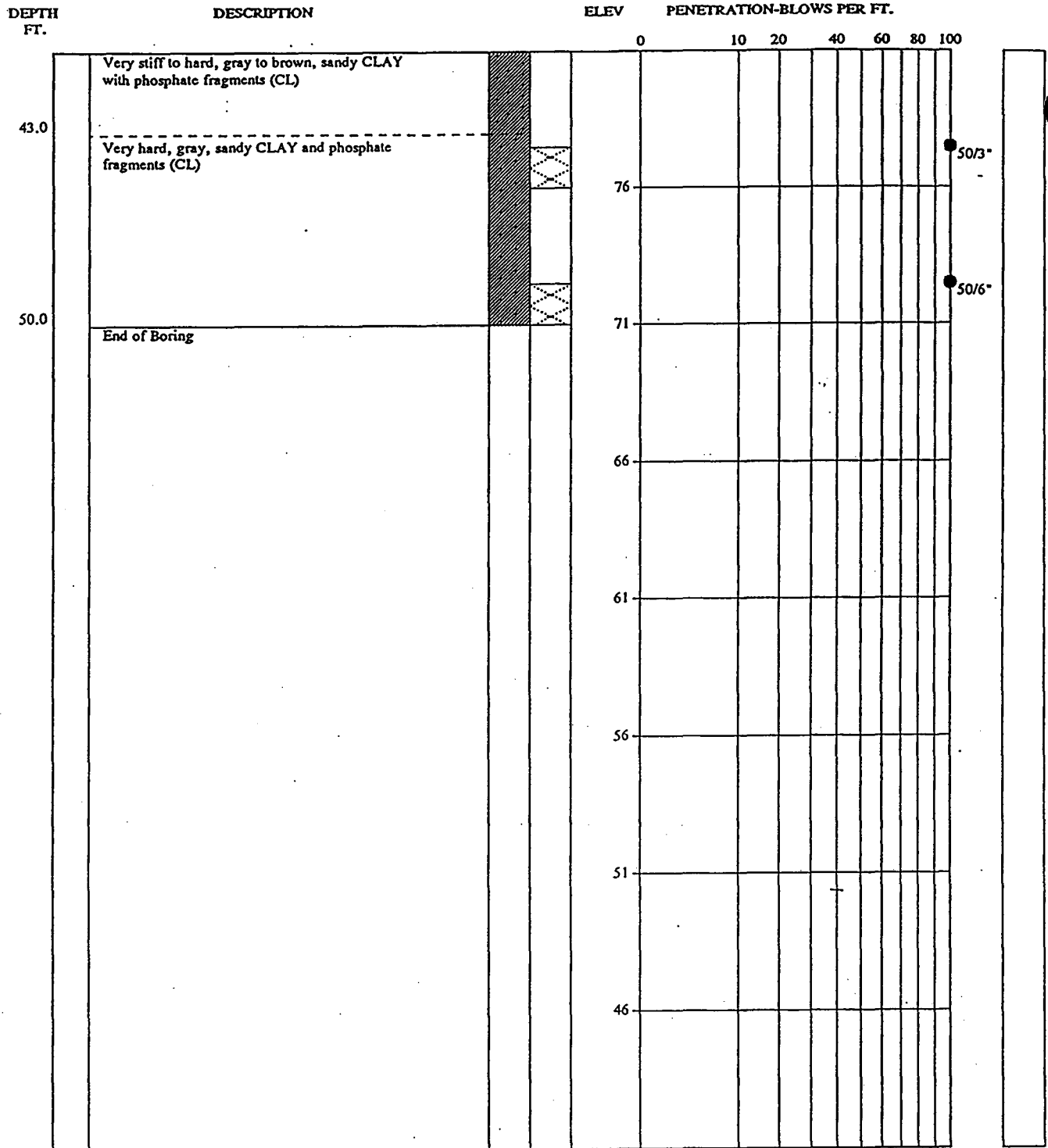
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UNDISTURBED SAMPLE
50% % ROCK CORE RECOVERY

WATER TABLE 24 HR.
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LOSS OF DRILLING WATER

TEST BORING RECORD

BORING NO. B-8 (pg. 1 of 2)
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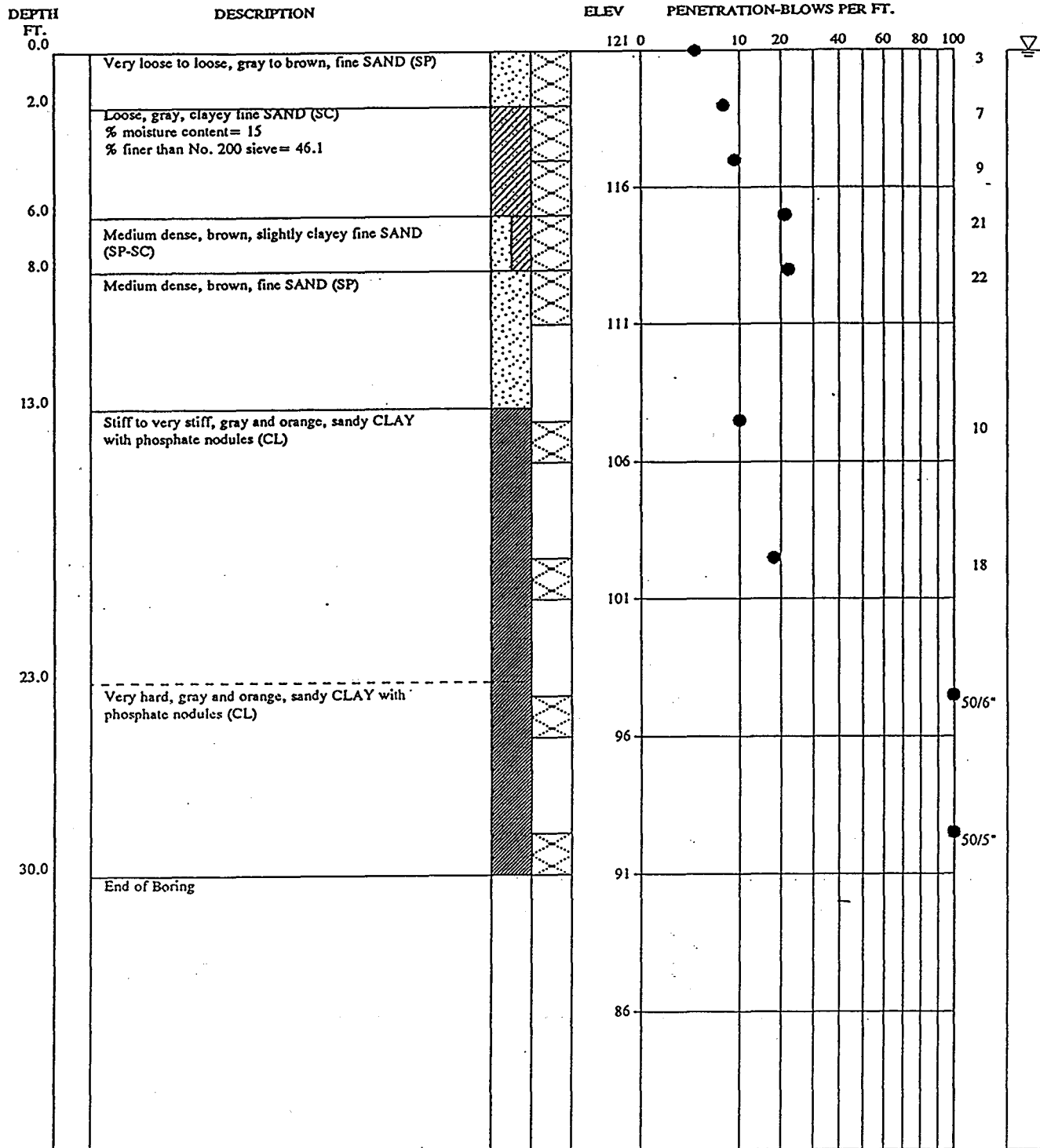
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TEST BORING RECORD

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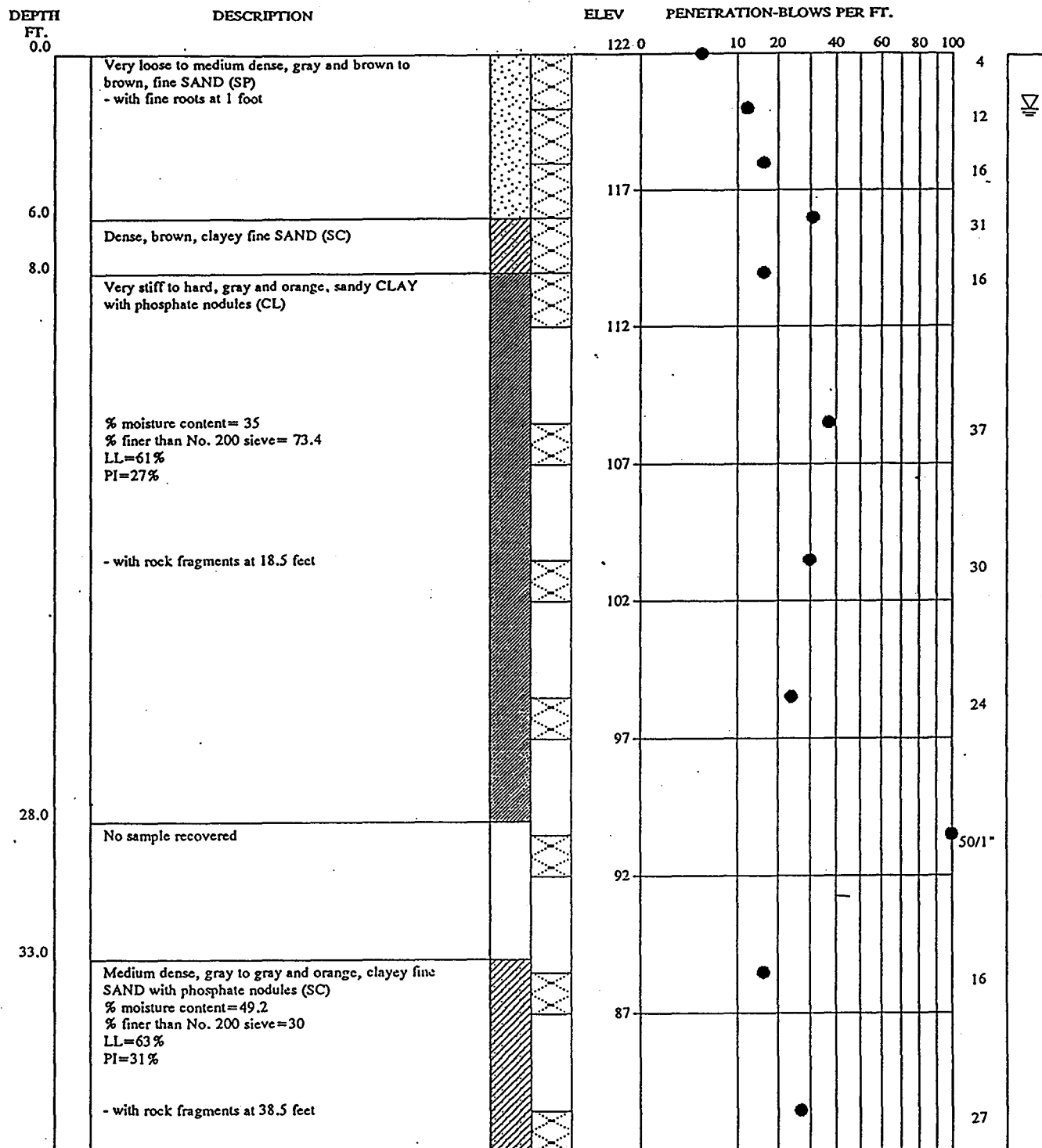
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LOSS OF DRILLING WATER

TEST BORING RECORD

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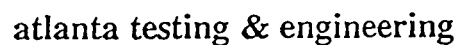
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UNDISTURBED SAMPLE
50% % ROCK CORE RECOVERY

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WATER TABLE, T.O.D.
LOSS OF DRILLING WATER

TEST BORING RECORD

BORING NO. B-10 (pg. 1 of 3)
DATE DRILLED 4-21-93
REPORT NO. 9767-1
JOB NO. 9767



10.7.1-47

DEPTH
FT.

DESCRIPTION

ELEV

PENETRATION-BLOWS PER FT.

0 10 20 40 60 80 100

85.0

Very hard, gray CLAY and phosphate fragments
(CL)

End of Boring

37

32

27

22

17

12

7

50/5"

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CORE DRILLING - ASTM D-2113

PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER
FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE

50% % ROCK CORE RECOVERY

WATER TABLE 24 HR.

WATER TABLE, T.O.D.

LOSS OF DRILLING WATER

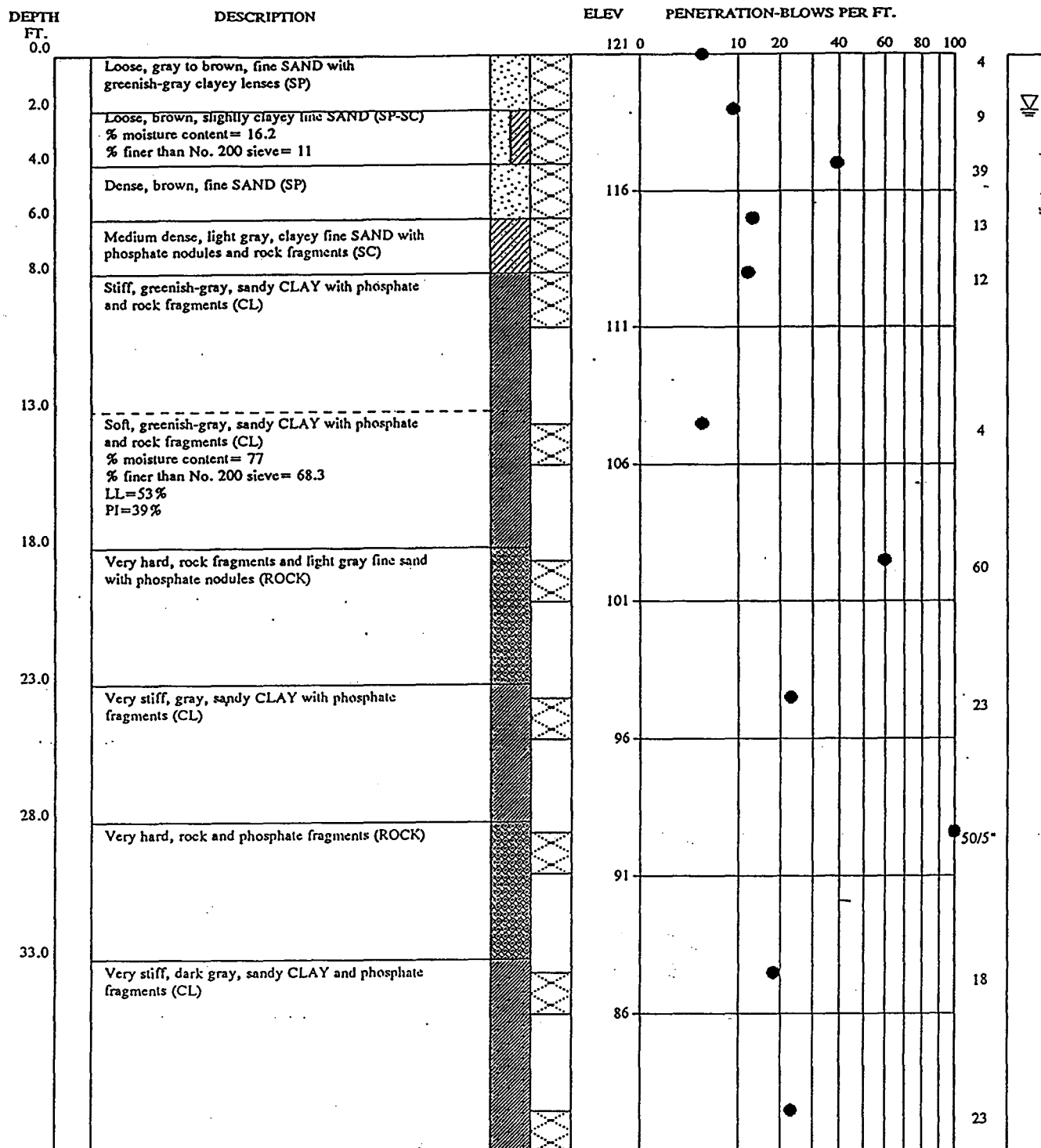
TEST BORING RECORD

BORING NO. B-10 (pg. 3 of 3)

DATE DRILLED 4-21-93

REPORT NO. 9767-1

JOB NO. 9767



atlanta testing & engineering

BORING AND SAMPLING - ASTM D-1586
CORE DRILLING - ASTM D-2113

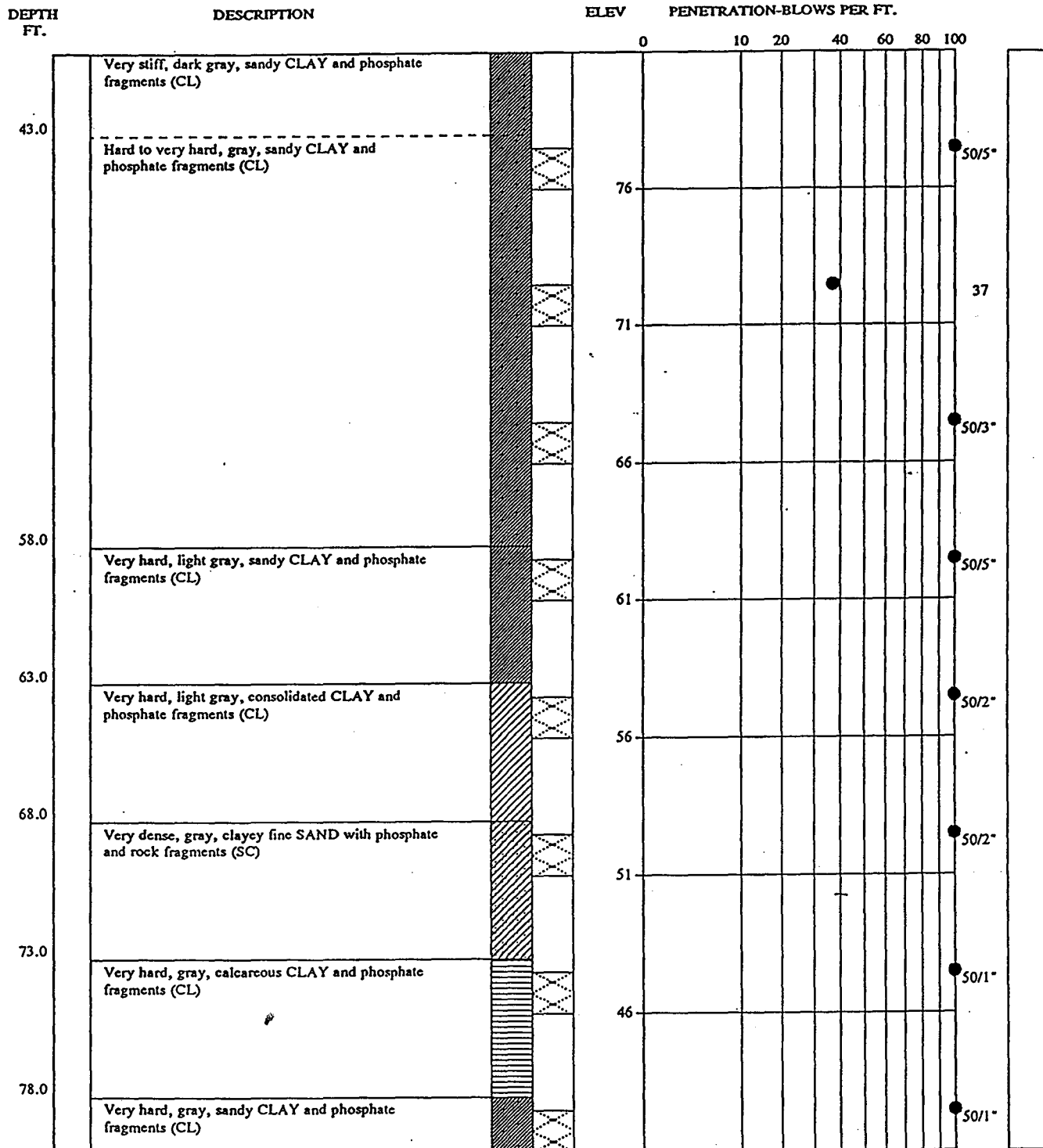
PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER
FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
50% % ROCK CORE RECOVERY

WATER TABLE 24 HR.
WATER TABLE, T.O.D.
LOSS OF DRILLING WATER

TEST BORING RECORD

BORING NO. B-11 (pg. 1 of 3)
DATE DRILLED 4-13-93
REPORT NO. 9767-1
JOB NO. 9767



atlanta testing & engineering

BORING AND SAMPLING - ASTM D-1586
CORE DRILLING - ASTM D-2113

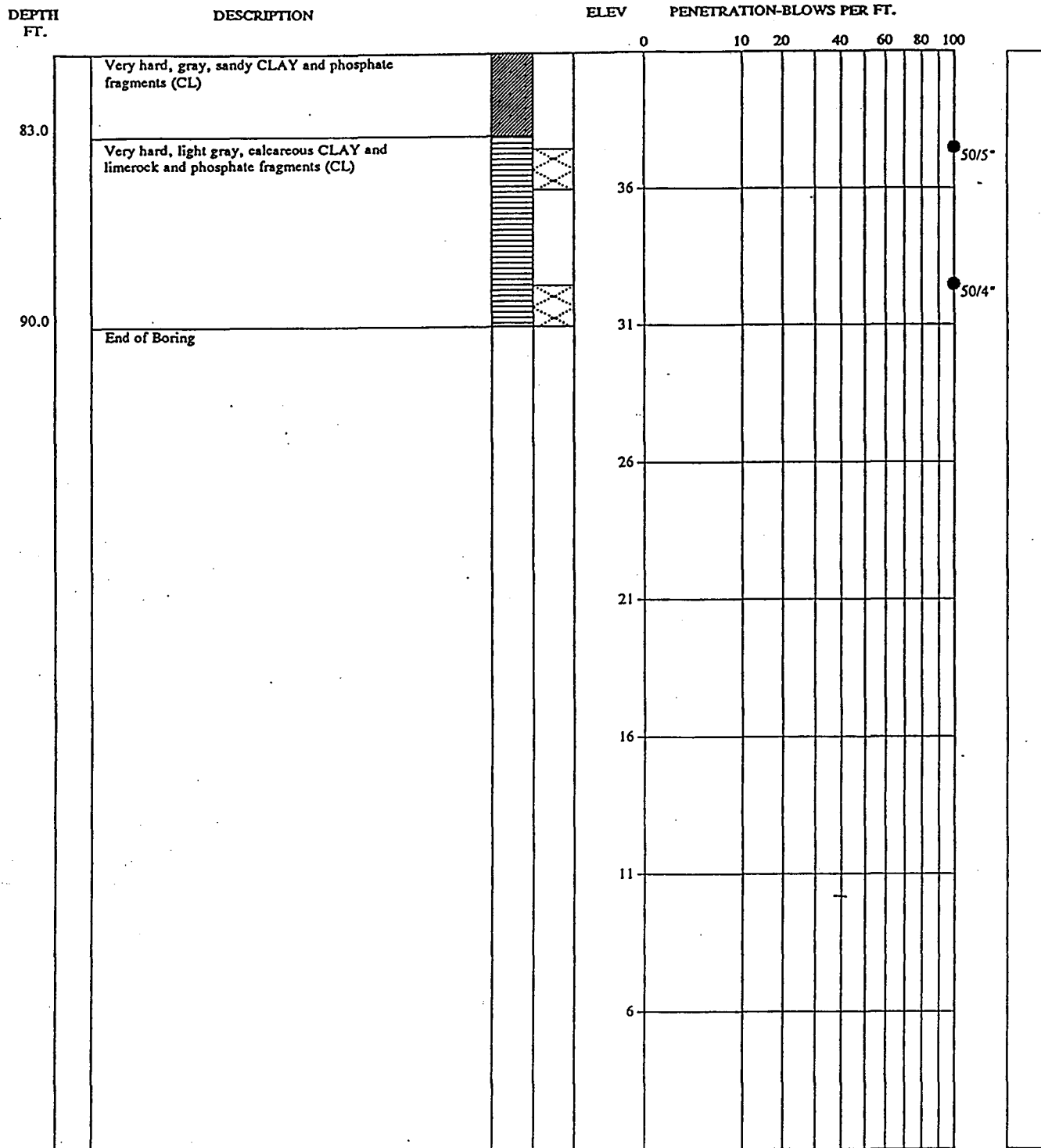
PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER
FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
50% % ROCK CORE RECOVERY

WATER TABLE 24 HR.
WATER TABLE, T.O.D.
LOSS OF DRILLING WATER

TEST BORING RECORD

BORING NO. B-11 (pg. 2 of 3)
DATE DRILLED 4-13-93
REPORT NO. 9767-1
JOB NO. 9767



atlanta testing & engineering

BORING AND SAMPLING - ASTM D-1586
CORE DRILLING - ASTM D-2113

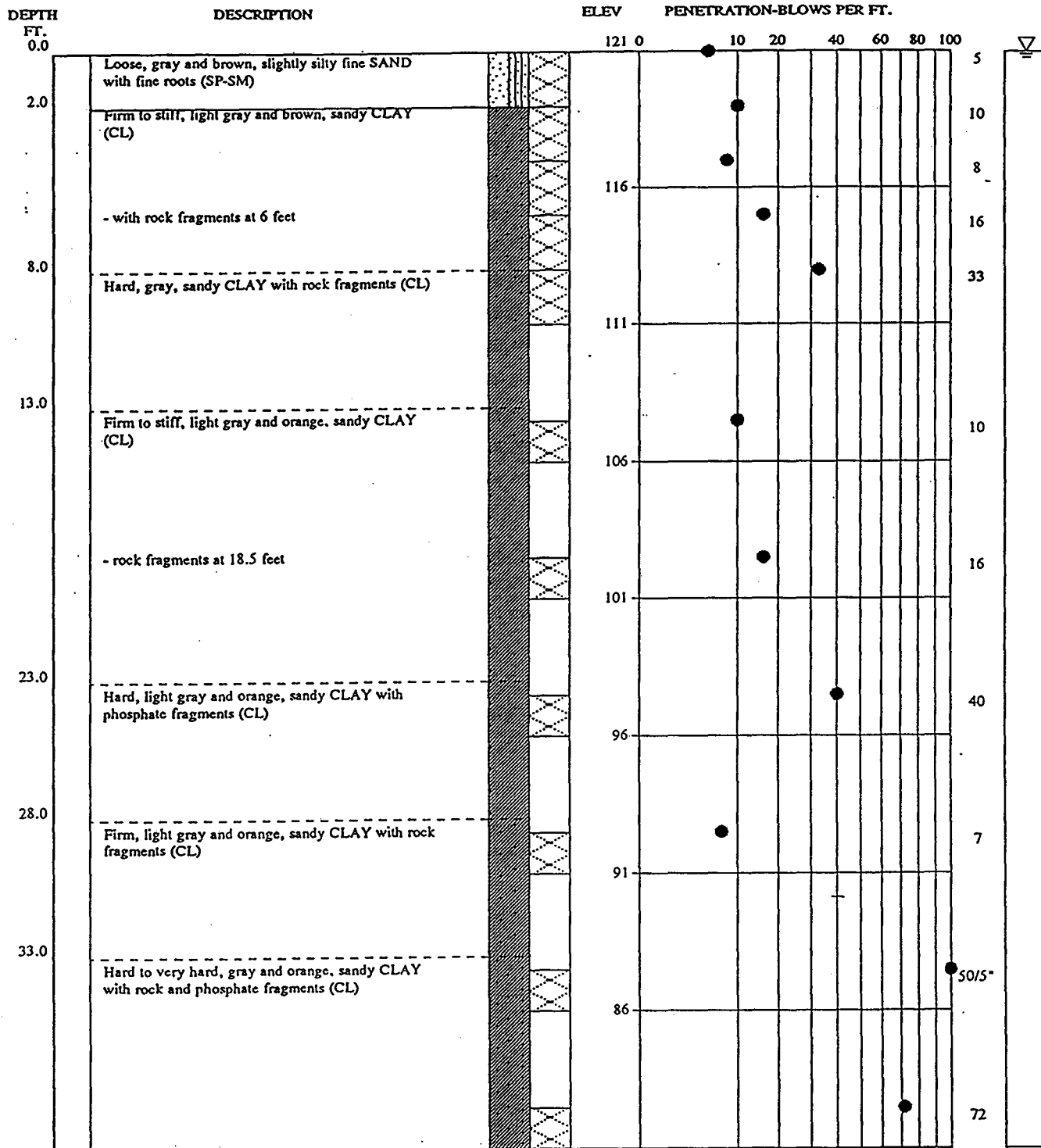
PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER
FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

— UNDISTURBED SAMPLE
50% % ROCK CORE RECOVERY

▼ WATER TABLE 24 HR.
▽ WATER TABLE, T.O.D.
◀ LOSS OF DRILLING WATER

TEST BORING RECORD

BORING NO. B-11 (pg. 3 of 3)
DATE DRILLED 4-13-93
REPORT NO. 9767-1
JOB NO. 9767



atlanta testing & engineering

BORING AND SAMPLING - ASTM D-1586
CORE DRILLING - ASTM D-2113

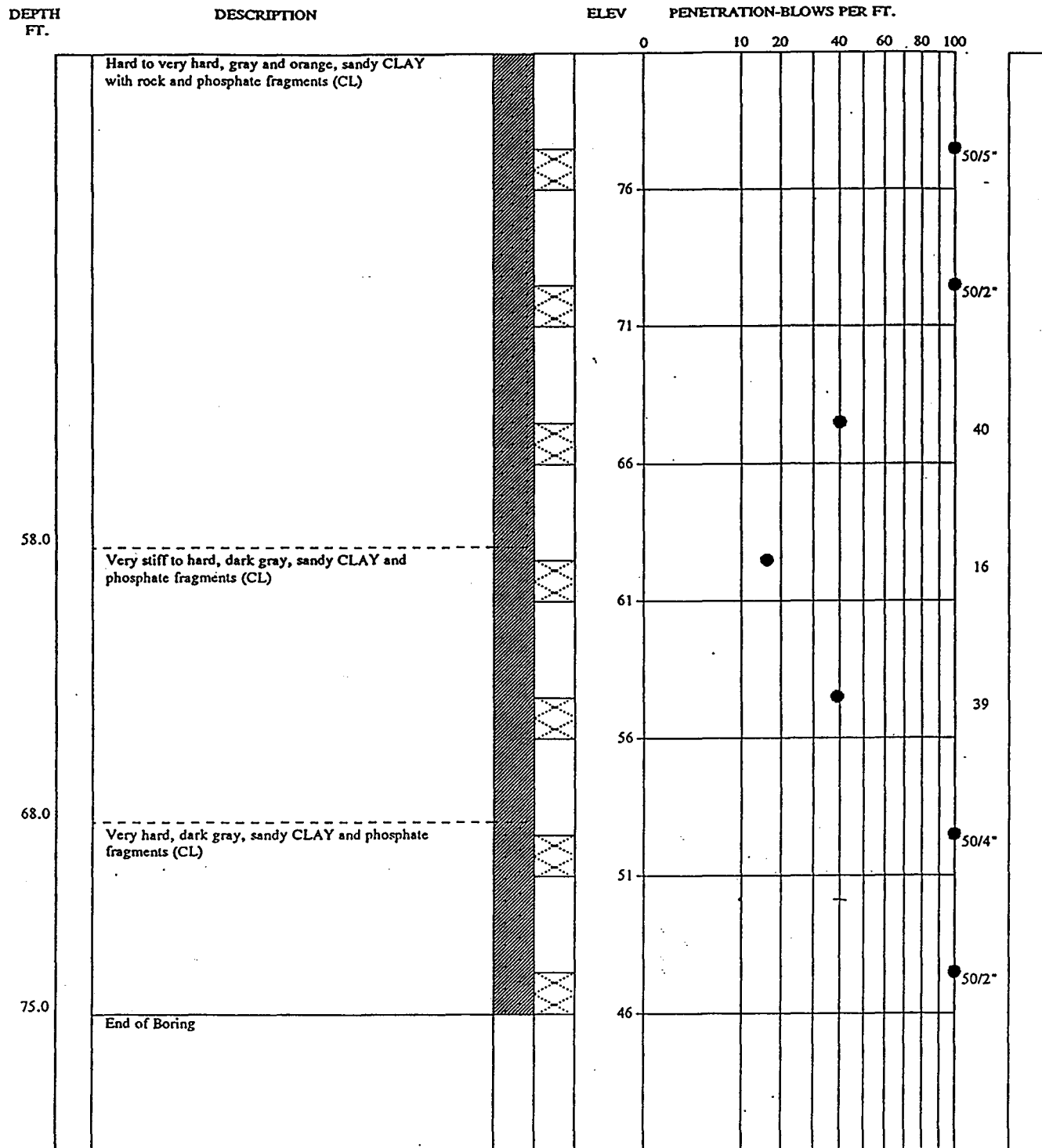
PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER
FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
50% % ROCK CORE RECOVERY

WATER TABLE 24 HR.
WATER TABLE, T.O.D.
LOSS OF DRILLING WATER

TEST BORING RECORD

BORING NO. B-12 (pg. 1 of 2)
DATE DRILLED 4-15-93
REPORT NO. 9767-1
JOB NO. 9767



atlanta testing & engineering

BORING AND SAMPLING - ASTM D-1586
CORE DRILLING - ASTM D-2113

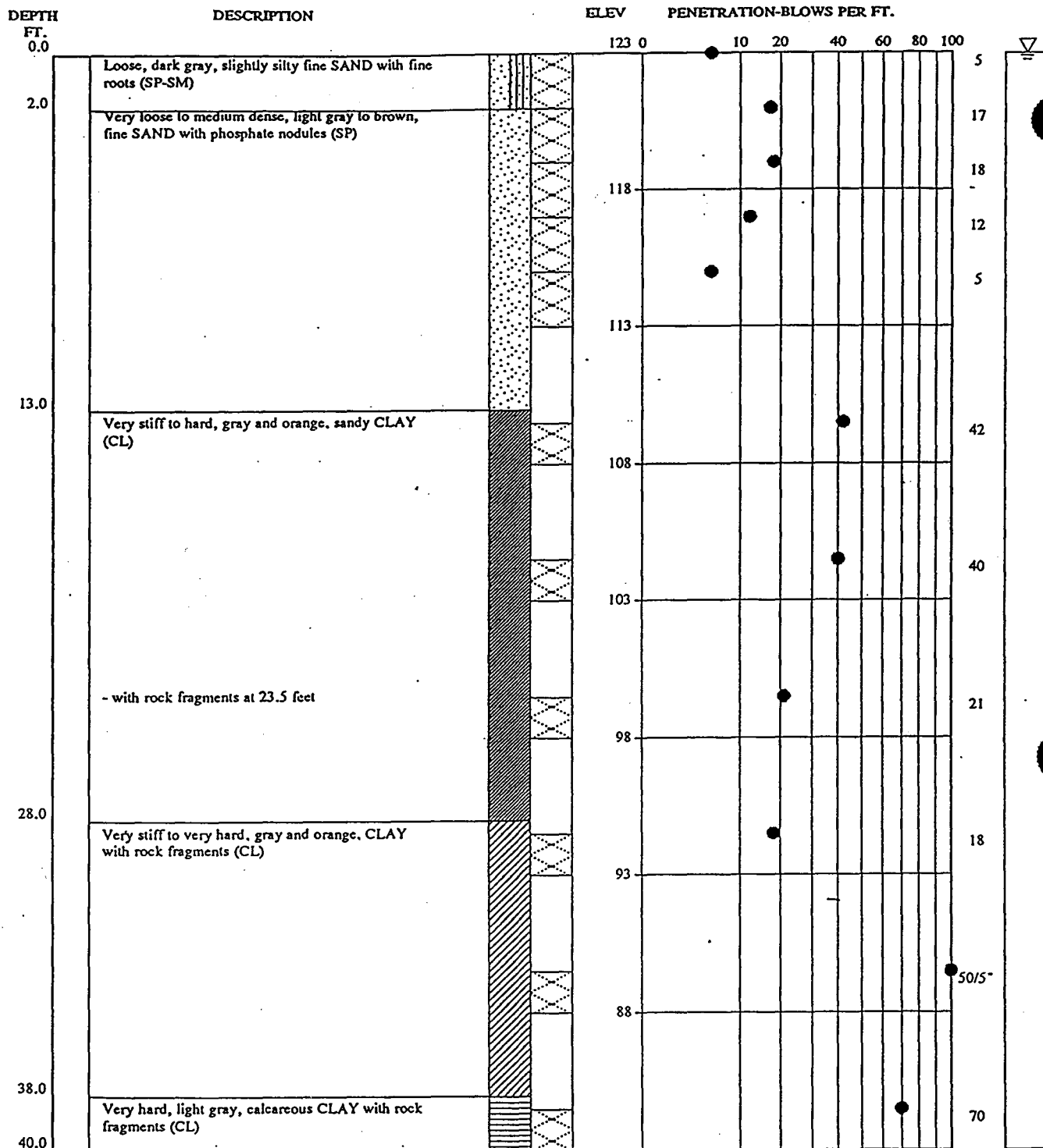
PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER
FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
50% % ROCK CORE RECOVERY

WATER TABLE 24 HR.
WATER TABLE, T.O.D.
LOSS OF DRILLING WATER

TEST BORING RECORD

BORING NO. B-12 (pg. 2 of 2)
DATE DRILLED 4-15-93
REPORT NO. 9767-1
JOB NO. 9767



atlanta testing & engineering

TEST BORING RECORD

BORING AND SAMPLING - ASTM D-1586
CORE DRILLING - ASTM D-2113

PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER
FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
50% % ROCK CORE RECOVERY

WATER TABLE 24 HR.
WATER TABLE, T.O.D.
LOSS OF DRILLING WATER

BORING NO. B-13 (pg. 1 of 2)
DATE DRILLED 4-16-93
REPORT NO. 9767-1
JOB NO. 9767

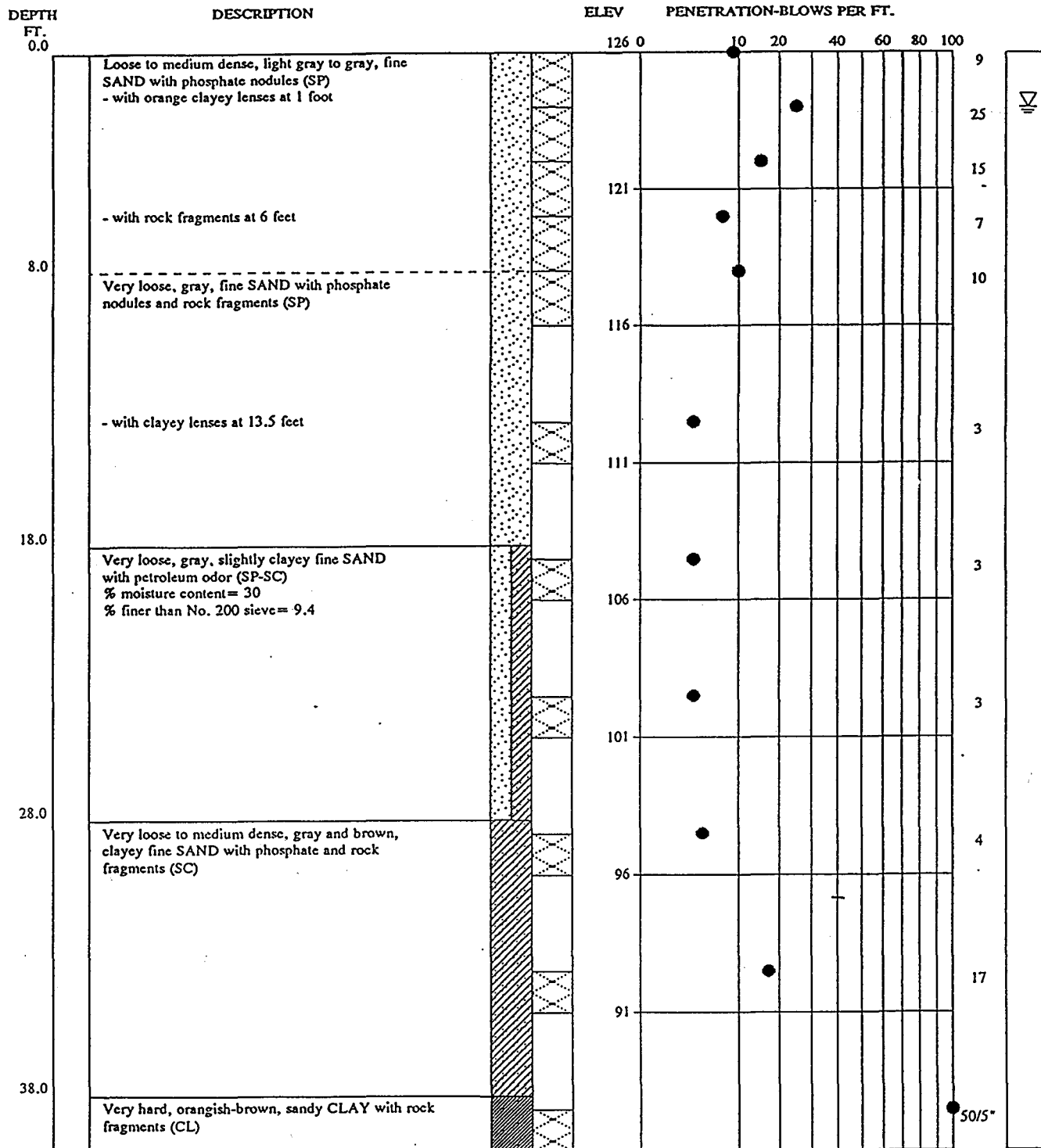
PENETRATION-BLOWS PER FT.

0 10 20 40 60 80 100

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 WATER TABLE 24 HR.
 WATER TABLE, T.O.D.
 LOSS OF DRILLING WATER

BORING NO. B-13 (pg. 2 of 2)
DATE DRILLED 4-16-93
REPORT NO. 9767-1
JOB NO. 9767



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BORING AND SAMPLING - ASTM D-1586
CORE DRILLING - ASTM D-2113

PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER
FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
50% % ROCK CORE RECOVERY

WATER TABLE 24 HR.
WATER TABLE, T.O.D.
LOSS OF DRILLING WATER

TEST BORING RECORD

BORING NO. B-14 (pg. 1 of 2)
DATE DRILLED 4-19-93
REPORT NO. 9767-1
JOB NO. 9767

45.0

Very hard, orangish-brown, sandy CLAY with rock fragments (CL)

End of Boring

0 10 20 40 60 80 100

81

10

20

40

60

80

100

50/4°

81

76

71

66

61

56

51

atlanta testing & engineering

BORING AND SAMPLING - ASTM D-1586
 CORE DRILLING - ASTM D-2113

PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER
FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE

50% % ROCK CORE RECOVERY

 WATER TABLE 24 HR. WATER TABLE, T.O.D.

▶ LOSS OF DRILLING WATER

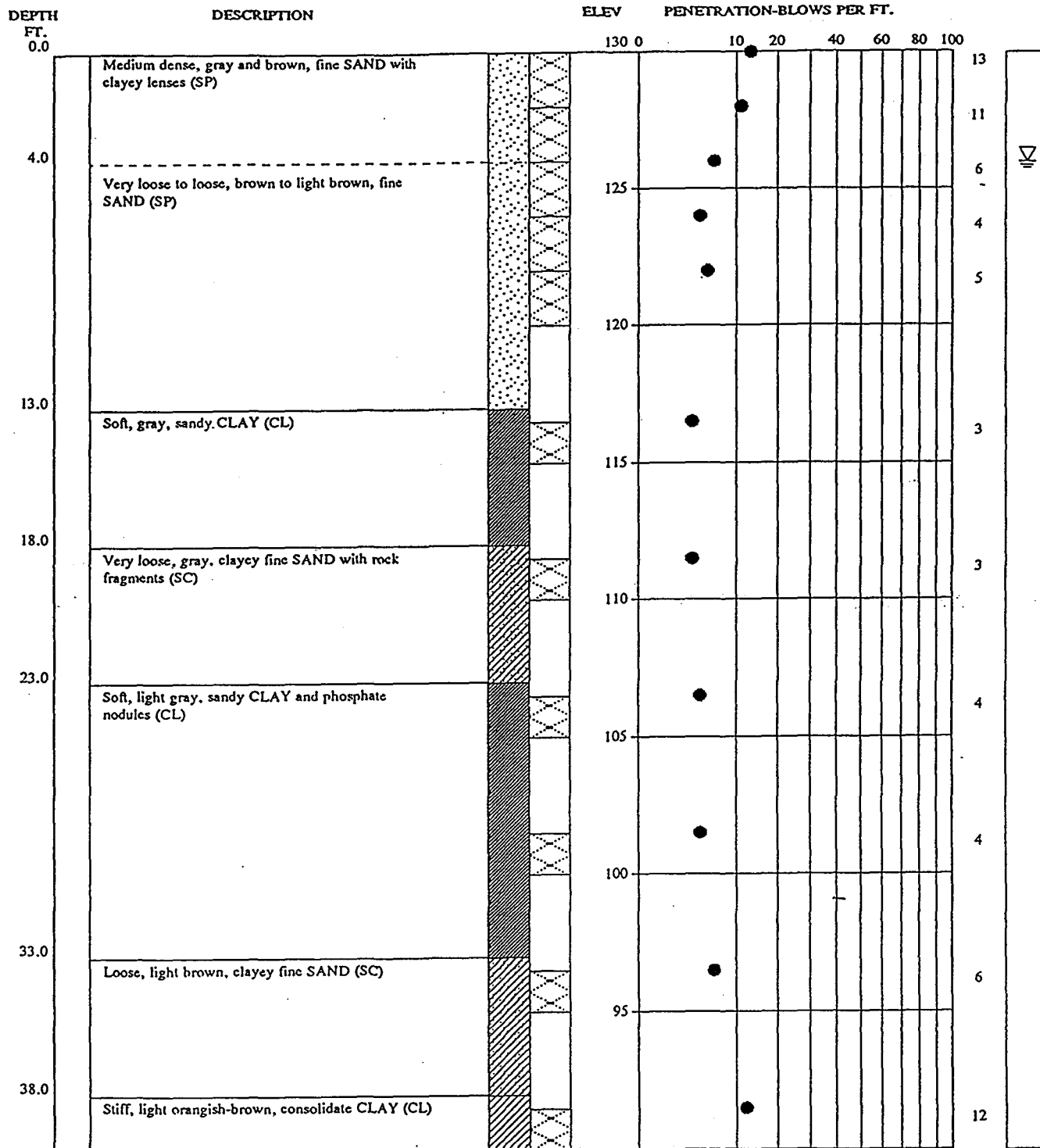
TEST BORING RECORD

BORING NO. B-14 (pg. 2 of 2)

DATE DRILLED 4-19-93

REPORT NO. 9767-1

JOB NO. 9767



atlanta testing & engineering

BORING AND SAMPLING - ASTM D-1586
CORE DRILLING - ASTM D-2113

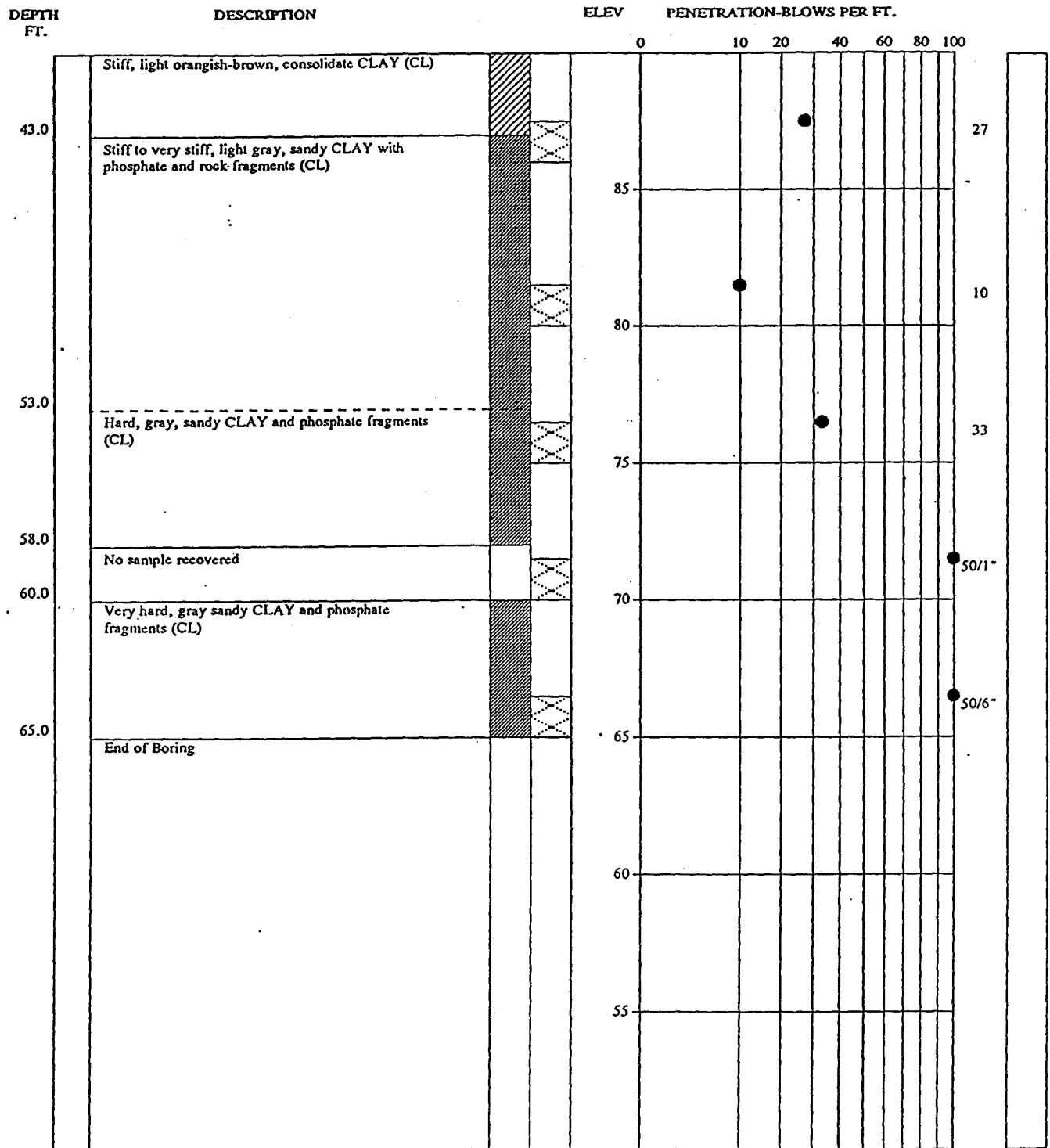
PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER
FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
50% % ROCK CORE RECOVERY

WATER TABLE 24 HR.
 WATER TABLE, T.O.D.
 LOSS OF DRILLING WATER

TEST BORING RECORD

BORING NO. B-15 (pg. 1 of 2)
 DATE DRILLED 4-19-93
 REPORT NO. 9767-1
 JOB NO. 9767



atlanta testing & engineering

BORING AND SAMPLING - ASTM D-1586
CORE DRILLING - ASTM D-2113

PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER
FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
50% % ROCK CORE RECOVERY

WATER TABLE 24 HR.
WATER TABLE, T.O.D.
LOSS OF DRILLING WATER

TEST BORING RECORD

BORING NO. B-15 (pg. 2 of 2)
DATE DRILLED 4-19-93
REPORT NO. 9767-1
JOB NO. 9767

PILE CAPACITY ANALYSIS

Project No: 9767
Boring No: B-2

Hardee Power Station

FLORIDA DEPARTMENT OF TRANSPORTATION
STRUCTURES DESIGN OFFICE
STATIC PILE BEARING CAPACITY ANALYSIS PROGRAM
SPT91 - VERSION 1.1 JANUARY, 1992
BASED ON RESEARCH BULLETIN RB-121
"GUIDELINES FOR USE IN THE SOILS INVESTIGATION
AND DESIGN OF FOUNDATIONS FOR
BRIDGE STRUCTURES IN THE STATE OF FLORIDA"

NOTE - THIS PROGRAM IS INTENDED FOR USE WITH
DRIVEN DISPLACEMENT PILES ONLY

A. GENERAL INFORMATION

INPUT FILE NAME	9767-b2
RUN DATE	05/21/93
RUN TIME	11:09:48
PROJECT NUMBER	9767
JOB NAME	Hardee Power Station
SUBMITTING ENGINEER	Hanecki
BORING NO.	B-2
DRILLING DATE	4/27/93
STATION NO.	
GROUND SURFACE ELEVATION	130.00 FEET
TYPE OF ANALYSIS	2 - DETERMINATION OF STATIC PILE BEARING CAPACITIES FOR A RANGE OF PILE LENGTHS (CAPACITY VS. TIP ELEVATION)

Project No: 9767

Hardee Power Station

Boring No: B-2

B. BORING LOG

ENTRY NO.	DEPTH (FT) D(I)	ELEVATION (FT)	SPT BLOWS/FT N(I)	SOIL TYPE ST(I)
1	2.0	128.0	10.0	3
2	4.0	126.0	16.0	3
3	6.0	124.0	18.0	3
4	8.0	122.0	33.0	3
5	10.0	120.0	20.0	2
6	15.0	115.0	11.0	3
7	20.0	110.0	9.0	3
8	25.0	105.0	3.0	3
9	30.0	100.0	50.0	3
10	35.0	95.0	37.0	3
11	40.0	90.0	33.0	3
12	45.0	85.0	55.0	3
13	50.0	80.0	39.0	1
14	55.0	75.0	100.0	1
15	60.0	70.0	10.0	1
16	65.0	65.0	100.0	1
17	70.0	60.0	51.0	4
18	.0	130.0	.0	0

SOIL TYPE LEGEND

- 0 - BOTTOM OF BORING
- 1 - PLASTIC CLAYS
- 2 - CLAY/SILT SAND MIXTURES, SILTS & MARLS
- 3 - CLEAN SAND
- 4 - SOFT LIMESTONE, VERY SHELLY SANDS
- 5 - VOID (NO CAPACITY)

Project No: 9767

Hardee Power Station

Boring No: B-2

C. PILE INFORMATION

 TEST PILE SECTION
 WIDTH OF PILE

 ISECT = 1 {square}
 WP = 12.00 INCHES

D. PILE CAPACITY VS. PENETRATION

TEST PILE LENGTH (FT)	PILE TIP ELEV (FT)	ULTIMATE SIDE FRICTION (TONS)	MOBILIZED END BEARING (TONS)	ESTIMATED DAVISSON CAPACITY (TONS)	ALLOWABLE PILE CAPACITY (TONS)	ULTIMATE PILE CAPACITY (TONS)
30.0	100.0	40.13	33.11	73.24	36.62	139.47
35.0	95.0	55.26	40.49	95.75	47.87	176.72
40.0	90.0	68.03	41.55	109.59	54.79	192.69
45.0	85.0	84.13	42.17	126.29	63.15	210.62
50.0	80.0	113.38	10.81	124.20	62.10	145.83
55.0	75.0	141.90	10.73	152.63	76.32	174.10

*** THE MAXIMUM PILE LENGTH HAS BEEN REACHED

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.
2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.
3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.
4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.

PROBLEM COMPLETED

ANALYSIS NO. 1

Project No: 9767

Hardee Power Station

Boring No: B-2

C. PILE INFORMATION

 TEST PILE SECTION
 WIDTH OF PILE

 ISECT = 1 {square}
 WP = 18.00 INCHES

D. PILE CAPACITY VS. PENETRATION

TEST PILE LENGTH (FT)	PILE TIP ELEV (FT)	ULTIMATE SIDE FRICTION (TONS)	MOBILIZED END BEARING (TONS)	ESTIMATED DAVISSON CAPACITY (TONS)	ALLOWABLE PILE CAPACITY (TONS)	ULTIMATE PILE CAPACITY (TONS)
30.0	100.0	56.74	62.28	119.02	59.51	243.59
35.0	95.0	76.59	76.53	153.12	76.56	306.17
40.0	90.0	94.89	100.61	195.50	97.75	396.72
45.0	85.0	117.99	84.22	202.21	101.11	370.65
50.0	80.0	170.08	26.22	196.29	98.15	248.73
55.0	75.0	213.27	21.88	235.16	117.58	278.93

*** THE MAXIMUM PILE LENGTH HAS BEEN REACHED

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.
2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.
3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.
4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.

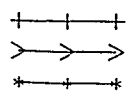
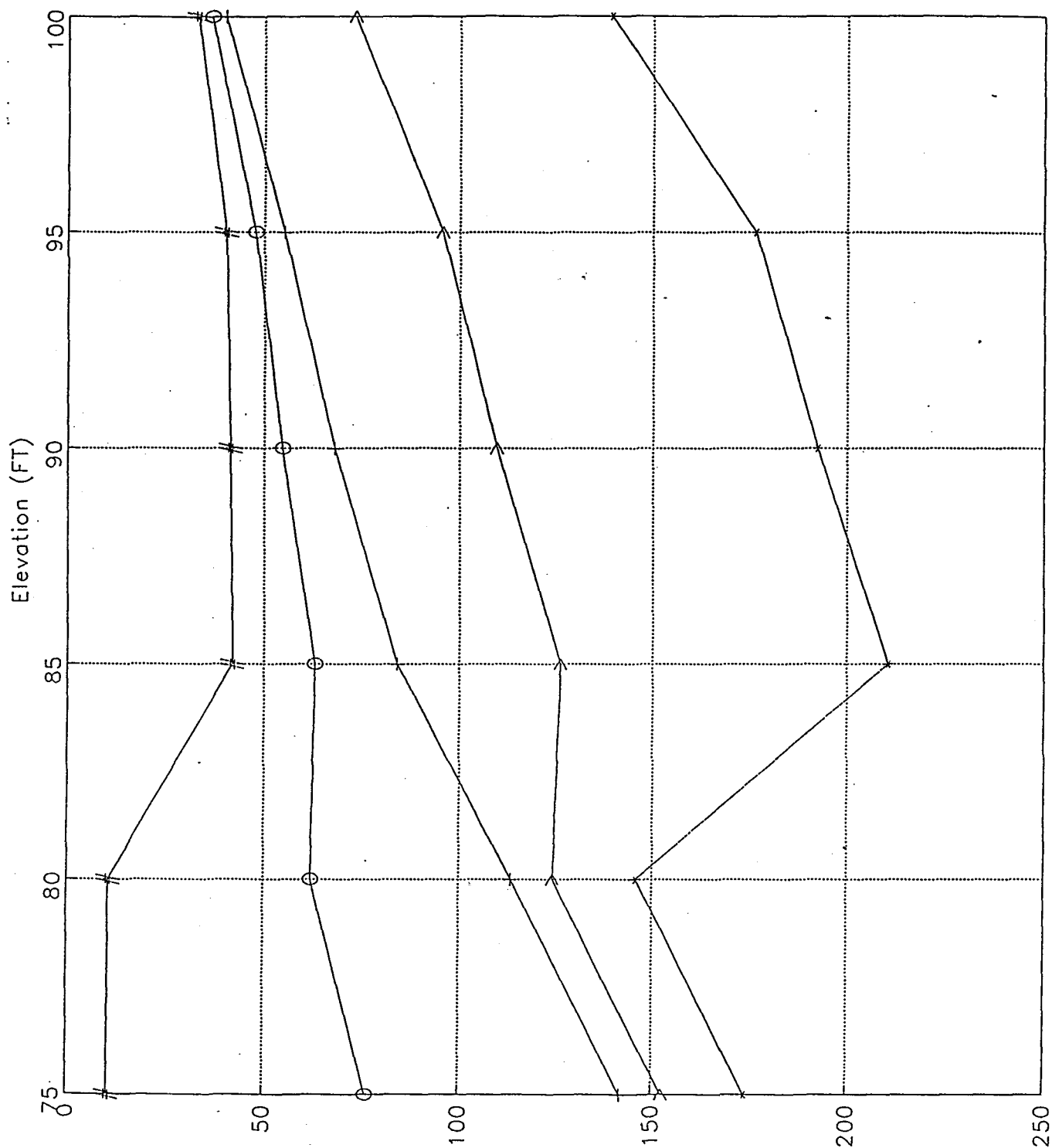
PROBLEM COMPLETED

ANALYSIS NO. 2

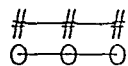
Hardee Power Station

Project No: 9767
Boring No: B-2
Engineer: DH

Station No:
Pile Size: 12 in.



Ultimate Skin Friction
Est. Davissom Cap.
Ultimate Cap.



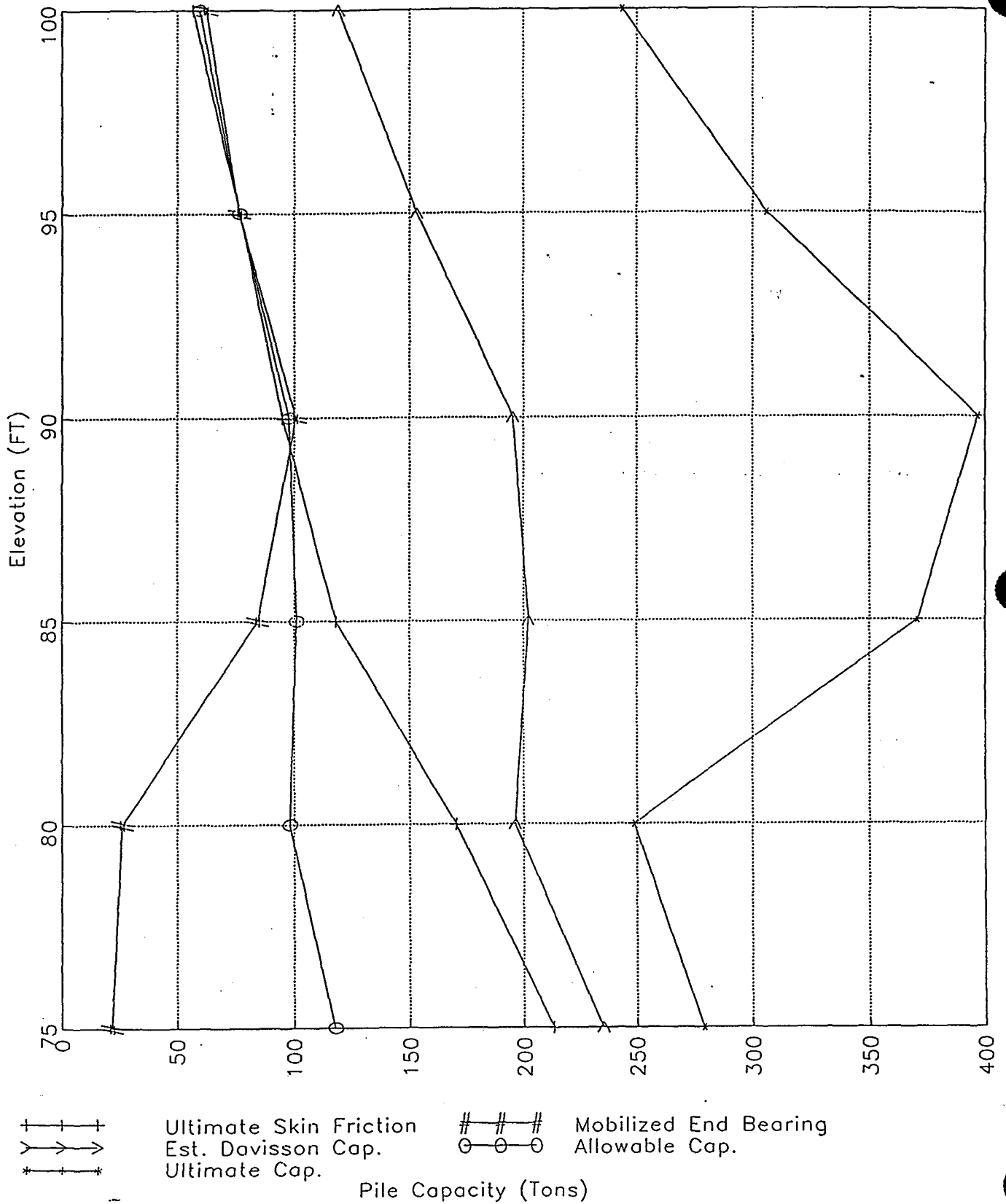
Mobilized End Bearing
Allowable Cap.

Pile Capacity (Tons)

Hardee Power Station

Project No: 9767
Boring No: B-2
Engineer: DH

Station No:
Pile Size: 18 in.



| Project No: 9767 |

| Hardee Power Station |

| Boring No: B-7 |
+-----+

FLORIDA DEPARTMENT OF TRANSPORTATION
 STRUCTURES DESIGN OFFICE
 STATIC PILE BEARING CAPACITY ANALYSIS PROGRAM
 SPT91 - VERSION 1.1 JANUARY, 1992
 BASED ON RESEARCH BULLETIN RB-121
 "GUIDELINES FOR USE IN THE SOILS INVESTIGATION
 AND DESIGN OF FOUNDATIONS FOR
 BRIDGE STRUCTURES IN THE STATE OF FLORIDA"

NOTE - THIS PROGRAM IS INTENDED FOR USE WITH
 DRIVEN DISPLACEMENT PILES ONLY

A. GENERAL INFORMATION

```

=====
INPUT FILE NAME           9767-b7
RUN DATE                  05/21/93
RUN TIME                  11:26:30

PROJECT NUMBER            9767
JOB NAME                  Hardee Power Station
SUBMITTING ENGINEER      DJH

BORING NO.                B-7
DRILLING DATE             4/23/93
STATION NO.
GROUND SURFACE ELEVATION  121.00 FEET

TYPE OF ANALYSIS          2 - DETERMINATION OF STATIC
                           PILE BEARING CAPACITIES
                           FOR A RANGE OF PILE LENGTHS
                           (CAPACITY VS. TIP ELEVATION)
  
```

Project No: 9767

Hardee Power Station

Boring No: B-7

B. BORING LOG

ENTRY NO.	DEPTH (FT) D(I)	ELEVATION (FT)	SPT BLOWS/FT N(I)	SOIL TYPE ST(I)
1	2.0	119.0	4.0	3
2	4.0	117.0	8.0	3
3	6.0	115.0	16.0	2
4	8.0	113.0	28.0	1
5	10.0	111.0	22.0	1
6	15.0	106.0	18.0	2
7	20.0	101.0	43.0	1
8	25.0	96.0	8.0	1
9	30.0	91.0	48.0	1
10	35.0	86.0	22.0	2
11	40.0	81.0	26.0	1
12	45.0	76.0	100.0	1
13	50.0	71.0	100.0	4
14	.0	121.0	.0	0

SOIL TYPE LEGEND

- 0 - BOTTOM OF BORING
- 1 - PLASTIC CLAYS
- 2 - CLAY/SILT SAND MIXTURES, SILTS & MARLS
- 3 - CLEAN SAND
- 4 - SOFT LIMESTONE, VERY SHELLY SANDS
- 5 - VOID (NO CAPACITY)

Project No: 9767

Hardee Power Station

Boring No: B-7

C. PILE INFORMATION

TEST PILE SECTION
WIDTH OF PILE

ISECT = 1 {square}
WP = 12.00 INCHES

D. PILE CAPACITY VS. PENETRATION

TEST PILE LENGTH (FT)	PILE TIP ELEV (FT)	ULTIMATE SIDE FRICTION (TONS)	MOBILIZED END BEARING (TONS)	ESTIMATED DAVISSON CAPACITY (TONS)	ALLOWABLE PILE CAPACITY (TONS)	ULTIMATE PILE CAPACITY (TONS)
30.0	91.0	97.30	8.54	105.85	52.92	122.94
35.0	86.0	120.61	10.03	130.64	65.32	150.71
40.0	81.0	139.96	9.37	149.33	74.66	168.07

*** THE MAXIMUM PILE LENGTH HAS BEEN REACHED

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.
2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.
3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.
4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.

PROBLEM COMPLETED

ANALYSIS NO. 1

STATIC PILE BEARING CAPACITY ANALYSIS - SPT91		Page 4
Project No: 9767	Hardee Power Station	
Boring No: B-7		

C. PILE INFORMATION

TEST PILE SECTION
WIDTH OF PILE

ISECT = 1 {square}
WP = 18.00 INCHES

D. PILE CAPACITY VS. PENETRATION

TEST PILE LENGTH (FT)	PILE TIP ELEV (FT)	ULTIMATE SIDE FRICTION (TONS)	MOBILIZED END BEARING (TONS)	ESTIMATED DAVISSON CAPACITY (TONS)	ALLOWABLE PILE CAPACITY (TONS)	ULTIMATE PILE CAPACITY (TONS)
30.0	91.0	145.66	19.93	165.59	82.79	205.45
35.0	86.0	180.91	18.97	199.87	99.94	237.80
40.0	81.0	209.93	22.87	232.81	116.40	278.56

*** THE MAXIMUM PILE LENGTH HAS BEEN REACHED

NOTES

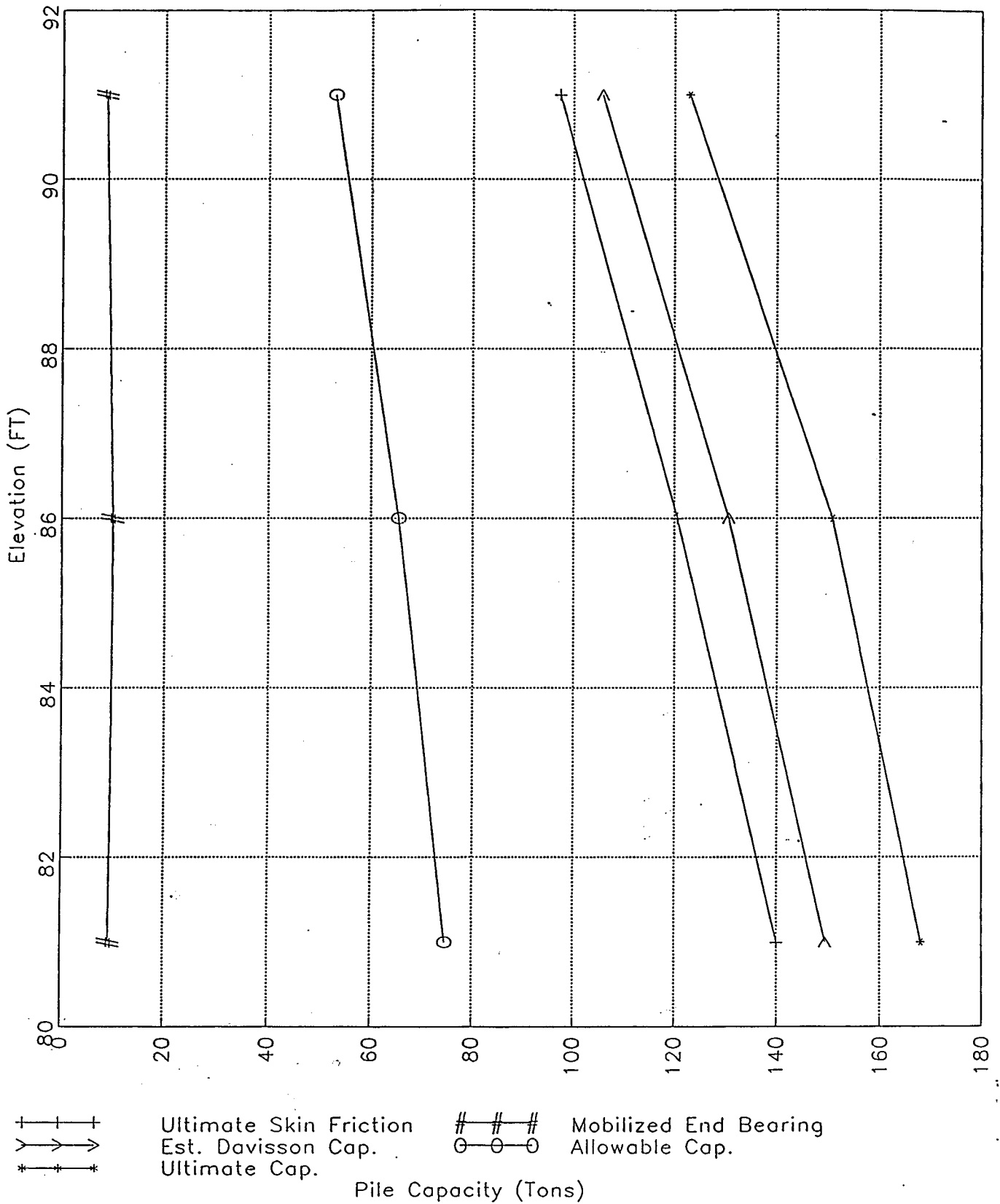
1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.
2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.
3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.
4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.

PROBLEM COMPLETED

ANALYSIS NO. 2

Project No: 9767
 Boring No: B-7
 Engineer: DJH

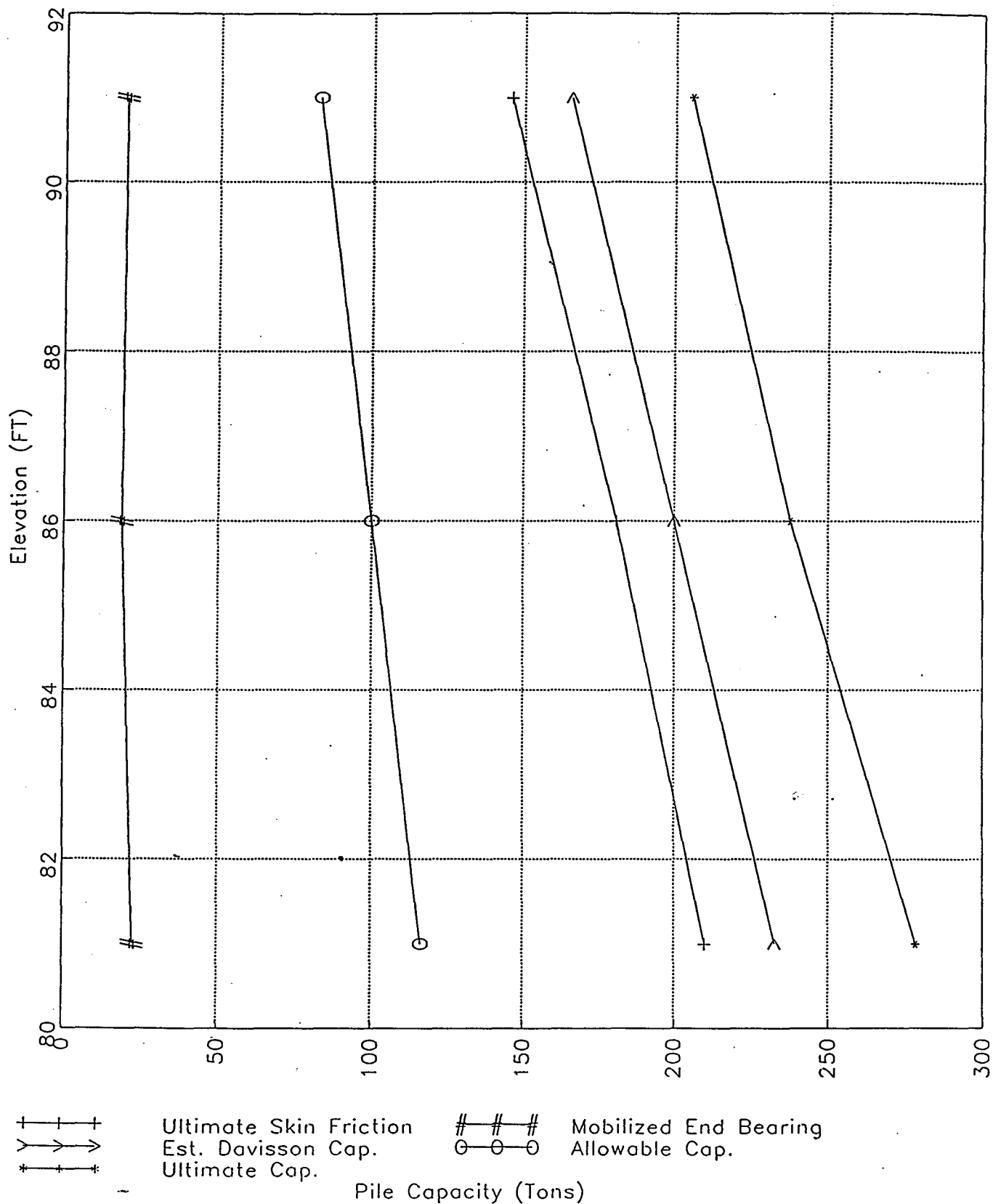
Station No:
 Pile Size: 12 in.

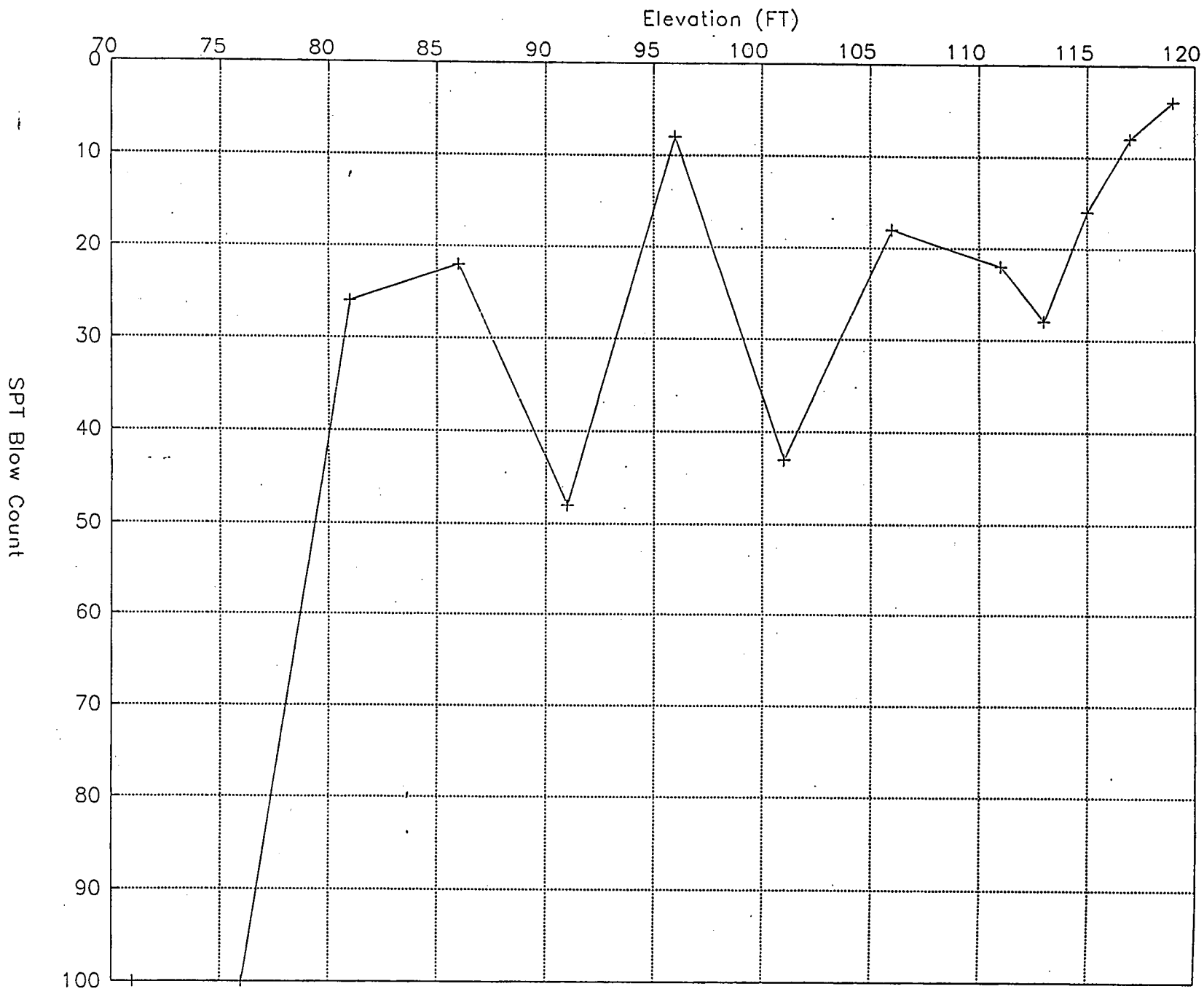


Hardee Power Station

Project No: 9767
Boring No: B-7
Engineer: DJH

Station No:
Pile Size: 18 in.





Project No: 9767

Hardee Power Station

Boring No: B-15

FLORIDA DEPARTMENT OF TRANSPORTATION
STRUCTURES DESIGN OFFICE
STATIC PILE BEARING CAPACITY ANALYSIS PROGRAM
SPT91 - VERSION 1.1 JANUARY, 1992
BASED ON RESEARCH BULLETIN RB-121
"GUIDELINES FOR USE IN THE SOILS INVESTIGATION
AND DESIGN OF FOUNDATIONS FOR
BRIDGE STRUCTURES IN THE STATE OF FLORIDA"

NOTE - THIS PROGRAM IS INTENDED FOR USE WITH
DRIVEN DISPLACEMENT PILES ONLY

A. GENERAL INFORMATION

INPUT FILE NAME	9767-b15
RUN DATE	05/21/93
RUN TIME	11:34:24
PROJECT NUMBER	9767
JOB NAME	Hardee Power Station
SUBMITTING ENGINEER	DH
BORING NO.	B-15
DRILLING DATE	4/19/93
STATION NO.	
GROUND SURFACE ELEVATION	130.00 FEET
TYPE OF ANALYSIS	2 - DETERMINATION OF STATIC PILE BEARING CAPACITIES FOR A RANGE OF PILE LENGTHS (CAPACITY VS. TIP ELEVATION)

Project No: 9767
 Boring No: B-15

Hardee Power Station

B. BORING LOG

ENTRY NO.	DEPTH (FT) D(I)	ELEVATION (FT)	SPT BLOWS/FT N(I)	SOIL TYPE ST(I)
1	2.0	128.0	13.0	3
2	4.0	126.0	11.0	3
3	6.0	124.0	6.0	3
4	8.0	122.0	4.0	3
5	10.0	120.0	5.0	3
6	15.0	115.0	3.0	1
7	20.0	110.0	3.0	2
8	25.0	105.0	4.0	1
9	30.0	100.0	4.0	1
10	35.0	95.0	6.0	2
11	40.0	90.0	12.0	1
12	45.0	85.0	27.0	1
13	50.0	80.0	10.0	1
14	55.0	75.0	33.0	1
15	60.0	70.0	100.0	1
16	65.0	65.0	100.0	4
17	.0	130.0	.0	0

SOIL TYPE LEGEND

- 0 - BOTTOM OF BORING
- 1 - PLASTIC CLAYS
- 2 - CLAY/SILT SAND MIXTURES, SILTS & MARLS
- 3 - CLEAN SAND
- 4 - SOFT LIMESTONE, VERY SHELLY SANDS
- 5 - VOID (NO CAPACITY)

Project No: 9767

Hardee Power Station

Boring No: B-15

C. PILE INFORMATION

 TEST PILE SECTION
 WIDTH OF PILE

 ISECT = 1 {square}
 WP = 12.00 INCHES

D. PILE CAPACITY VS. PENETRATION

TEST PILE LENGTH (FT)	PILE TIP ELEV (FT)	ULTIMATE SIDE FRICTION (TONS)	MOBILIZED END BEARING (TONS)	ESTIMATED DAVISSON CAPACITY (TONS)	ALLOWABLE PILE CAPACITY (TONS)	ULTIMATE PILE CAPACITY (TONS)
40.0	90.0	16.97	3.37	20.34	10.17	27.08
45.0	85.0	33.33	4.43	37.75	18.88	46.60
50.0	80.0	49.53	4.44	53.96	26.98	62.84
55.0	75.0	67.19	7.18	74.37	37.18	88.73
60.0	70.0	94.74	21.68	116.42	58.21	159.78

*** THE MAXIMUM PILE LENGTH HAS BEEN REACHED

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.
2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.
3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.
4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.

PROBLEM COMPLETED

ANALYSIS NO. 1

Project No: 9767

Hardee Power Station

Boring No: B-15

C. PILE INFORMATION

 TEST PILE SECTION
 WIDTH OF PILE

 ISECT = 1 {square}
 WP = 18.00 INCHES

D. PILE CAPACITY VS. PENETRATION

TEST PILE LENGTH (FT)	PILE TIP ELEV (FT)	ULTIMATE SIDE FRICTION (TONS)	MOBILIZED END BEARING (TONS)	ESTIMATED DAVISSON CAPACITY (TONS)	ALLOWABLE PILE CAPACITY (TONS)	ULTIMATE PILE CAPACITY (TONS)
40.0	90.0	25.46	7.36	32.82	16.41	47.55
45.0	85.0	49.58	8.78	58.36	29.18	75.91
50.0	80.0	73.89	10.49	84.38	42.19	105.36
55.0	75.0	100.37	17.88	118.25	59.12	154.00

*** ERROR *** PILE TIP TOO NEAR END OF BORING LOG FOR LENGTH = 60.00 FT

NOTES

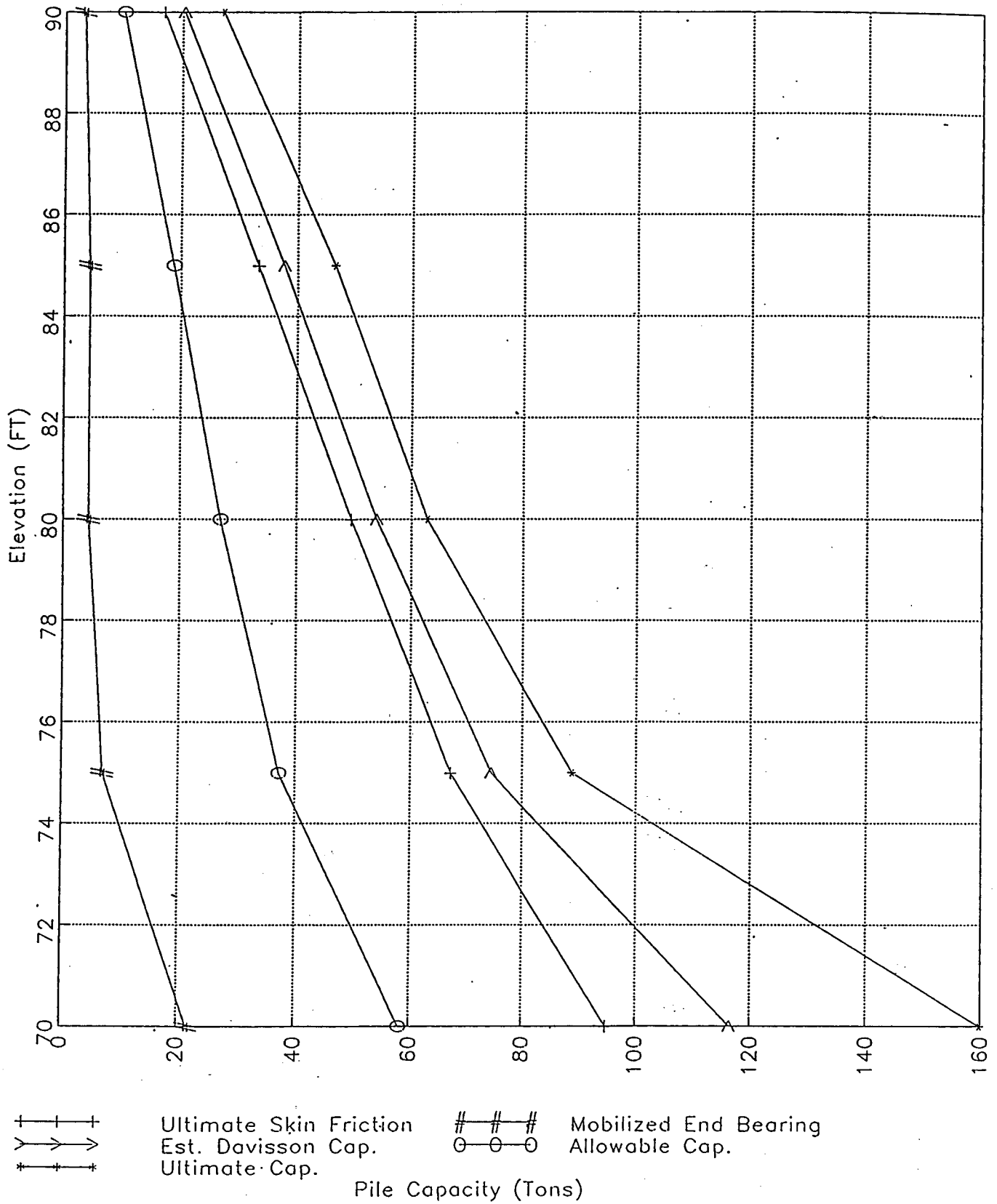
1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.
2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.
3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.
4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.

PROBLEM COMPLETED

ANALYSIS NO. 2

Project No: 9767
 Boring No: B-15
 Engineer: DH

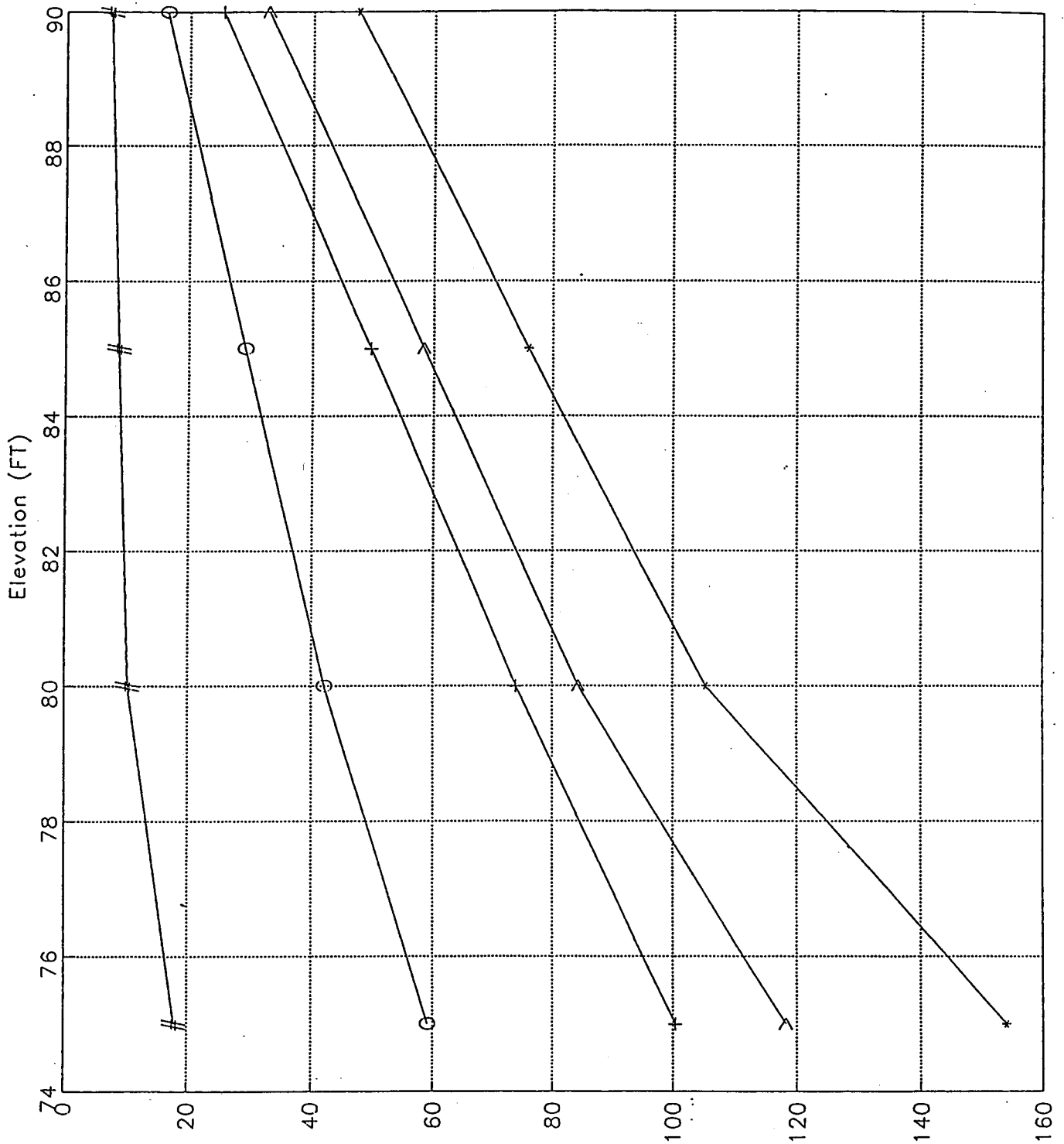
Station No:
 Pile Size: 12 in.



Hardee Power Station

Project No: 9767
Boring No: B-15
Engineer: DH

Station No:
Pile Size: 18 in.



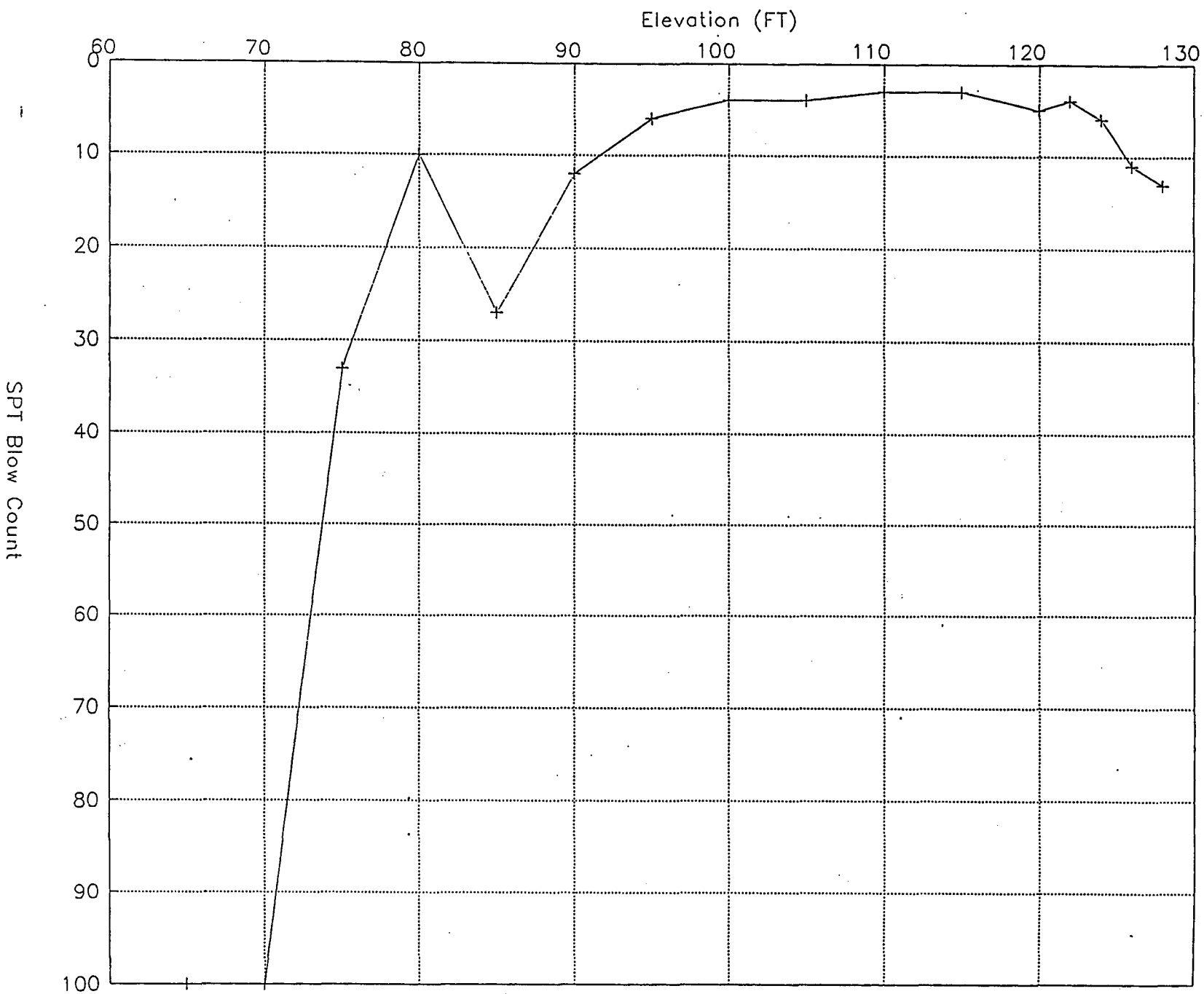
+ + + Ultimate Skin Friction # # # Mobilized End Bearing
 > > > Est. Davisson Cap. o o o Allowable Cap.
 * * * Ultimate Cap.

Pile Capacity (Tons)

Hardee Power Station

Project No: 9767
Boring No: B-15
Engineer: DH

Station No:



10.7.1-83



TABLE OF SOIL BORING
ELEVATIONS AND POSITIONS

Hardee Power Station
Hardee County, Florida
AT&E Report No. 9767-1

TABLE OF SOIL BORING ELEVATIONS AND POSITIONS

Boring No.	Northing	Easting	Elevation
B-1	7327.9	2729.3	118.5
B-2	7327.9	3004.3	120.8
B-3	7327.9	3279.3	122.9
B-4	7214.9	2869.8	119.8
B-5	7202.9	3141.8	121.9
B-6	7077.9	2729.3	119.4
B-7	7077.9	3004.3	121.2
B-8	7077.9	3279.3	122.0
B-9	6952.9	2866.8	120.7
B-10	6952.9	3141.8	121.8
B-11	6827.9	2729.3	120.6
B-12	6827.9	3004.3	121.0
B-13	6827.9	3279.3	122.6
B-14	6927.9	3779.3	125.9
B-15	6927.9	4379.3	130.3

LABORATORY
TEST PROCEDURES

Atterberg Limits Test

Representative samples were subjected to Atterberg limits testing to determine the soil's plasticity characteristics. The plasticity index (PI) is the range of moisture content over which the soil deforms as a plastic material. It is bracketed by the liquid limit (LL) and the plastic limit (PL). The liquid limit is the moisture content at which the soil becomes sufficiently "wet" to flow as a heavy viscous fluid. The tests were performed in general compliance with ASTM procedure D-4318. The Atterberg limits tests performed on soils obtained during this study suggest that most of the cohesive soils encountered have low plasticity and are relatively non-expansive. The results of the Atterberg limits tests are indicated on the attached Test Boring Logs.

Grain Size Distribution Test

The grain size distribution of soil particles in a specimen is recognized as an indicator of certain physical properties including permeability, compaction characteristics, consolidation, shrinkage and swell characteristics, liquefaction characteristics, and numerous other engineering related properties. The soil specimen is prepared and tested to determine the percentages of particles within a range of selected sizes. The measured cumulative quantities for each size are depicted on a graph that shows a distribution of gradations. The distribution of particles larger than 75 microns (retained on the No. 200 sieve) is determined by sieving, while the smaller particle sizes are measured by a sedimentation process, using a hydrometer to secure the necessary data. Test results are included in the Grain Size Distribution Test Results portion in the Appendix of this report.

The grain size distribution tests suggest that the sandy soil components predominantly fall within a narrow range of soil particle sizes. These soils are commonly referred to as uniformly graded. Most soils pass between the No. 40 and No. 100 sieves. Soils passing the No. 200 sieve consist of silts and clays and are indicative of the cohesiveness of the soils. In general, soils exhibiting a high percentage of particles passing an No. 200 sieve are more cohesive than similar soils with lesser percentages of particles passing the No. 200 sieve.

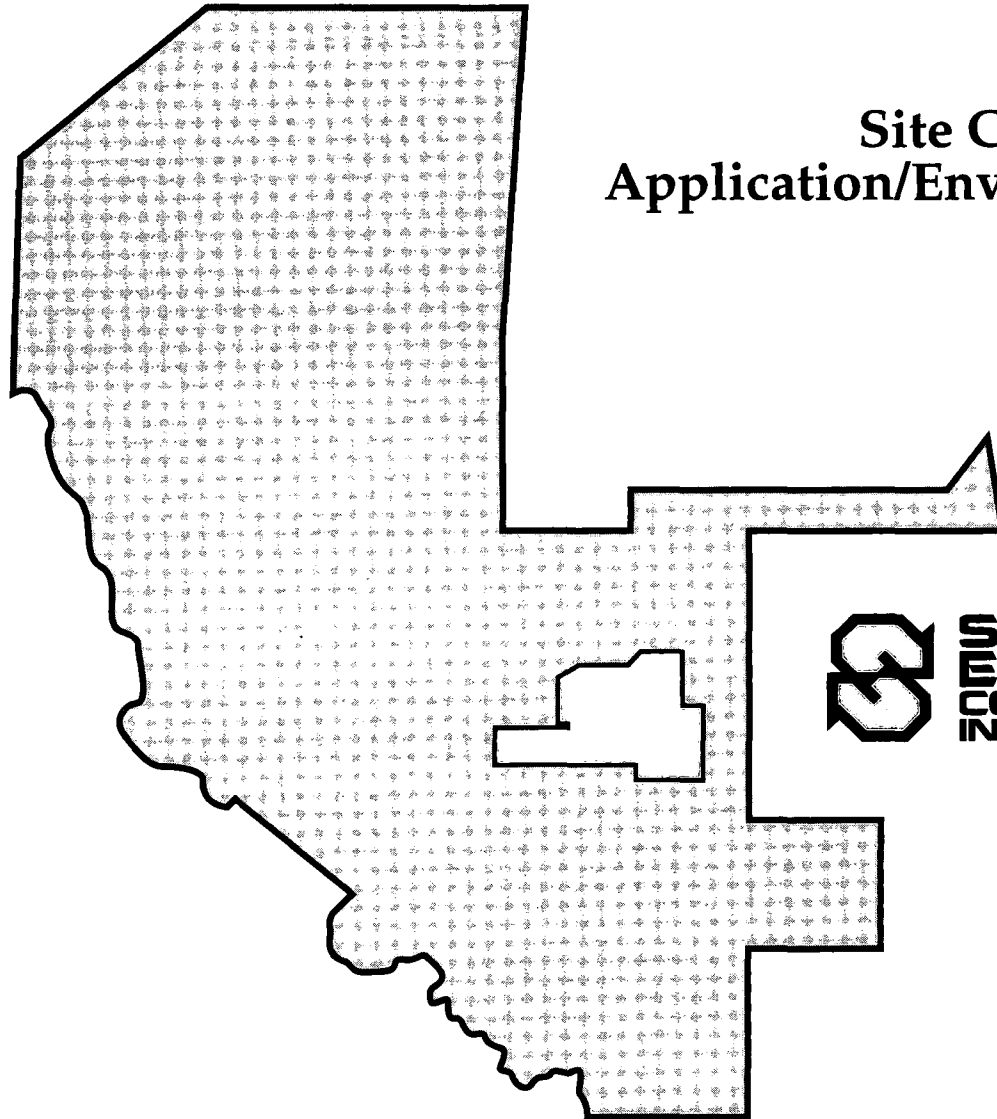
Moisture Content Tests

The moisture content of soils is an indicator of various physical properties, including strength and compressibility. Selected samples were taken from sealed containers obtained during the drilling phase of the project. The weight of the water in the sample is divided by the weight of the dry soil to yield the moisture content based on the dry unit mass of the soil. The moisture content results included on the Test Boring Logs utilize the dry unit mass method.

The moisture content described in the Chemical Laboratory Test Results section in the Appendix utilized the total unit mass method of determining the moisture content. Instead of dividing the weight of water in the sample by the weight of the dry soil, the weight of the water is divided by the total initial sample weight.

HARDEE UNIT 3

Site Certification
Application/Environmental
Analysis



**SEMINOLE
ELECTRIC
COOPERATIVE
INCORPORATED**

Appendix 10.8



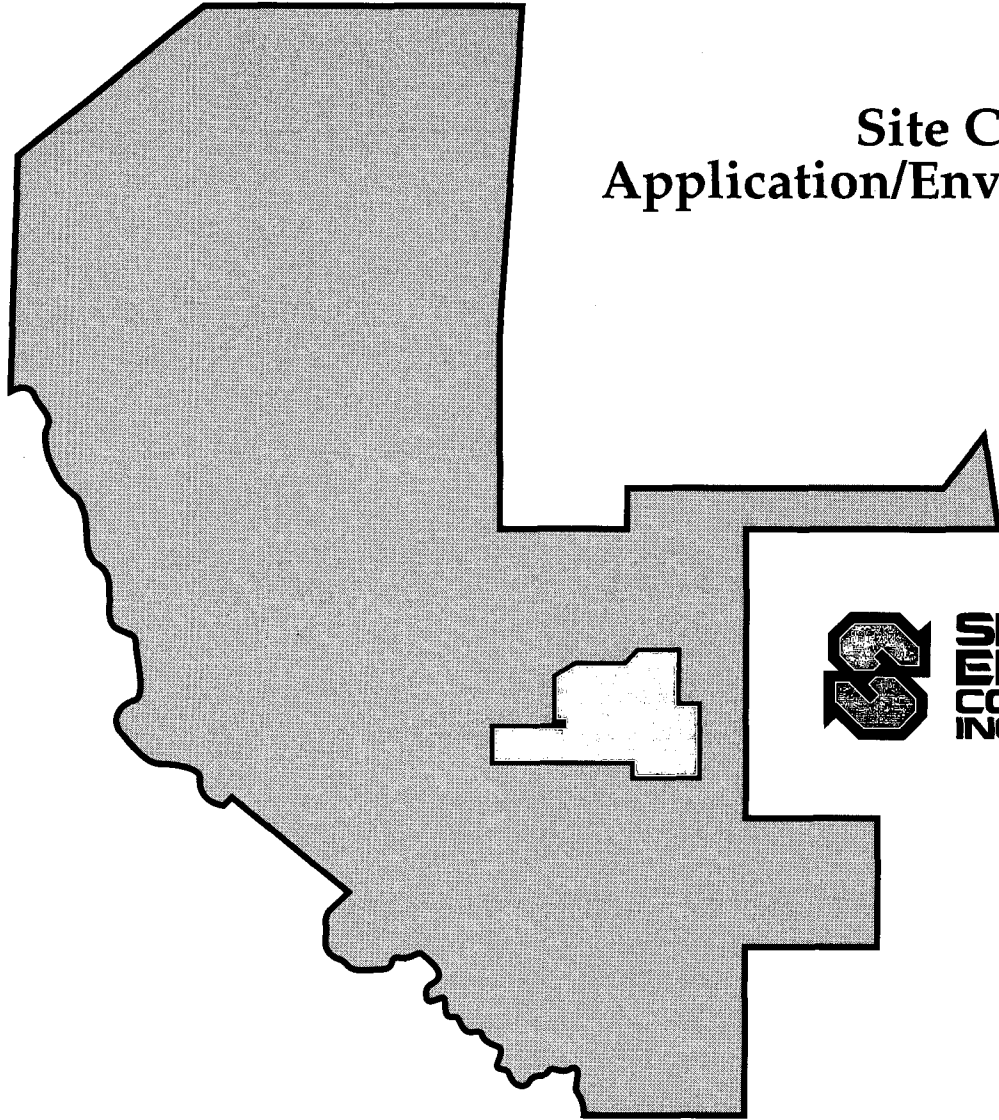
APPENDIX 10.8

**FLORIDA PUBLIC SERVICE COMMISSION
ORDER DETERMINING NEED**

The Florida Public Service Commission Order Determining Need will be provided when available.

HARDEE UNIT 3

Site Certification
Application/Environmental
Analysis



Appendix 10.9



APPENDIX 10.9

EROSION AND SEDIMENTATION CONTROL PLAN

SEMINOLE ELECTRIC COOPERATIVE, INC.

HARDEE POWER STATION UNIT 3

EROSION AND SEDIMENTATION CONTROL PLAN

B&V FILE NO. 23930.32.0206

ISSUE DATE AND REVISION NO. 012894-0

SECI 23930
01-28-94

HARDEE POWER STATION

EROSION AND SEDIMENTATION CONTROL PLAN

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 - 1.1 PURPOSE
 - 1.2 DESCRIPTION OF PROJECT
- 2.0 GRADING AND DRAINAGE
 - 2.1 TOPOGRAPHY
 - 2.2 SOIL TYPES
 - 2.3 STORMWATER HANDLING
 - 2.3.1 General
 - 2.3.2 Excavation
 - 2.3.3 Fills
 - 2.3.4 Ditches
 - 2.3.5 Culverts
- 3.0 DEWATERING
- 4.0 EROSION AND SEDIMENTATION CONTROL
 - 4.1 PROPOSED ALTERATIONS
 - 4.2 STAGING EARTHMOVING ACTIVITIES
 - 4.3 TEMPORARY CONTROL MEASURES
 - 4.4 PERMANENT CONTROL MEASURES
 - 4.5 MAINTENANCE PROGRAM
- APPENDIX A - DRAWINGS
 - 23930-CSTU-S3001 SITE ARRANGEMENT
 - 23930-CSTF-S3021 SITE - EROSION AND SEDIMENTATION CONTROL PLAN

EROSION AND SEDIMENTATION CONTROL PLAN

SEMINOLE ELECTRIC COOPERATIVE, INC. HARDEE POWER STATION UNIT 3

1.0 INTRODUCTION

1.1 PURPOSE

This plan outlines the project requirements and procedures to be used during, and after construction for the control of erosion and to minimize offsite deposition of sediment.

1.2 DESCRIPTION OF PROJECT

Hardee Power Station Unit 3 will be a combined cycle electric generating facility with nominal capacity of 440 MW. The new facilities will be built on a 1300 acre site in Hardee and Polk Counties about 9 miles northwest of Wauchula, west of County Road 663. The site is owned by Seminole Electric Cooperative, Inc. The site includes both undisturbed and mined areas of an active phosphate mine. The mined areas have been reclaimed by Agrico Chemical Company under the provisions of their phosphate mine reclamation plan. The entire site drains to an unnamed tributary of Payne Creek. Areas in the Payne Creek floodplain will not be disturbed.

The facility will use natural gas and distillate oil as fuels. An existing cooling reservoir will be used for heat rejection from the steam cycle.

2.0 GRADING AND DRAINAGE

2.1 TOPOGRAPHY

The site is located generally on areas reclaimed from phosphate mining.

The overall existing site drainage pattern directs runoff from the east to the west to an unnamed tributary of Payne Creek. The project grading plan will make use of this pattern to facilitate gravity drainage to the runoff detention pond. The pond will be located in the southwestern portion of the site.

2.2 SOIL TYPES

Based on information available from the adjacent site, the natural soils vary aerially and with depth. The upper 5 to 10 feet are composed of fine grained sands, with underlying clayey sands. Organic material is typically found in only the top foot of soil. These soils are about 85 feet deep.

2.3 STORMWATER HANDLING

2.3.1 General

Site grading and drainage will be designed to comply with all applicable federal, state, and local regulations. The general site grading will establish a working surface for construction and plant operating areas, provide positive drainage from buildings and structures, and provide adequate soil coverage for underground utilities.

Onsite drainage will be accomplished through gravity flow. The surface drainage system will consist of mild overland slopes, ditches, and culverts. Buildings and structures will be located with the ground floor elevation a minimum of six inches above finish grade. The graded areas adjacent to buildings will be sloped away with a 1 percent slope. Other areas will have a minimum slope of 0.5 percent.

Stormwater calculations were made using the U.S. Department of Agriculture (USDA) Soil Conservation Service (SCS) Methods or other approved methods. Peak discharges and runoff volumes were determined using methods approved by the Southwest Florida Water Management District.

2.3.2 Excavation

In areas requiring excavation, earth material will be removed to the required lines and grades. Any undesirable material will be removed and replaced with suitable earth material. The remaining in situ material will be graded and compacted to the depth, density, and contour determined by detailed design. Excavated material that meets the design requirements will be used as general site fill where possible. Any material not used in the site grading will be stockpiled on the site as directed by the Construction Manager.

2.3.3 Fills

Fills for general site grading will be required to raise portions of the site to facilitate drainage. Compacted fill material for these areas will be obtained from onsite excavations, and offsite sources if necessary. This material will be placed and compacted to the grades and density determined by the design.

2.3.4 Ditches

Ditches will generally be trapezoidal in section, of sufficient width to facilitate cleaning, and mildly sloping so that erosion of the ditch bottom due to high flow velocities is minimized. Side slopes on ditches will be 3 horizontal to 1 vertical. The preferred slope of the ditch bottom will be 200 horizontal to 1 vertical, with a minimum slope of 1000 horizontal to 1 vertical. In areas where space is limited and design flow rates are small, ditches having a triangular cross section will be provided.

Ditches will be designed to carry the 25-year, design rainfall event with flows less than eroding velocities. Erosion protection will consist of grassed surfaces in all ditches. Enkamat, or an approved equal, erosion control fabric will be installed to limit erosion at culvert outlets.

2.3.5 Culverts

Drainage culverts will be provided at the intersection of ditches and embankments. Culverts will be constructed of reinforced concrete or corrugated HDPE pipe. Reinforced concrete box culverts will be provided where necessary.

The drainage culverts and associated ditches will be designed to ensure passage of the 25-year peak runoff flow without producing a headwater elevation above the bottom of the roadway base course. The minimum cover requirement for culverts will be 12 inches. All culverts will be designed to handle AASHTO HS20 and construction equipment loadings as applicable to the design. Culverts will have beveled end sections compatible with the ditch side slopes or concrete headwalls at both ends.

3.0 DEWATERING

Dewatering equipment will be provided and maintained to remove and dispose of all surface and ground water entering excavations and other parts of the work. Groundwater dewatering will be used primarily for excavation, installation, and backfill of underground utilities. Dewatering effects will be shallow and will not impact existing facilities or wetlands. A silt screen, such as straw bales or silt fence, or other methods of sediment removal will be used to minimize the transport of suspended solids in the dewatering flow. Discharge from dewatering operations will be directed to the runoff detention pond. Each excavation will be kept dry during subgrade preparation and continually thereafter until the construction therein is completed to the extent that no damage from hydrostatic pressure, flotation, or related other cause will result.

4.0 EROSION AND SEDIMENTATION CONTROL

4.1 PROPOSED ALTERATIONS

The site arrangement for the project is shown on Drawing 23930-CSTU-S3001. Site development will not significantly alter the grades or drainage patterns of the site. Existing vegetation will be removed as required during initial site preparation operations. Final grading will include seeding all disturbed areas not occupied by plant facilities nor surfaced with asphalt or crushed aggregate.

Existing natural and mine reclamation drainage patterns will be altered so that all runoff from the main plant site will be directed to the runoff detention pond.

4.2 STAGING EARTHMOVING ACTIVITIES

All significant vegetation (trees, brush, etc.) will first be cleared from the project area. The runoff detention pond and necessary ditches will be constructed concurrently with clearing operations. Topsoil will be stripped and stockpiled for finish grading and reseeding at the end of construction. The general preparation of the overall site will be followed by earthmoving activities required for the construction of specific facilities. Final finish grading and seeding will begin when earthmoving operations are completed in each area.

4.3 TEMPORARY CONTROL MEASURES

The temporary erosion and sedimentation control measures will be designed to prevent sediments from being displaced and carried offsite by construction runoff. The primary destination of construction runoff will be the runoff detention pond, which is discussed in Section 4.4 Permanent Control Measures.

Prior to beginning excavation activities, a silt fence or straw bales will be installed along the perimeter of the project where runoff to offsite areas is expected. (See Figure 4.1). This silt fence will filter sediments from construction runoff. Drawing 23930-CTSF-S3021 shows the anticipated location of the silt fence. During construction, the extent of earth disturbances will be minimized as much as practical. Areas outside of cut and fill operations will be protected against unnecessary equipment traffic. Aggregate surfaced areas will be provided for construction parking and roads.

Erosion control during construction will also include minimizing fugitive dust from the project area through periodic spraying of water. A sediment filter or small sediment trap will be provided at the culverts, and ditches to reduce the amount of sediment load carried into the drainage system and pond.

Diversion ditches and/or berms will be constructed as necessary to divert runoff from offsite areas around the construction site. Temporary control measures will be maintained as necessary throughout the construction period and removed at the end of construction.

4.4 PERMANENT CONTROL MEASURES

Permanent erosion and sedimentation control measures within the project plant site will include the runoff collection system (ditches, culverts, and swales), surfaced traffic and work areas, seeded non-working areas, and the detention pond. These measures will minimize any appreciable erosion or the resulting sedimentation on the project site.

The permanent erosion and sediment control system will be installed during construction operations and will remain in service throughout the life of the project. The primary components of this system will be a series of ditches and culverts which will collect the site runoff and direct it to the detention pond.

The site will be graded with moderate slopes of 0.5 to three percent for effective drainage of storm water without erosion. High traffic areas of the site will be surfaced with asphalt or crushed rock. Site areas not surfaced with these materials will be sodded or seeded. Areas to be sodded will be covered with centipede or bahia sod tamped or rolled into place. Areas to be seeded will be covered with topsoil, fertilized, seeded, and mulched. The seed will be a mixture of bermuda and Pensacola bahia. All planted areas will be watered until a complete cover of green turf is established.

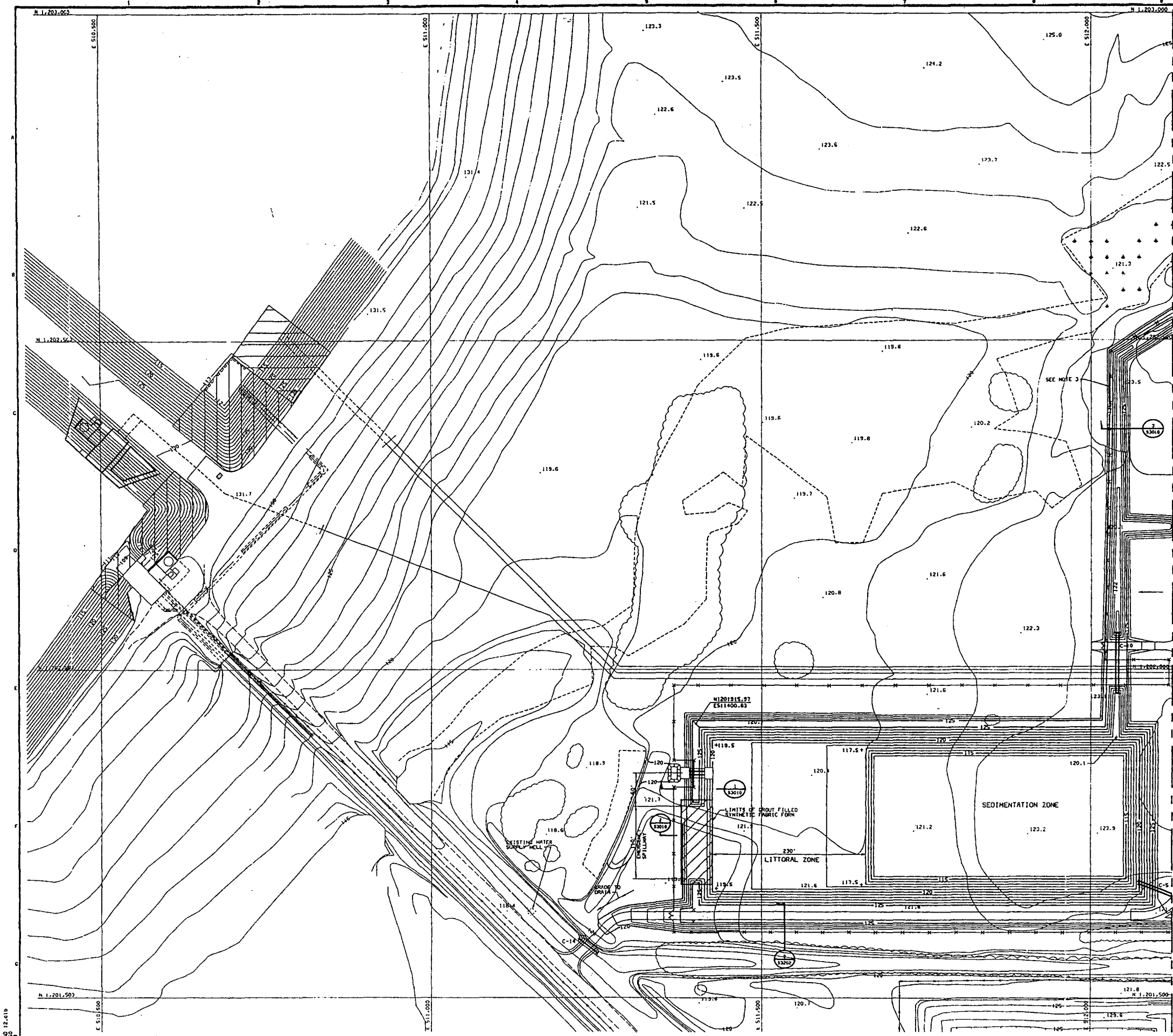
The primary drainage ditches and the detention pond will be constructed early in the construction period. All main plant site construction runoff will be routed to the detention pond, which will serve as a wet sedimentation basin. Discharge from the detention pond during construction will be through a filtration system or an emergency overflow weir.

Construction runoff from the access roads will be collected in ditches with silt screens or straw bale dikes for erosion and sediment control.

4.5 MAINTENANCE PROGRAM

The ditches and runoff pond will require periodic cleaning, especially during the plant construction period before vegetative cover is established and all work area surfacing is complete. This cleaning will be accomplished with backhoes or crane and clamshell bucket. The sediment removed from the ditches and ponds will be stored on the site and reseeded to control additional erosion. Cleaning will be done during plant operation as required to maintain the design capacities in the ditches and ponds.

APPENDIX A
DRAWINGS



MATCHLINE E512.125 - FOR CONTINUATION SEE DWG S3002

Reference

- GENERAL NOTES**
1. SEE DWG. S3000 FOR GENERAL NOTES AND LEGEND.
 2. SEE DWG S3010 FOR CULVERT DETAILS AND BEDDING REQUIREMENTS.
 3. THE BERM ALONG THE NORTHWEST SIDE OF THE SITE SHALL FOLLOW THE PROPOSED FENCE. SEE DWG. S3200 & S3201 FOR LOCATION.
- EXTENSIVE REVISIONS**
- NOT TO BE USED FOR CONSTRUCTION**
- DATE OF ISSUE 2-15-94

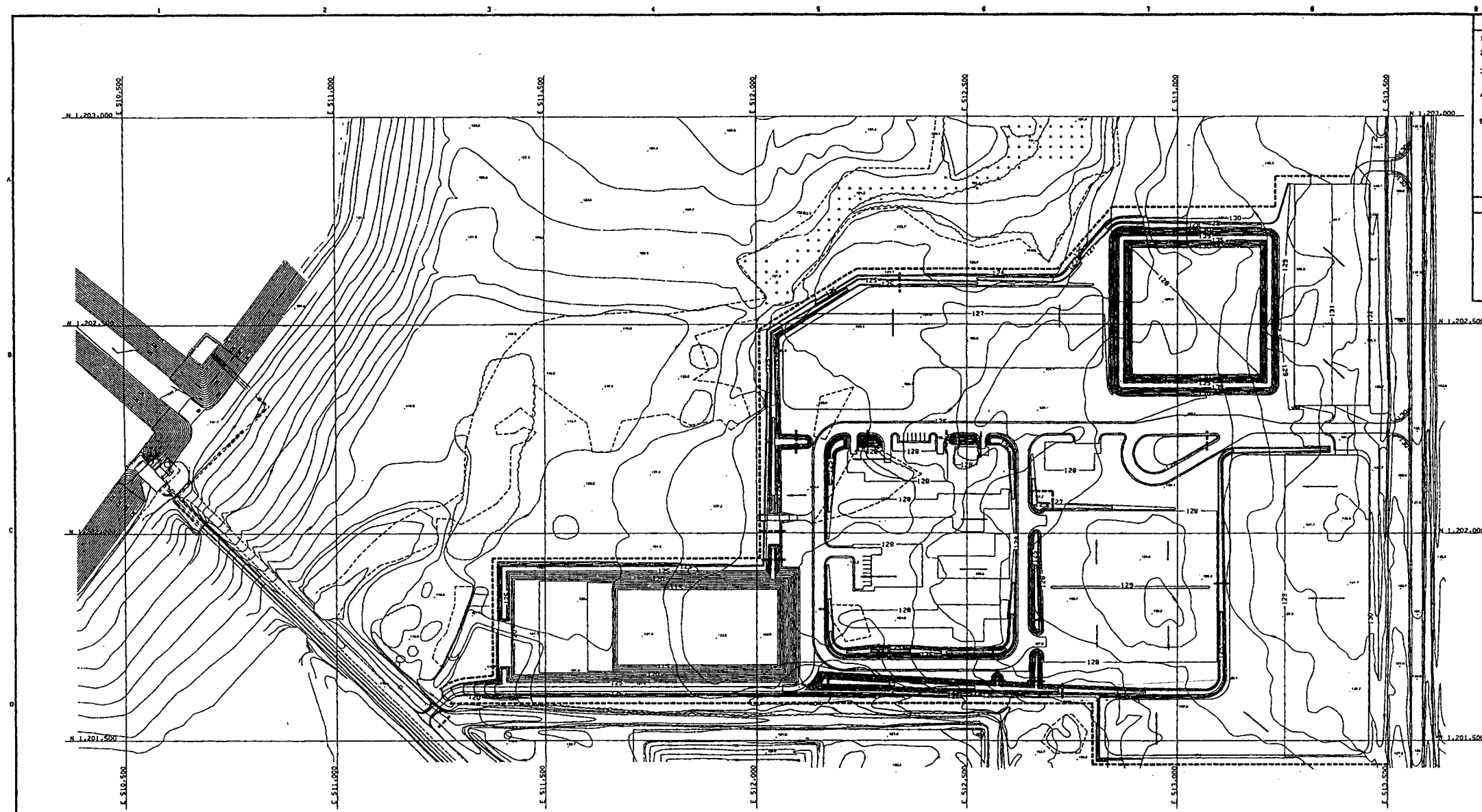
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2	01-20-94	REVISION	ISSUE
PROJECT		23930-CSTF-S3001	
CLIENT		SEMINOLE ELECTRIC COOP, INC.	
DESIGNER		HARDEE POWER STATION UNIT 3	
CHECKED		DATE	
SIGNED		DATE	
AREA		CS-35010-00-3015	



I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A duly registered PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF FLORIDA

BLACK & VEATCH

SEMINOLE ELECTRIC COOP, INC.
HARDEE POWER STATION UNIT 3
SITE - GRADING AND DRAINAGE
AREA 1



NOTES

1. SEE DRAWING E3000 FOR GENERAL NOTES AND LEGEND.

2. SILT FENCES SHALL BE INSTALLED AT ALL CULVERT INLETS AND AREA INLETS.

3. EROSION AND SEDIMENTATION CONTROL MEASURES INSTALLED UNDER CONTRACT 71-0201. THESE INSTALLATIONS SHALL BE REMOVED AT PROJECT COMPLETION.

4. CONTRACTOR SHALL INSTALL ADDITIONAL SILT FENCE, AS NECESSARY, OR AS DIRECTED BY THE CONSTRUCTION MANAGER, TO CONTROL EROSION AND SEDIMENTATION.

5. THE EROSION CONTROL SHOWN ON THIS DRAWING IS THE MINIMUM REQUIRED. HOWEVER, THE CONTRACTOR SHALL INSTALL ADDITIONAL MEASURES AS NEEDED TO CONTROL EROSION AND SEDIMENT FROM CONSTRUCTION OPERATIONS.

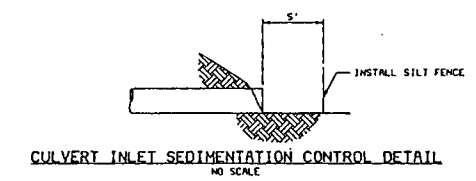
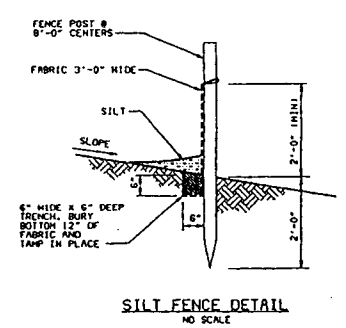
EROSION CONTROL LEGEND

—125— EXISTING CONTOURS

—125— NEW CONTOURS

--- CONSTRUCTION SILT FENCE

--- DIRECTION OF FLOW



Reference

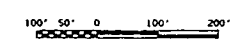
EXTENSIVE REVISIONS

NOT TO BE USED
FOR CONSTRUCTION

DATE OF ISSUE 02-15-94

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NO.	DATE	REVISIONS AND RECORD OF ISSUE	BY
1	02-15-94	REVISION ISSUE	JK
2	01-28-94	REVISION ISSUE	JK



DESIGNER CERTIFICATE THAT THIS DOCUMENT HAS BEEN PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF FLORIDA

SIGNED _____ DATE _____ REG. NO. _____

BLACK & VEATCH

CHECKED _____ DATE _____

SEMINOLE ELECTRIC COOP, INC.
HARDEE POWER STATION UNIT 3

SITE EROSION & SEDIMENTATION
CONTROL PLAN

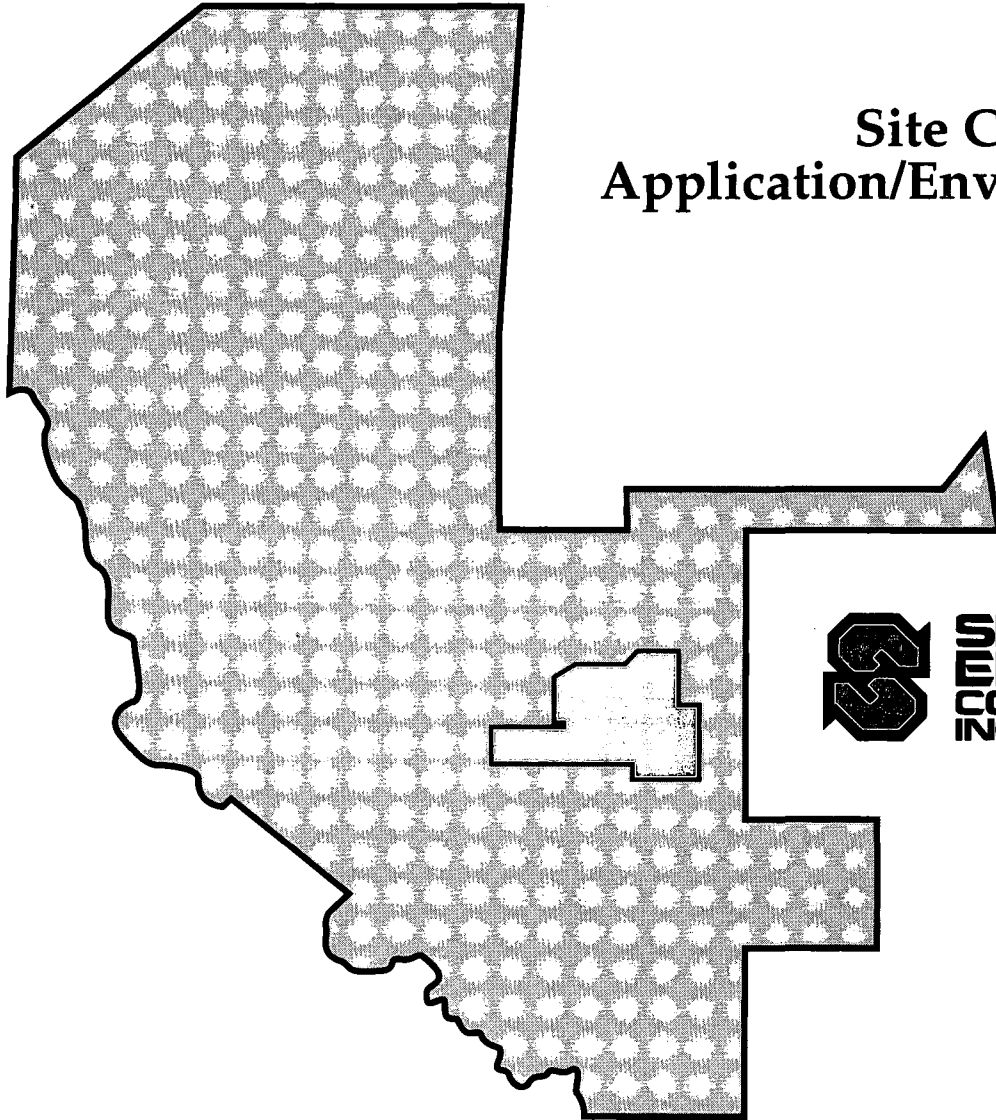
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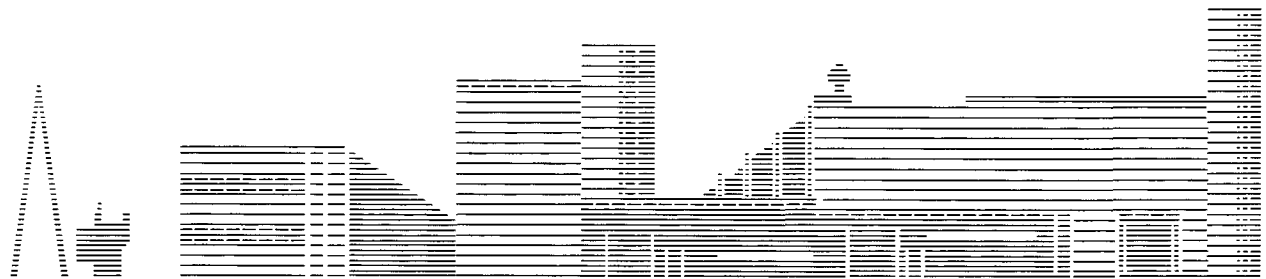
REV 8

HARDEE UNIT 3

Site Certification
Application/Environmental
Analysis



Appendix 10.10



APPENDIX 10.10
WATER ALTERNATIVES STUDY

HARDEE UNIT 3
WATER ALTERNATIVES STUDY

Prepared For:

Seminole Electric Cooperative Incorporated
16313 North Dale Mabry Highway
Tampa, Florida 33618

April 1994
13225E1

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EXECUTIVE SUMMARY

Seminole Electric Cooperative Incorporated (SECI) is proposing to own and operate a new 440-megawatt (MW) combined cycle power plant [the Hardee Power Station Unit 3 (Hardee Unit 3) Project]. The Hardee Unit 3 Project will be located on the existing Hardee Power Station (HPS) site and will represent an incremental increase in the ultimate power-generating capacity of the HPS site from 660 MW to 880 MW. The HPS site was selected as the preferred location for the Hardee Unit 3 Project because this site has been previously identified for 660 MW of combined cycle power generation (Certification Number PA89-25). Locating the Hardee Unit 3 Project at the HPS site takes advantage of the existing infrastructure and onsite facilities, and minimizes potential environmental impacts that might otherwise be associated with the construction of a combined cycle power plant at a previously undeveloped site.

A Water Alternatives Study (WAS) was conducted to evaluate potential water sources for the proposed project. The WAS design included an evaluation of the existing cooling reservoir (to determine its capability to provide the necessary cooling), cooling towers for Hardee Unit 3 only, and supplemental cooling for the reservoir. Potential water source options for the proposed project were selected from a variety of sources (e.g., existing Floridan wells, cropping of surface water runoff, and reuse of treated effluent from municipal sewage treatment plants and/or industry) located within a 16-km (10-mile) radius of the proposed project. The potential sources were evaluated in terms of water availability and reliability of supply, water quality, environmental and regulatory considerations, engineering requirements, and capital cost.

Thermal and water budget model results show that the existing cooling reservoir can provide acceptable condenser cooling for the proposed 880-MW (280-MW steam) buildout at HPS. The evaporative cooling options evaluated (i.e., cooling towers and supplemental cooling) exhibit slightly improved cooling performance when compared to the reservoir. However, the cooling reservoir results in a significantly lower water use (when compared to the evaporative cooling options).

The recommended water source for the Hardee Unit 3 Project is to utilize the existing certified cooling reservoir configuration and groundwater consumptive use allocation for the HPS. The reasons for this selection include:

1. The existing cooling reservoir was originally designed with sufficient safety margins that allow for the incremental increase in power generation from 660 MW to 880 MW; and
2. Use of the existing cooling reservoir and groundwater allocation results in the lowest overall environmental impacts while optimizing the use of available water resources.

In summary, the recommended alternative of using the existing certified cooling reservoir and consumptive use allocation to supply all water needs for the Hardee Unit 3 Project is the most environmentally sound and cost-effective alternative available.

1.0 INTRODUCTION

1.1 BACKGROUND

Seminole Electric Cooperative Incorporated (SECI) is proposing to own and operate a new 440-megawatt (MW) combined cycle power plant [the Hardee Power Station Unit 3 (Hardee Unit 3) Project]. This facility will be constructed under a turnkey construction arrangement with Westinghouse Electric Corporation and Black & Veatch Construction, Inc. The Hardee Unit 3 Project will be located on the existing Hardee Power Station (HPS) site and will represent an incremental increase in the ultimate power-generating capacity of the HPS site from 660 MW to 880 MW. The HPS site was selected as the preferred location for the Hardee Unit 3 Project because this site has been previously identified for 660 MW of combined cycle power generation (Certification Number PA89-25). Furthermore, the HPS site has adequate area to accommodate the proposed expansion in ultimate site capacity from 660 MW to 880 MW. Locating the Hardee Unit 3 Project at the HPS site takes advantage of the existing infrastructure and onsite facilities, and minimizes potential environmental impacts that might otherwise be associated with the construction of a combined cycle power plant at a previously undeveloped site.

During the preliminary design of Hardee Unit 3, it was recognized that the existing cooling reservoir would likely be able to provide the heat dissipation requirements for additional generating capacity. This recognition was based on the existing cooling reservoir size (i.e., 570 acres) and the total proposed generating capacity (i.e., 280-MW, steam cycle) heat load rejected to the reservoir (versus the 210-MW steam cycle in the original design). The engineering rule of thumb for cooling reservoir area per megawatt of generating capacity is approximately 2.0 acres/MW of steam; with the addition of Hardee Unit 3, the area-to-capacity ratio will be 2.04 acres/MW.

As part of the overall licensing process for the Hardee Unit 3 Project, a Water Alternatives Study (WAS) was conducted to:

1. Evaluate the adequacy of the existing cooling reservoir,
2. Evaluate the adequacy of the existing groundwater allocation for the HPS site, and
3. Evaluate potential alternative water sources for the proposed project.

The WAS design included an evaluation of the existing cooling reservoir (to determine its capability to provide the necessary cooling), cooling towers for Hardee Unit 3 only, and supplemental cooling for the reservoir. Potential water source options for the proposed project were selected from a variety of sources (e.g., existing Floridan wells, cropping of surface water runoff, and reuse of treated effluent from municipal sewage treatment plants and/or industry) located within a 16-km (10-mile) radius of the proposed project.

The results of the WAS are presented in this report.

1.2 THE APPLICANT

SECI is a generation and transmission cooperative which generates and transmits bulk supplies of electricity to 11 member distribution cooperatives throughout Florida. More than 1 million Floridians in 45 counties rely on SECI for their electricity. SECI's existing generating capabilities consist of two 600-MW coal-fired units near Palatka, Florida, and a 14.4-MW share of Florida Power Corporation's (FPC's) Crystal River Unit 3 nuclear power plant. In addition, SECI owns 70 miles of 230-kilovolt (kV) double-circuit transmission line, 140 miles of 230-kV single-circuit transmission line, and 157 miles of 69-kV transmission line connecting with its existing power plant, substations, and other distribution systems. SECI also purchases backup power from TECO Power Services (TPS), which operates the 295-MW facility at the HPS site.

1.3 GENERAL SITE LOCATION AND DESCRIPTION

The Hardee Unit 3 Project will be located on the 526-hectare (ha) (1,300-acre) HPS site in Hardee and Polk counties approximately 14 kilometers (km) (9 miles) northwest of Wauchula, 26 km (16 miles) south-southwest of Bartow, and 64 km (40 miles) east of Tampa Bay (Figures 1-1 and 1-2). The HPS site is bordered on the east by County Road (CR) 663, a CSX right-of-way, and CF Industries' Hardee Complex. IMC-Agrico properties surround the remaining portions of the site. Payne Creek flows along the southern and western boundaries of the HPS site. The Hardee Unit 3 facility will occupy approximately 20 ha (50 acres) of the HPS site.

The HPS site is currently owned by the Acuera Corporation, Inc., a subsidiary of SECI. In 1990, a final certification order from the Governor and Cabinet (Certification Number PA89-25)



Sources: SECI, 1994; KBN, 1994.



Sources: FDOT, 1990 and 1992; KBN, 1994.



and approval through Rural Electrification Authority (REA) were obtained for the construction and operation of up to 660 MW of combined cycle power generating capacity at the HPS site.

1.4 PROJECT DESCRIPTION

The Hardee Unit 3 Project involves an incremental increase to the previously certified HPS capacity of 660 MW to 880 MW and will consist of a highly efficient 440-MW combined cycle unit that will take advantage of the latest pollution abatement technology and will provide optimum efficiency with regard to electric power generation. The proposed project will burn natural gas as the primary fuel, will utilize dry low nitrogen oxide (NO_x) combustors, and will share a number of the existing onsite facilities, such as the existing transmission lines, with the HPS existing units. The site layout for the Hardee Unit 3 Project is provided in Figure 1-3. A discussion of the relationship between the previously certified HPS units and the Hardee Unit 3 Project is provided in the following paragraph.

Hardee Power Partners, Limited (HPP), a subsidiary of TPS, entered into a contract with SECI and Tampa Electric Company for operating the HPS existing units. HPP, SECI, and Tampa Electric submitted the original site certification application (SCA) with a plan for construction of the HPS to be completed in three phases (Phases 1A, 1B, and 2), resulting in the construction of 660 MW of generating capacity. Phase 1A of HPS (existing units) consists of a 295-MW generating facility with a 220-MW combined cycle unit and a 75-MW stand-alone combustion turbine (CT). Phase 1A was placed in commercial operation on January 1, 1993. Phase 1B, scheduled to be completed before 2003, will consist of adding a 75-MW CT to the Phase 1A stand-alone CT, two heat recovery steam generators (HRSGs), and a 70-MW steam turbine to complete a second 220-MW combined cycle unit. Phase 1B will increase the total generating output of HPS to 440 MW. Phase 2 was planned to consist of a third 220-MW combined cycle unit to be constructed by SECI and had no projected in-service date. The Hardee Unit 3 Project will be an expansion of Phase 2 from 220 MW to 440 MW, thus giving the site an ultimate generating capacity of 880 MW, of which 280 MW will be water-cooled steam cycle capacity. When Hardee Unit 3 is placed in service in 1999, the station will have a total generating capacity of 735 MW. The ultimate HPS generating capacity of 880 MW will be achieved with the completion of Phase 1B.

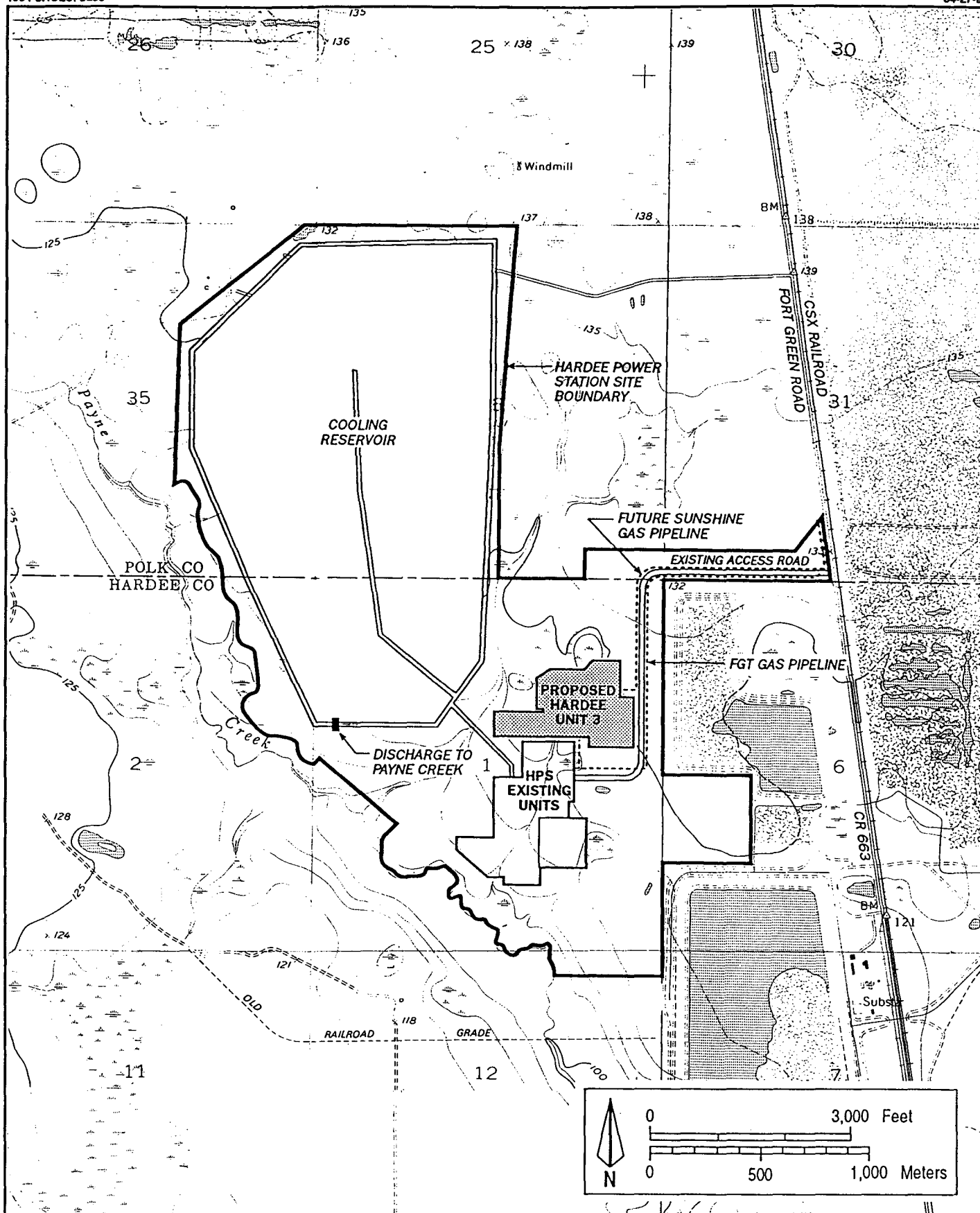


Figure 1-3
Hardee Unit 3 Facility

Source: USGS, 1987; KBN, 1994.



1.5 HISTORY OF RESERVOIR DESIGN AND MODELING EFFORTS

As part of the original design for the HPS, a 570-acre onsite cooling reservoir was constructed to provide once-through cooling for a minimum of 660 MW of combined cycle generating capacity (210 MW of steam). Environmental licensing of the existing cooling reservoir was accomplished through the HPS site certification process (TPS/SECI, 1989). The cooling reservoir was constructed at the site of a previous phosphate mine and was completed in 1992. Makeup water for the cooling reservoir is obtained from the Floridan aquifer from three onsite wells, rainfall, runoff, and recycled wastewater. The reservoir has been periodically used for condenser cooling since initial startup of the HPS Phase 1A in January 1993.

The existing cooling reservoir provides two critical functions: (1) to collect, store, and supply water for use in condenser cooling; and (2) to reject heat through evaporative, radiant, and other cooling mechanisms. Water from the cooling reservoir is pumped through the condenser to condense the turbine exhaust steam. Heated water is then discharged back to the reservoir, where it is cooled through evaporative, radiant, and other cooling mechanisms as it flows through the reservoir. After cooling, the water is then reused for additional condenser cooling.

As a recirculating/recycling cooling system, the reservoir is designed to maximize water reuse and thereby minimize groundwater withdrawals for makeup. Water makeup to the reservoir includes direct rainfall, runoff and seepage from the upland watershed, treated wastewaters from the HPS existing units and, as necessary, pumped deep well (Floridan aquifer) water. To accommodate the infrequent discharges from the reservoir which may occur during extreme (wet) meteorological conditions, an overflow to Payne Creek is provided.

The cooling reservoir substantially dampens short-term variations in cooling water makeup because of its large size and volume. Though actual evaporative losses may vary significantly based on plant load or daily meteorological conditions, the relative fluctuation in the reservoir level will be small. The cooling reservoir functions as a surface water reservoir, managing all water inflows and outflows to maximize water reuse, minimize water withdrawals, and minimize makeup water demand and use variations.

The existing reservoir, constructed on reclaimed phosphate land, was designed based on the following specifications:

1. Inside edge slope of 4:1 (horizontal:vertical);
2. Outside edge slope of 20:1 (horizontal:vertical);
3. Northeastern portion of the reservoir is below grade (i.e. the reservoir water surface will be below the adjacent reclaimed ground surface);
4. South and western edges of the reservoir are above grade (i.e. the reservoir water surface will be above the adjacent reclaimed and/or undisturbed ground surface); and
5. Minimum water depth of 10 feet (ft).

The cooling reservoir will only discharge in cases of extreme or cumulative rainfall in excess of the 10-year, 24-hour hydrologic event (TPS/SECI, 1989). The discharge was needed to prevent loss of life, severe property damage, or damage to the physical integrity of the cooling reservoir or its structures that could result from a flood induced reservoir dike break. Any discharges from the reservoir will occur during high flow conditions into Payne Creek, resulting in substantial dilution of any reservoir discharges. The impacts of these infrequent discharges are further minimized by the sheet flow nature of the discharge into Payne Creek.

The impact analysis presented in the original HPS Site Certification Application (TPS/SECI, 1989) shows that discharges from the cooling reservoir will not cause adverse thermal impacts, will not significantly increase the temperature of Payne Creek, and will not impair or interfere with its existing or anticipated future beneficial use. With the previously certified mixing zone (less than 200 ft), the infrequent reservoir discharges will meet all thermal requirements of Chapter 17-302.530, Florida Administrative Code (F.A.C.).

2.0 ENGINEERING EVALUATION OF THE ALTERNATIVE COOLING TECHNOLOGIES

2.1 THERMAL MODELING OF THE EXISTING COOLING RESERVOIR

Modeling was conducted to evaluate the thermal capacity of the existing reservoir to determine its availability as a potential cooling water source for the Hardee Unit 3 Project and the ultimate 880-MW site capacity. The Sonnichsen (1975) heat budget model used in the 1989 assessment of the cooling reservoir was used for this analysis. A detailed discussion of the model is presented in Attachment A.

The following sections present the cooling reservoir modeling results.

2.1.1 EVALUATION OF RESERVOIR TO DETERMINE IF IT CAN ACCEPT AN ADDITIONAL HEAT LOAD WITHOUT MODIFICATIONS

The modeling conducted in this analysis was a real-time simulation of 37 years of meteorological data; therefore, reservoir water temperatures have been estimated for each of the 444 months of historical data. As noted elsewhere, the average load scenario is defined as the expected station demand that ranges from 27 to 100 percent for Units 1A and 1B and from 28 to 100 percent for Unit 3. The annual average load factor for the average load scenario is approximately 57 percent for the "average load" scenario. The maximum load scenario is defined as all HPS units (i.e., Units 1A and 1B and Hardee Unit 3) operating at 100 percent load. For reporting purposes, monthly average and monthly maximum values are presented for each of the two load scenarios (i.e., average load and maximum load). Thus, the following cases presented in the following discussions are defined as follows:

1. Average operating conditions, average monthly temperature--When the station is operating under average load conditions, the average value for a given month (e.g., the average of the estimated 37 June temperatures equals the June average monthly temperature).
2. Average operating conditions, maximum monthly temperature--When the station is operating under average load conditions, the maximum value for a given month (e.g., the maximum of the estimated 37 June temperatures equals the June maximum monthly temperature).

3. Maximum operating conditions, average monthly temperature--When the station is operating under maximum load conditions, the average value for a given month (e.g., the average of the estimated 37 June temperatures equals the June average monthly temperature).
4. Maximum operating conditions, maximum monthly temperature--When the station is operating under maximum load conditions, the maximum value for a given month (e.g., the maximum of the estimated 37 June temperatures equals the June maximum monthly temperature).

The heat rejection capabilities of the reservoir were calculated for a variety of load scenarios using a 37-year climatological data base and monthly time steps. The base case for comparison was the 660-MW output modeled in the original SCA under average conditions computed with the revised heat budget model (see Table 2-1). As seen in the table, under average load conditions, the maximum monthly average reservoir temperature is 94°F.

The estimated reservoir temperatures based on the 880-MW power output configuration (i.e., Units 1A, 1B, and 3) under average load conditions are also shown in Table 2-1. As seen in the table, the incremental temperature increase in the cooling reservoir temperatures are slight. As expected, the monthly average inlet temperatures will be slightly higher under the 880-MW configuration and the average monthly incremental increase will be 1.9°F.

Under maximum load conditions, the original plant design (i.e., 660-MW) would experience maximum monthly average inlet water temperatures >95°F for the months of June and July; see Table 2-2. For the revised plant design (i.e., 880-MW) and maximum load conditions, maximum monthly average inlet water temperatures are estimated to be >95°F for the months of June, July, and August (see Table 2-2).

2.1.2 RESERVOIR MODELING TO DETERMINE SIZE NEEDED TO HANDLE A HEAT LOAD FROM THE TOTAL 280 MW OF STEAM GENERATING CAPACITY

The reservoir model was run under the maximum load conditions for the 880-MW configuration and a variety of reservoir sizes to determine the reservoir size needed to always keep the monthly average inlet temperature <95°F. This temperature level in the reservoir has no environmental or regulatory impact. However, inlet temperatures to the condenser above 95°F have the

Table 2-1. Estimated Cooling Reservoir Temperature by Month--Average Load Conditions

Month	660-MW			880-MW		
	Load Factor (%)	Average Temperature (°F)	Maximum Temperature (°F)	Load Factor (%)	Average Temperature (°F)	Maximum Temperature (°F)
January	27.0	62.8	68.9	43.0	65.1	71.1
February	27.0	64.6	68.3	42.5	66.5	70.4
March	27.0	68.2	71.0	27.5	68.6	71.7
April	100.0	75.7	80.5	100.0	77.3	82.2
May	51.0	78.4	83.4	60.0	80.2	85.3
June	27.0	85.0	94.0	48.0	86.5	95.7
July	27.0	87.6	92.1	50.0	89.3	94.0
August	27.0	86.1	89.8	51.5	88.1	92.3
September	27.0	80.4	84.5	47.5	82.3	86.7
October	100.0	76.4	82.1	84.0	77.0	82.7
November	51.0	69.2	73.6	75.5	72.6	76.9
December	27.0	63.8	67.0	52.5	68.0	70.5
Annual	43.2	74.9	79.6	56.8	76.8	81.6

Note: For the 880-MW scenario, the load factors for the various units are as follows:

Month	Units 1A & 1B	Unit 3
Jan	27.0%	59.0%
Feb	27.0%	58.0%
Mar	27.0%	28.0%
Apr	100.0%	100.0%
May	51.0%	69.0%
Jun	27.0%	69.0%
Jul	27.0%	73.0%
Aug	27.0%	76.0%
Sep	27.0%	68.0%
Oct	100.0%	68.0%
Nov	51.0%	100.0%
Dec	27.0%	78.0%
Average	43.2%	70.5%

Source: KBN, 1994.

Table 2-2. Estimated Cooling Reservoir Temperature by Month--Maximum Load Conditions

Month	660-MW			880-MW		
	Load Factor (%)	Average Temperature (°F)	Maximum Temperature (°F)	Load Factor (%)	Average Temperature (°F)	Maximum Temperature (°F)
January	100	68.0	74.2	100	69.6	75.8
February	100	69.5	73.7	100	71.1	75.3
March	100	72.6	76.5	100	74.2	78.1
April	100	75.7	80.5	100	77.3	82.2
May	100	81.4	86.6	100	83.0	88.2
June	100	88.5	97.9	100	90.1	99.5
July	100	91.2	96.1	100	92.8	97.7
August	100	90.0	94.4	100	91.6	96.0
September	100	84.6	89.2	100	86.2	90.8
October	100	76.4	82.1	100	78.0	83.7
November	100	72.7	77.0	100	74.3	78.6
December	100	69.2	72.8	100	70.7	74.3
Annual	100	78.3	82.6	100	79.9	85.0

Note: For the 880-MW scenario, the load factors for the various units are as follows:

Month	Units 1A & 1B	Unit 3
Jan	100%	100%
Feb	100%	100%
Mar	100%	100%
Apr	100%	100%
May	100%	100%
Jun	100%	100%
Jul	100%	100%
Aug	100%	100%
Sep	100%	100%
Oct	100%	100%
Nov	100%	100%
Dec	100%	100%
Average	100%	100%

Source: KBN, 1994.

potential of slightly reducing the efficiency of the steam turbine due to increased backpressure to the turbine. This modeling effort indicates that a reservoir area of 860 acres (i.e., a reservoir area increase of about 300 acres) would be needed to maintain the water inlet temperature below 95°F at all times.

The land required to affect such a reservoir area increase does not exist within the site boundary. Therefore, implementation of this alternative is not feasible. Based on the modeling results in Tables 2-1 and 2-2, the potential loss of efficiency would be insignificant when compared to the environmental impact and economic cost of expanding the reservoir.

2.1.3 DETERMINATION OF WATER NEEDS FOR THE COOLING RESERVOIR

The makeup water requirements for the cooling reservoir with the proposed 880-MW configuration and existing supply sources (i.e., Floridan aquifer wells, rainfall, surface water runoff, and recycled treated wastewater from the plant) were estimated using a water balance methodology. This water balance approach considers all the water inflows to and outflows from the cooling reservoir in order to calculate monthly water makeup and discharge requirements.

The water balance of the cooling reservoir can be summarized as the following:

$$\Delta Q = Q_P + Q_R + Q_{SA} + Q_D + Q_{DW} - Q_E - Q_L - Q_{BS} - Q_{SD}$$

where:

ΔQ = Gain or loss in reservoir volume over a specified unit of time

Q_P = Precipitation on the reservoir

Q_R = Upland runoff into reservoir

Q_{SA} = Surficial aquifer seepage into the reservoir

Q_D = Effluents discharged the reservoir

Q_{DW} = Deep well makeup to the reservoir

Q_E = Evaporation

Q_L = Leakance

Q_{BS} = Berm seepage out of the reservoir

Q_{SD} = Surface discharge to Payne Creek

Given monthly variations in rainfall and runoff into the reservoir, monthly variations in reservoir levels are calculated. If the reservoir level exceeds the control elevation [124 feet above mean sea level (ft-msl)], the required discharge quantity is calculated and mathematically subtracted from the reservoir. If the reservoir level drops below the minimum operating elevation (122 ft-msl), the required deep well makeup quantity is calculated and mathematically added to the reservoir in order to maintain it at the minimum elevation. By tracking and maintaining this monthly balance in reservoir water levels, the long term water makeup and discharge requirements are calculated for various operational (load) scenarios. The various components of the water balance were calculated as described in Attachment B.

Based on this methodology, the reservoir makeup and process water requirements for the full 880-MW buildout are shown in Tables 2-3 and 2-4. As seen in these tables, the average monthly Floridan aquifer makeup requirement to the reservoir is estimated to be 2.6 million gallons per day (mgd) under average load conditions to a monthly maximum water demand of 6.7 mgd under maximum load conditions.

The estimated average total monthly Floridan aquifer makeup requirement (i.e., reservoir makeup and plant service water for 880-MW buildout) is 3.17 mgd. Average monthly and the maximum daily makeup is 8.65 mgd. The average makeup does not consider the variability of climatic conditions (e.g., a succession of dry or wet months) that will determine actual groundwater withdrawals. To estimate these types of scenarios, a probabilistic frequency analysis (i.e., Log-Pearson Type III) was conducted as follows:

1. Average annual monthly water requirements under average load conditions were computed for each of the 37 years modeled via the heat and water budget models;
2. The Log-Pearson Type III probability distribution was calculated for the 37-years of average annual monthly water requirements; and
3. Using the probability density function; water withdrawals for various recurrence intervals (e.g. once in 10 years) were computed.

The results of this frequency analysis are presented in Table 2-5. As seen in the table, the 10 percent (e.g., once in 10 years) water withdrawal is 3,807,750 gpd. Given the projected load scenarios and reliability criteria for HPS, this value was selected as the required design average makeup water requirement.

Table 2-3. Reservoir Statistics for Average Load Conditions for 880 MW

Total Floridan Aquifer Well Requirements			
Water Use	Average Annual (gpd)		
Reservoir Makeup	2,602,000		
Unit 1A & 1B Service Water	408,000		
Unit 3 Service Water	164,000		
Total Floridan Aquifer Water Required	3,174,000		

Summary of Predicted Reservoir Evaporation			
	Unit 1A & 1B	Unit 3	Reservoir Evaporation
	Load	Load	Average
	Factor	Factor	Month
Month	(%)	(%)	(gpd)
January	27	59	3,051,054
February	27	58	3,394,265
March	27	28	3,186,019
April	100	100	4,991,168
May	51	69	4,618,892
June	27	69	5,244,984
July	27	73	5,490,065
August	27	76	4,923,289
September	27	68	3,574,984
October	100	68	3,732,538
November	51	100	3,532,808
December	27	78	3,009,311
Annual Average	43	70	--

Summary of Reservoir Water Balance -- Annual Average Conditions		
Reservoir Water Inflows		
Direct Rainfall	2,224,900	gallons/day
Surface Runoff	311,500	gallons/day
Surficial Aquifer Seepage	--	gallons/day
Unit 1A & 1B Wastewater Discharge	86,300	gallons/day
Unit 3 Wastewater Discharge	93,700	gallons/day
Deep Well Makeup	2,602,000	gallons/day
Total Reservoir Inflow	5,318,400	gallons/day
Reservoir Water Outflows		
Leakance Losses	336,000	gallons/day
Dike Seepage Losses	920,000	gallons/day
Evaporation from Reservoir	4,062,400	gallons/day
Discharges to Payne Creek	--	gallons/day
Total Reservoir Outflow	5,318,400	gallons/day

Table 2-4. Reservoir Statistics for Maximum Load Conditions for 880 MW

Total Floridan Aquifer Well Requirements	
Water Use	Maximum Monthly (gpd)
Reservoir Makeup	6,685,400
Unit 1A & 1B Service Water	945,000
Unit 3 Service Water	937,000
Total Floridan Aquifer Water Required	8,567,400

Summary of Predicted Reservoir Evaporation

Month	Unit 1A & 1B Load Factor (%)	Unit 3 Load Factor (%)	Reservoir Evaporation Average Month (gpd)
January	100	100	4,550,000
February	100	100	5,213,300
March	100	100	5,668,300
April	100	100	5,551,700
May	100	100	6,078,600
June	100	100	7,817,700
July	100	100	7,948,800
August	100	100	7,042,100
September	100	100	5,627,600
October	100	100	4,659,000
November	100	100	4,612,800
December	100	100	4,390,500

Summary of Reservoir Water Balance -- Maximum Load Conditions

Reservoir Water Inflows		
Direct Rainfall	2,034,600	gallons/day
Surface Runoff	--	gallons/day
Surficial Aquifer Seepage	--	gallons/day
Unit 1A & 1B Wastewater Discharge	200,000	gallons/day
Unit 3 Wastewater Discharge	285,000	gallons/day
Deep Well Makeup	6,685,400	gallons/day
Total Reservoir Inflow	9,205,000	gallons/day
Reservoir Water Outflows		
Leakance Losses	336,000	gallons/day
Dike Seepage Losses	920,000	gallons/day
Evaporation from Reservoir	7,949,000	gallons/day
Discharges to Payne Creek	--	gallons/day
Total Reservoir Outflow	9,205,000	gallons/day

Source: KBN, 1994.

Table 2-5. Estimation of Monthly Average Water Demand Under Average Load Conditions Using the Log-Pearson Type III Distribution

Interval (yrs)	Recurrence		Flow (gpd)
		Percent	
1.01		99	1,905,023
2		50	3,208,315
5		20	3,619,754
10		10	3,807,750
25		4	3,984,341
50		2	4,085,172
100		1	4,166,616
200		0	4,233,623

Note: Results of the Log-Pearson Type III distribution based on average annual monthly water requirements under average load conditions (for 880 MW) computed for each of 37 years show that an average monthly water withdrawal rate of 3.8 mgd will be required once every 10 years. The withdrawal rate of 3.8 mgd is consistent with the currently existing groundwater allocation for the HPS.

Data Statistics:

Average	3,173,000 gpd
Minimum	2,101,000 gpd
Maximum	4,131,000 gpd
Standard Deviation	487,600 gpd
Number of Observations	37 years ^a

^a based on 444 months of historical data.

Source: KBN, 1994.

2.2 THERMAL MODELING OF RESERVOIR RECEIVING COOLING TOWER BLOWDOWN

As discussed in Section 2.1.2, running the units at full load conditions at 880-MW capacity may create reservoir temperatures in excess of 95°F. To eliminate this potential scenario, the cooling reservoir was modeled when all units are at maximum 880-MW load conditions, Units 1A and 1B use the reservoir, and Unit 3 uses cooling towers that discharge in the reservoir. To model this scenario, the cooling reservoir model was run as follows:

1. The heated condenser cooling water from the 440 MW of generating capacity from Units 1A and 1B were routed through the cooling reservoir per their existing design (i.e., the operating conditions used to generate Table 2-2); and
2. The heated condenser cooling water from the 440 MW of generating capacity from Unit 3 was routed to a cooling tower. The cooling tower was assumed to operate at three cycles of concentration with cooling tower blowdown recycled to the cooling reservoir. The discharge temperature for the cooling tower blowdown was assumed to be 5°F above the monthly average wet-bulb temperature.

Under this scenario, the maximum monthly average temperature at the inlet is 95.3°F and exceeds 95°F only once (see Table 2-6). The total Floridan aquifer makeup water requirement (i.e., reservoir, cooling tower, and service water) for HPS at 880-MW build out and maximum load condition averages 7.6 mgd with a maximum monthly withdrawal of 9.6 mgd. The use of cooling towers for Hardee Unit 3 would increase monthly average groundwater use by approximately 4.5 mgd when compared to using only the reservoir while not appreciably reducing modeled reservoir water temperatures.

2.3 COOLING RESERVOIR WITH SUPPLEMENTAL COOLING

A second supplemental cooling option that would ensure that cooling reservoir temperatures do not exceed 95°F is enhanced reservoir evaporative cooling. An evaporative cooling system would consist of multiple nozzles covering an area of about 10 acres within the reservoir that would spray water into the air. As the water droplets fall back into the reservoir, water would be evaporated, thus enhancing cooling in the reservoir.

Table 2-6. Temperature and Makeup Water Requirements for Cooling Tower Option or Enhanced Supplemental Cooling Option

Month	Unit 1A & 1B Load Factor (%)	Unit 3 Load Factor (%)	Reservoir Temperature at Intake (°F)	Total Plant Makeup Water Requirement (gpd)
January	100	100	71.8	6,564,860
February	100	100	72.5	7,043,360
March	100	100	74.1	7,400,160
April	100	100	77.9	7,311,360
May	100	100	85.3	7,909,460
June	100	100	94.0	9,375,760
July	100	100	95.3	9,585,060
August	100	100	93.7	8,814,260
September	100	100	87.4	7,389,560
October	100	100	81.2	6,450,960
November	100	100	74.8	6,577,660
December	100	100	70.6	6,347,260
Average	--	--	81.6	7,564,100
Maximum	--	--	95.3	9,585,060

Note: Units 1A and 1B use the cooling reservoir, Unit 3 uses cooling towers.

Source: KBN, 1994.

The net effect of the evaporative cooling system is identical to using a cooling tower (i.e., reservoir water temperatures are lowered via evaporation). The only difference between enhanced supplemental cooling and towers is the supplemental cooling system would be used on an as-needed basis. For example, the supplemental system would be used only when inlet temperatures were predicted to be $> 95^{\circ}\text{F}$. When inlet temperatures would be less than 95°F , the reservoir alone would be utilized. If cooling towers were used, they would operate continuously. The evaporative water losses and ultimate temperatures at the reservoir intake for enhanced supplemental cooling is in operation would be identical to the cooling tower water losses and temperatures presented above.

2.4 CONCLUSION

The existing cooling reservoir can provide acceptable condenser cooling for the proposed 880-MW (280-MW steam) buildout at HPS. The evaporative cooling options evaluated (i.e., cooling towers and supplemental cooling) exhibit slightly improved cooling performance when compared to the reservoir. However, the cooling reservoir results in a significantly lower water use (when compared to the evaporative cooling options).

3.0 EVALUATION OF ALTERNATIVE COOLING WATER SOURCES

The engineering evaluation of the cooling alternatives presented in the previous section concluded that use of the reservoir is the best alternative and that the average monthly water requirement for the 880-MW proposed at HPS will remain within the currently certified groundwater annual average withdrawal rate of 3.8 mgd and the daily maximum within 8.64 mgd. Water sources evaluated to provide all or part of that demand include:

1. The existing HPS Floridan aquifer wells;
2. Cropping of surface water runoff (from either onsite or offsite lands);
3. Treated municipal sewage effluent;
4. Treated industrial wastewater effluent;
5. New Floridan aquifer wells; and
6. New deep Floridan aquifer (depth > 2,000 ft) wells.

Evaluation of the potential water sources included assessments of the available flow and quality conditions. Since the quality and quantity of available water quality data for the various potential sources is widely varied, qualitative judgments of some of the potential source were necessary to avoid premature exclusion of a source. The general "requirements" of any source water to the cooling reservoir are discussed in the following paragraphs.

The cooling system at HPS consists of the cooling reservoir which uses rainfall, surface runoff, and groundwater as its makeup sources. The reservoir design includes a variety of non-structural features (e.g., minimum depth > 10 ft, littoral plantings, etc.) intended to maintain good chemical quality that will, in turn, minimize the need for off-reservoir water treatment facilities. In order to maintain this operational feature of the reservoir, makeup water sources to the reservoir need to have the following characteristics:

1. Low organic loading [expressed as 5-day biological oxygen demand (BOD₅)]--Organic loading to the reservoir is undesirable in that it is a source of food for the aquatic micro-organisms, and an overabundance of the food source creates an overpopulation of the micro-organisms. These micro-organisms consume the dissolved oxygen (DO) in the water. Low DO, in turn, can kill many of the beneficial organisms living in the reservoir as well as creating nuisance conditions (e.g., odor problems) and water quality conditions (e.g., extreme pH excursions) that can be damaging to the cooling

- water mechanical systems. Low BOD₅ is also a requirement for the infrequent (i.e., in response to the 10-year, 24-hour rainfall event) discharges from the reservoir.
2. Low nutrient loadings--Low nutrient (i.e., nitrogen and phosphorus compounds) concentrations in the reservoir are a necessary condition to controlling algal populations. Eutrophic conditions caused by high nutrient loadings produce excessive algal growths and, when the algae die, they add an organic load to the water that can cause the problems associated with DO explained above. Additionally, eutrophic conditions will increase the biofouling in the contact portions of the cooling water mechanical systems (e.g., condenser tubes) that will require either chemical biocides or increased mechanical cleaning to control. Low nutrient concentrations are also a requirement for the infrequent (i.e., in response to the 10-year, 24-hour rainfall event) discharges from the reservoir.
 3. Low solids loadings--Low solids (typically inert solids such as sand or silt) in the reservoir water are necessary to maintaining proper hydraulics within the reservoir. A high settleable solids load can cause shoaling within the reservoir that would cause flow short-circuiting that would result in poorer cooling. Additionally, a high suspended solids load can reduce the life cycle of the cooling mechanical systems (e.g., pumps) because of abrasion of pump impellers and seals. Low suspended solids concentrations are also a requirement for the infrequent (i.e., in response to the 10-year, 24-hour rainfall event) discharges from the reservoir.
 4. Low bacteriological loadings--The bacteriological quality (especially coliform bacteria) of the reservoir water should be kept low to reduce potential human health risks. The potential health risks can arise primarily through plant maintenance activities (e.g., mechanical cleaning of the condensers). Low coliform bacteria concentrations are also a requirement for the infrequent (i.e., in response to the 10-year, 24-hour rainfall event) discharges from the reservoir.
 5. Minimal or no toxicological characteristics--Makeup water sources to the reservoir that exhibit some toxicological properties will impair the reservoir's flora and fauna populations and thus can create some of the water quality related problems discussed above. A water's toxicological properties are a function of heavy metals concentrations and synthetic organic compounds (e.g., industrial solvents, pesticides, herbicides, etc.). Also, the makeup water needs to be free from chemicals that can

cause the toxicological impacts so that water quality impacts from reservoir seepage and the infrequent surface water discharges remain negligible.

6. Total Dissolved Solids--Low total dissolved solids (TDS) concentrations are needed in the reservoir to both meet environmental discharge criteria and prevent scaling in the steam condenser. High TDS concentrations increase the potential for water quality impacts from the reservoir's infrequent discharges and will require cooling water treatment to reduce scaling potential.

The existing makeup sources meet these water quality requirements. Rainfall is inherently a very pure source of water and contains essentially no dissolved salts. Groundwater (from the Floridan aquifer) has small amounts of the primary production nutrients and is free from the other loading types listed above. The surface water runoff to the reservoir is acceptable given the small area of the drainage basin and its vegetation and land uses. The cooling reservoir also receives treated industrial wastewater effluents from the power plant. These effluents can be comparatively high in dissolved solids but their volume is sufficiently small (i.e., <5 percent of total reservoir inflow) to preclude adverse reservoir quality conditions.

Selecting candidate "offsite" water sources was accomplished by:

1. Obtaining a listing of wastewater dischargers within a 10-mile radius of HPS from the Florida Department of Environmental Protection (FDEP) records (see Table 3-1);
2. Reviewing the listed dischargers to remove any records from locations too distant from HPS or insignificant discharges (<0.25 mgd) (see Table 3-2);
3. Obtaining the discharge permits and monitoring reports for the list of dischargers developed in Step 2 from FDEP. Using these data, infrequent and/or low-volume dischargers were also removed from further consideration (see Table 3-3); and
4. Using water quality and flow data on these remaining candidate dischargers for subsequent source analyses (see Tables 3-4 through 3-8).

Using the above methodology, the following were identified as candidate water sources:

1. Existing Floridan wells;
2. Water cropping from the reclaimed mining area adjacent to and east and north of the cooling reservoir;
3. Water cropping from HPS site;

Table 3-1. Listing of Industrial and/or Mine Discharges Evaluated as Potential Supply Sources for HPS Unit 3

Source	Mine/Area Name	Permit #	Distance (miles)
CF Mining Corp	Hardee Complex I	IO25-170754	2.3
CF Mining Corp	Hardee Complex I	IO25-125839	2.3
CF Mining Corp	Hardee Complex I	IO25-172624	2.3
Agrico Chemical Co.	Payne Creek Mine		2.9
IMC-Agrico Co.	Ft Green Mine	IO53-167787	3.1
IMC-Agrico Co.	Ft Green Mine	IO53-169657	3.1
IMC-Agrico Co.	Payne Creek Mine	numerous	3.4
Agrico Chemical Co	Ft Green Mine		4.1
Agrico Mining Co	Ft Green Sett Area		4.7
Agrico Chem Co	Palmetto Mine		6.1
IMC-Agrico Co.	Four Corners Mine	IO53-223712	6.3
IMC-Agrico Co.	Four Corners Mine	IC53-122164	6.3
Gardinier			6.9
USS Agri-Chem	Rockland Sett Area S7		7.2
Gardinier	Ft Meade Mine		7.4
Gardinier	Ft. Meade Mine	numerous	7.5
American Cyanamid Co	Lonesome Plant	MP53-76224	7.8
American Cyanamid Co	Lonesome Plant	MP53-76224A	7.8
IMC-Agrico Co.	Four Corners Mine	IO41-222075	8.4
IMC-Agrico Co.	Four Corners Mine	IC29-210653	8.4
IMC-Agrico Co.	Haynesworth Mine		8.4
Gardinier			8.5
Mobil Mining & Minerals	Bowling Green		8.5
Gardinier			8.6
USS Agri-Chem	Rockland Mine		9.0
Cardox Corp		IC53-120194	9.7
Cardox Corp		IO53-146947	9.7
Mobil Mining	South Ft Meade Mine	numerous	10.2
IMC-Agrico Co.		IO53-214930	10.2
Estech	Watson Mine	numerous	10.3
Alcoa, Inc			10.6
Estech	Silver City Mine	IO53-146828	10.7
Estech	Silver City Mine	IO53-160115	10.7
Mobil Mining	Ft. Meade Mine		10.8
Borden, Inc.	Big Four Mine		10.8
Swift Chemical Co.	Bartow		11.1
Estech	Agricola Gyp Stack	MP53-76006	11.1
Swift Chemical Co.	Silver City Mine		11.1
Swift Chem Co			11.3
Orange Co of FL	Wauchula Plant	numerous	11.4
USS Agri-Chem	Rockland McCullough Cr		11.4
Mobil	Fort Meade Mine		11.6
USS Agri-Chem	Rockland Sett Area N9		12.0
IMC Fertilizer	Lonesome Mine		12.1
Estech	Watson Mine Slurry Line		12.5
Estech	Duette Mine	IC41-30501	12.8
IMC-Agrico Co.	Noralyn Mine	IO53-168512	13.5
IMC-Agrico Co.	Lonesome Mine		13.6
Mobile Chemical Co.	Ft. Meade/Peace R. 001	NA	14.6
Pembroke Materials		IC53-177055	14.8

Source: FDEP, 1994.
KBN, 1994.

Table 3-2. Industrial and Mine Discharges Located Within 10 Miles of the HPS Site

Source	Mine/Area Name	Permit #	Distance (miles)
CF Mining Corp	Hardee Complex I	IO25-170754	2.29523
CF Mining Corp	Hardee Complex I	IO25-125839	2.29523
CF Mining Corp	Hardee Complex I	IO25-172624	2.29523
IMC-Agrico Co.	Ft Green Mine	IO53-167787	3.07352
IMC-Agrico Co.	Ft Green Mine	IO53-169657	3.07352
IMC-Agrico Co.	Payne Creek Mine	IO53-169655	3.41027
IMC-Agrico Co.	Payne Creek Mine	IO53-167788	3.41027
IMC-Agrico Co.	Four Corners Mine	IO53-223712	6.32813
Gardinier	Ft. Meade Mine	IO53-199082	7.48284
Gardinier	Ft. Meade Mine	IO53-170848	7.48284
Gardinier	Ft. Meade Mine	IO53-165831	7.48284
IMC-Agrico Co.	Four Corners Mine	IO41-222075	8.39375
IMC-Agrico Co.	Four Corners Mine	IC29-210653	8.39534
USS Agri-Chem	Rockland Mine	IO53-198646	9.02641
USS Agri-Chem	Rockland Mine	IO53-169467	9.02641
Cardox Corp.	-	IC53-120194	9.7
Cardox Corp.	-	IO53-146947	9.7

Source: FDEP, 1994.

Table 3-3. Industrial and/or Mine Discharges Meeting Study Requirements

Source/Facility	Area/Mine Name	Discharge Frequency	Projected Remaining Project Life (years)	Flow (lowest) (MGD)	Distance From Hardee Power Station (miles)	Approximate Required Pipe Length (mi)
IMC-Agrico Co.	Ft. Green Mine	Continuous	10	Outfall 002= 0.92	3.10	8
IMC-Agrico Co.	Payne Creek Mine	Continuous	<10	9.3	3.40	7
Gardinier (Cargill)	Ft. Meade Mine	Continuous	10	16.42	7.50	16
Gardinier (Cargill)	Ft. Meade Mine	Continuous	10	0.19	7.50	16

Source: FDEP, 1994.

Table 3-4. Water Quality Data from Gardinier Fort Meade Mine (Cargill Fertilizer) Outfall No. 001

Parameter	Units	Dry Season (20 Apr 1992)	Wet Season (15 Sep 1992)
Flow	mgd	16.42	25.06
Temperature	°C	28.00	28.00
pH	std units	7.40	6.90
Fluoride	mg/L as F	2.00	1.80
Sulfate	mg/L as SO ₄	15.30	95.00
TKN	mg/L	0.70	1.30
Ammonia	mg-N/L	<.10	0.10
Nitrate	mg-N/L	<.10	<.10
Nitrite	mg-N/L	<.10	<.10
Total Phosphorus	mg/L	2.70	0.60
Ortho Phosphorus	mg/L	2.70	0.50
Cholorophyll a	mg/m ³	4.70	18.00
DO	mg/L	8.30	6.30
TSS	mg/L	1.60	5.00
Total Fixed Suspended Solids	mg/L	<1	<1
BOD	mg/L	2.40	2.50

Permit number: IO53-199082

Source: KBN, 1994.

Table 3-5. Water Quality Data from the Gardinier Fort Meade Mine (Cargill Fertilizer) Outfall No. 002 – Discharge to Whidden Creek

Date	Flow		Fixed Solids		Total Suspended Solids		Total Phosphorus		pH		Dissolved Oxygen (mg/L)
	Average (mgd)	Maximum (mgd)	Average (mg/L)	Maximum (mg/L)	Average (mg/L)	Maximum (mg/L)	Average (mg/L)	Maximum (mg/L)	Minimum (std. units)	Maximum (std. units)	
Mar 1992	0.188	0.734	4.00	6.00	2.00	6.00	2.00	2.00	7.10	8.40	5.10
Jul 1992	3.414	8.693	1.00	2.00	11.00	18.00	2.00	3.00	7.60	8.60	5.70
Nov 1992	1.195	3.106	5.00	7.00	7.00	9.00	2.00	2.00	7.00	7.70	5.10
Dec 1992	0.604	2.028	6.00	10.00	5.00	13.00	2.76	3.84	7.10	7.80	5.10
Jan 1993	0.761	3.008	4.00	8.00	8.00	13.00	2.00	2.00	7.20	7.70	5.10
Feb 1993	0.055	0.337	0.00	1.00	2.00	4.00	1.00	1.00	7.40	7.60	5.20
Apr 1993	0.383	1.045	3.00	5.00	5.00	9.00	1.00	2.00	7.20	7.50	5.20
May 1993	0.49	2.31	4.00	10.00	10.00	24.00	1.00	1.00	7.00	7.80	5.00
Jun 1993	0.463	4	2.00	3.00	3.00	5.00	1.00	1.00	7.20	7.50	5.00

Permit number: IO53-165831

Source: KBN, 1994.

Table 3-6. Water Quality Data from the IMC Agrico Payne Creek Mine Outfall No. 001

Date	Flow		Total Non-Filtrable Solids		Total Non-Filtrable Non-Volatile Solids		Total Phosphorus		pH		
	Average (mgd)	Maximum (mgd)	Average (mg/L)	Maximum (mg/L)	Average (mg/L)	Maximum (mg/L)	Average (mg/L)	Maximum (mg/L)	Minimum (std. units)	Maximum (std. units)	Average (std. units)
Jun 1992	16.3	9.3	2.00	2.00	<1	<1	0.85	0.78	6.62	6.88	6.74
Jul 1992	163.0	91.5	2.00	1.00	<1	<1	0.80	0.61	6.71	7.03	6.85
Aug 1992	224.6	172.4	2.00	1.00	1.00	1.00	0.55	0.52	6.71	6.95	6.84
Sep 1992	193.7	115.1	1.00	1.00	<1	<1	0.50	0.44	6.70	7.02	6.80
Oct 1992	86.3	49.7	1.00	1.00	<1	<1	0.42	0.37	6.70	7.12	6.91
Nov 1992	24.1	16.8	2.00	2.00	<1	<1	0.60	0.46	7.00	7.13	7.06
Dec 1992	27.0	17.7	<1	<1	<1	<1	0.50	0.43	7.01	7.13	7.08
Jan 1993	38.1	30.0	1.00	1.00	<1	<1	0.61	0.50	7.06	7.18	7.14
Feb 1993	40.6	31.9	1.00	1.00	<1	<1	0.45	0.42	6.89	7.39	7.10
Mar 1993	37.0	30.9	1.00	1.00	<1	<1	0.37	0.34	7.04	7.20	7.10
Apr 1993	48.3	38.7	2.00	1.00	<1	<1	0.38	0.35	6.54	6.74	6.66
May 1993	24.1	10.7	4.00	2.00	2.00	1.00	0.69	0.52	6.76	7.00	6.91
Jun 1993	31.4	18.2	2.00	2.00	1.10	1.10	0.82	0.75	6.93	7.10	6.94

Permit number: IO53-167788

Source: KBN, 1994.

Table 3-7. Water Quality Data from the IMC Agrico Fort Green Mine Outfall No. 001

Date	Flow		Total Non-Filtrable Solids		Total Non-Filtrable Non-Volatile Solids		Total Phosphorus		pH	
	Average (mgd)	Maximum (mgd)	Average (mg/L)	Maximum (mg/L)	Average (mg/L)	Maximum (mg/L)	Average (mg/L)	Maximum (mg/L)	Minimum (std. units)	Maximum (std. units)
Jun 1992	0.010	0.014	4	5	1	2	1.11	1.24	7.21	7.35
Jul 1992	0.641	1.424	4	7	2	5	1.07	1.28	6.85	7.12
Aug 1992	1.176	2.715	6	15	4	11	1.42	2.13	6.72	7.06
Sep 1992	0.584	1.060	4	8	2	2	0.83	0.86	6.70	6.92
Oct 1992	0.556	1.145	7	11	3	6	0.85	1.17	6.97	7.39
Nov 1992	0.412	1.056	7	9	4	6	0.72	0.83	7.21	7.58
Dec 1992	0.334	0.886	7	9	3	4	0.62	0.76	7.34	7.60
Jan 1993	0.718	2.256	4	4	2	2	0.68	0.89	7.25	7.36
Feb 1993	0.393	1.236	5	8	3	5	0.66	0.74	7.07	7.45
Mar 1993	0.171	0.258	6	9	3	7	0.82	0.96	6.94	7.59
Apr 1993	0.144	0.315	4	4	2	3	0.88	0.97	6.68	7.28
May 1993	0.155	0.577	3	3	<1	<1	0.78	0.87	7.04	7.26
Jun 1993	0.101	0.205	4.8	7	1.1	1.1	0.96	1.17	7.34	7.41

Permit number: IO53-167787

Source: KBN, 1994.

Table 3-8. Water Quality Data from the IMC Agrico Fort Green Mine Outfall No. 002

Date	Flow		Total Non-Filtrable Solids		Total Non-Filtrable Non-Volatile Solids		Total Phosphorus		pH	
	Average (mgd)	Maximum (mgd)	Average (mg/L)	Maximum (mg/L)	Average (mg/L)	Maximum (mg/L)	Average (mg/L)	Maximum (mg/L)	Minimum (std. units)	Maximum (std. units)
Jun 1992	0.9	1.1	7	9	2	3	0.65	0.66	8.68	9.00
Jul 1992	0.6	1.0	5	7	1	2	0.41	0.74	8.48	8.92
Aug 1992	4.6	13.1	4	5	1	2	0.66	0.70	7.62	8.31
Sep 1992	1.0	1.6	4	6	1	1	0.61	0.63	7.68	8.30
Oct 1992	7.1	26.3	5	9	2	3	0.67	0.83	7.62	8.47
Nov 1992	0.9	1.6	8	10	3	4	0.73	0.79	8.00	8.37
Dec 1992	0.5	0.7	6	7	2	3	0.68	0.74	7.82	8.44
Jan 1993	1.0	1.8	5	6	2	3	0.68	0.76	7.85	8.30
Feb 1993	1.1	1.9	6	8	2	3	0.68	0.77	7.92	8.16
Mar 1993	0.5	1.1	5	9	2	4	0.68	0.72	7.48	8.18
Apr 1993	0.5	1.2	5	8	2	4	0.64	0.81	7.68	8.02
May 1993	0.7	2.6	7	13	2	5	0.37	0.46	8.00	8.40
Jun 1993	4.1	15.7	5.7	7	1.1	1.1	0.41	0.43	7.90	8.24

Permit number: IO53-167787

Sources: FDEP, 1994.
KBN, 1994.

4. Municipal sewage effluent from the city of Bowling Green;
5. Effluents from the Fort Green phosphate mine;
6. Effluents from the Payne Creek phosphate mine;
7. Effluents from the Fort Meade phosphate mine;
8. Additional Floridan aquifer wells; and
9. Deep Floridan aquifer (>2,000 ft) wells.

Several candidate water sources that are near the HPS site but were not evaluated include:

1. City of Wauchula Sewage Treatment Plant (excluded because of distance);
2. Hardee County Correctional Institution Sewage Treatment Plant (excluded because the minimum flow criteria was not met); and
3. Adjacent (i.e., southeast of HPS) Clay Settling Areas (excluded because the frequency of discharge is too intermittent).

A discussion of each of the candidate sources is presented in the following sections.

3.1 EXISTING FLORIDAN AQUIFER WELLS

Source Description - The Floridan aquifer is the predominate source of industrial groundwater in the vicinity of the HPS site. Three Floridan wells (depths of approximately 1,300 ft) are in use for the existing HPS units each with a permitted pumping rate of 2,000 gallons per minute (gpm). Flows in the Floridan aquifer are generally to the south-southwest. Saturated flows are thought to be concentrated in the fractured rock zone in the Avon Park carbonates.

Quantities Available and Reliability of Supply - The existing wells are equipped with 2,000 gpm pumps and are each capable of producing 2.88 mgd for a combined maximum withdrawal rate of 8.64 mgd. The wells are currently licensed for 3.8 mgd on a monthly average basis and 8.64 mgd for a daily maximum. Addition of the proposed Hardee Unit 3 (i.e., total plant buildout of 880 MW) will not require increasing these withdrawal rates.

The Floridan aquifer is a productive water-bearing unit. Data from a total of 11 pump tests within a 24-km (15-mile) radius of the site were obtained from Southwest Florida Water Management District (SWFWMD) (SWFWMD, 1988, Table 4). These tests indicated that for the Floridan aquifer, transmissivity (T) equals 133,000 ft² per day, storativity (S) equals 0.0014, and

leakance (L) equals 0.00015 cubic foot (ft³) per day per square foot (ft²). The ratio of horizontal to vertical hydraulic conductivity is on the order of 2. Groundwater modeling associated with the original 1989 SCA showed an average drawdown of less than 0.2 ft based on 3.8 mgd at the HPS site boundary. Refer to Section 6.0 for full discussion on potential drawdown impacts.

Water Quality and Variability of Quality - Floridan aquifer water quality is dominated by calcium and magnesium carbonate compounds with small amounts of sodium and potassium compounds; the total dissolved solids (TDS) content of the water is approximately 350 milligrams per liter (mg/L). Trace amounts of nutrients and heavy metals are found in the water. The Floridan aquifer under the HPS site meets all state of Florida primary and secondary drinking water standards. The aquifer's water quality is very stable and is not expect to vary by ± 10 percent over the next several decades.

Pretreatment Requirements - There are no water quality limitations for the Hardee Unit 3 for the Floridan aquifer water. As such, no pretreatment is required.

3.2 WATER CROPPING FROM THE ADJACENT RECLAIMED PHOSPHATE LANDS

Source Description - Immediately east and north of the cooling reservoir are approximately 1,250 acres of former phosphate mine lands that are currently being reclaimed into upland pasture with several interspersed wetlands (see Figure 3-1). The natural drainage from this reclaimed site is to Payne Creek via an unnamed tributary that flows southward and passes between the Hardee Unit 3 plant area and the cooling reservoir. The soils in the area consist of several feet of mine sand tailing overlain by clays, silty clays, and topsoil. The land slopes to the south and southwest with local grades ranging from 0 percent to 6 percent. At the completion of reclamation activities (scheduled for spring 1994), the area will be planted with pasture grasses, pine flatwood community trees, and herbaceous and woody wetland species in the several planned wetland communities.

Quantities Available and Reliability of Supply - By its very nature, water cropping is not a continuous water supply source. Water is available only in response to rainfall events sufficiently large to produce surface water runoff. At such times, the HPS cooling reservoir would not require additional water. In order to utilize, or crop, the surface water runoff, a large retention basin would need to be constructed to hold the water so that it could be pumped to the cooling

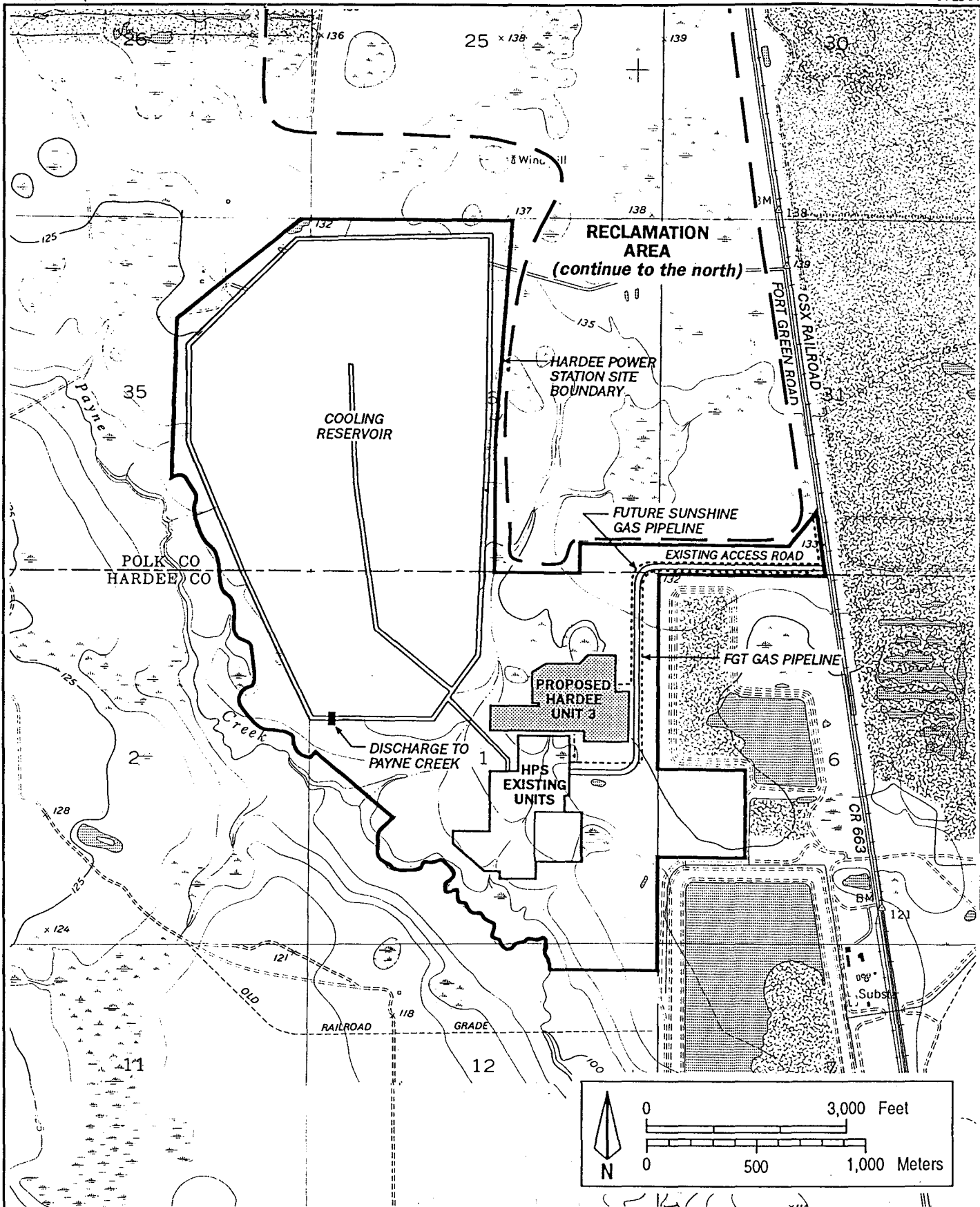


Figure 3-1
General Location of Reclamation Areas North and East
of the HPS Site

Sources: USGS, 1987; KBN, 1994.



reservoir. Gravity transport of the runoff water to the cooling reservoir is not possible since the logical location of the holding basin (i.e., the downstream end of the watershed) is several feet lower (i.e., at approximately 120 ft-msl) than the minimum reservoir water level.

Runoff quantities were calculated for the area using a U.S. Soil Conservation Service (SCS) based runoff model described in Attachment B. The runoff model was coupled to the heat budget model used for the analyses in Section 2 and described in Attachment A. This combined model was run for the 37-year period of record under the average load conditions and assuming holding reservoir sizes ranging from 10 to 100 acres; the results of the model are summarized in Table 3-9. As seen in Table 3-9, water cropping from this area could supply 14.6 percent (with a 10-acre holding reservoir) to 49.8 percent (with a 100-acre holding reservoir) of the monthly average cooling reservoir makeup supply. Given the availability of land on the HPS site north of the Hardee Unit 3 site, a holding reservoir of 25 acres would be feasible.

Water Quality and Variability of Quality - The quality of the surface water runoff from the reclaimed mine areas can have floating debris (e.g., dead branches and tree limbs), moderate suspended solids (occasionally high), potentially high phosphate concentrations (e.g., > 1 mg/L), and moderate dissolved solids concentrations (typically less than 200 mg/L).

Additionally, pH values may range below 6.0 standard units. Such waters are not expected to routinely exceed FDEP Class III surface water quality standards.

Pretreatment Requirements - Water from reclaimed areas can have high levels of suspended solids (TSS), phosphates, and pH. While the holding reservoir can serve as a sedimentation basin for the treatment of TSS, such a use of the reservoir will ultimately require periodic dredging of portions of the reservoir. Additionally, at least a fraction of the TSS can be expected to be in the colloidal size range and thus would not settle in the reservoir and could ultimately create water quality problems when the reservoir discharges.

As such, the following treatment scheme may be required to assure that water from this area is compatible with existing reservoir quality:

1. A 25-acre holding reservoir with an average depth of 5 ft;
2. Coagulation and sedimentation basins--for removal of colloidal TSS particles;

Table 3-9. Summary of Water Budget Modeling for the Adjacent Reclaimed Phosphate Area

Reservoir Area (acres)	Storage Volume (ac-ft)	Water Supply from Cropping		Maximum Percent of HPS Monthly Average Annual Requirement
		Average Monthly (mgd)	Maximum Monthly (mgd)	
10	50	0.381	0.528	14.6%
20	100	0.671	1.04	25.7%
25	125	0.780	1.29	29.9%
30	150	0.877	1.53	33.6%
40	200	1.05	2.05	40.2%
50	250	1.16	2.54	44.4%
75	375	1.28	3.80	49.0%
100	500	1.30	5.07	49.8%

- Notes: 1. Average hold pond depth = 5 feet.
2. Annual requirement = Average monthly water supply to the cooling reservoir which is 2.6 mgd out of total plant makeup requirement of 3.17 mgd. The percent of average monthly supply value includes only makeup flows to the reservoir.

Source: KBN, 1994.

3. Phosphate precipitation--a treatment train of coagulation and sedimentation basins for the removal of phosphates;
4. pH adjustment--a mixing chamber and contact basin for pH neutralization; and
5. Solids handling system--the first three process steps identified above would generate sludges that would have to be dewatered and the solids disposed of offsite.

3.3 ADDITIONAL WATER CROPPING FROM HPS LANDS

Source Description - Immediately south of the cooling reservoir are approximately 40 acres of former phosphate mine lands that are reclaimed into pasture. The natural drainage from this reclaimed site is toward the Payne Creek floodplain. The soils in the area consist of several feet of mine sand tailings, clays, and silty clays. The land slopes to the west and southwest with local grades ranging from 0 percent to 6 percent. This area is planted with pasture grasses.

Quantities Available and Reliability of Supply - By its very nature, water cropping is not a continuous water supply source. Water is available only in response to rainfall events sufficiently large to produce surface water runoff. At such times, the HPS cooling reservoir would not require additional water. In order to utilize, or crop, the surface water runoff, a retention basin will need to be constructed to hold the water so that it can be pumped to the cooling reservoir. Gravity transport of the runoff water to the cooling reservoir is not possible because the area is downstream of the reservoir.

Runoff quantities were calculated using the methodology described in Section 3.2. The model was run for the 37-year period of record under the average load conditions and assuming a holding reservoir surface area of 1 acre and a depth of 5 ft. With this configuration, the area can provide a monthly average water flow of about 0.03 mgd or 1.3 percent of the required reservoir makeup.

Water Quality and Variability of Quality - The quality of the surface water runoff from the reclaimed mine area is expected to have floating debris (e.g., dead grasses and tree limbs), moderate suspended solids (occasionally high), potentially high phosphate concentrations (e.g., > 1 mg/L), and moderate dissolved solids concentrations (typically less than 200 mg/L). Additionally, pH values may range below 6.0 standard units. The waters are not expected to routinely exceed FDEP Class III surface water quality standards.

Pretreatment Requirements - As noted above, water from the adjacent reclaimed areas may be expected to have high levels of TSS, phosphates, and pH. While the holding reservoir can serve as a sedimentation basin for the treatment of TSS, such a use of the reservoir will ultimately require periodic dredging of portions of the reservoir. Additionally, at least a fraction of the TSS can be expected to be in the colloidal size range and thus would not settle in the reservoir and could ultimately create water quality problems when the reservoir discharges.

As such, the following treatment scheme may be required to assure that water from this area is compatible with existing reservoir quality:

1. A 5-acre holding reservoir with an average depth of 5 ft;
2. Coagulation and sedimentation basins--for removal of colloidal TSS particles;
3. Phosphate precipitation--a treatment train of coagulation and sedimentation basins for the removal of phosphates;
4. pH adjustment--a mixing chamber and contact basin for pH neutralization; and
5. Solids handling system--the first three process steps identified above would generate sludges that would have to be dewatered and the solids disposed of offsite.

3.4 TREATED MUNICIPAL SEWAGE EFFLUENT FROM THE CITY OF BOWLING GREEN

Source Description - The use of treated sewage effluent from municipal sewage treatment plants (STP) has been identified as a source of cooling water for one licensed but not yet constructed power plant north of HPS and is being considered for another. The STPs to be utilized by those projects are the cities of Lakeland and Bartow, which differ significantly from the STP available to HPS (i.e., the city of Bowling Green) in both quantity of flow and water quality. The City of Bowling Green has an average daily flow of approximately 0.25 mgd (compared with 2.6 mgd for Bartow and more than 10 mgd for Lakeland). Additionally, the Bartow and Lakeland STPs are or will be providing advanced wastewater treatment while the Bowling Green plant provides only secondary treatment. SECI contacted the Polk County Water Reuse Advisory Board regarding the potential reuse of the City of Bowling Green treated effluent. SECI was informed that such a reuse would likely not be economically feasible for HPS because other potential users are closer and SECI has other potential reuse options.

Quantities Available and Reliability of Supply - Available data indicate that the average daily discharge from the Bowling Green STP is about 0.25 mgd. Effluents from (and influents to) STPs tend to follow seasonal patterns, with higher flows typically occurring during the summer due to increased potable water demand as well as groundwater infiltration into the sewer lines. As such, the flow from the plant likely will not decrease by 25 percent or increase by more than 100 percent on a daily basis. The discharge from the STP is expected to increase in proportion to the population growth and, assuming historical growth rates, the daily average STP discharge rate is estimated to be between 0.35 and 0.5 mgd in the year 2010.

Water Quality and Variability of Quality - Generally, smaller sewage treatment plants have more variable and, on average, poorer effluent quality than larger ones. The reason for the variability in effluent quality and resulting poorer average quality is that smaller plants have less buffering capacity and are thus more prone to upsets in treatment. The Bowling Green plant is no exception to this generality and FDEP records indicate an inconsistent treatment history for the plant. Given the secondary treatment design of the plant, FDEP-technology based effluent limitations (TBELs) are applicable to the effluent quality. The TBELs for this type of plant include an effluent BOD of 20 mg/L, total suspended solids of 20 mg/L, total nitrogen concentration of 5 mg/L and total phosphorus concentration of 3 mg/L.

Pretreatment Requirements - The available information on the Bowling Green STP effluent indicate that pretreatment would be required prior to its addition to the cooling reservoir. The potential for treatment plant upsets and/or high bacterial counts in the water suggest the following treatment steps as precautions to maintaining reservoir quality.

1. Polishing reservoir--a polishing reservoir with a 10-day detention time would serve both as a flow equalization basin [to minimize any "shocks" associated with publicly owned treatment works (POTW) plant upsets] and would also further reduce BOD and suspended solids concentrations in the effluent. Influent into the polishing reservoir would be monitored daily to ensure proper water quality is delivered to the plant; and
2. Contact chlorination chamber--the contact chlorination chamber would be located downstream of the polishing reservoir and would assure proper biocidal treatment is received by the effluent prior to release into the reservoir.

3.5 WASTEWATER EFFLUENTS FROM THE FORT GREEN, PAYNE CREEK, AND/OR FORT MEADE MINES

Source Description - Phosphate mining in Hardee County is expected to increase over the next several decades. Stormwater or industrial wastewater from nearby (i.e., within 10 miles of the HPS site) proposed phosphate mines present a potential source of water. Groundwater use for mining in Hardee County is expected to increase from a current usage of about 2.2 mgd to about 51.2 mgd in the year 2020. Although this appears to represent a large volume of potentially reusable water, it is noted much of the water is bound in clay settling reservoirs and that SWFWMD is encouraging the mining industry to minimize water use.

As seen previously in Tables 3-1 through 3-3, these three mines have permitted outfalls whose upstream treatment processes include sedimentation, impoundment, volume reduction/resource recovery, and burial. As a general rule, the "burial" treatment classification indicates that the discharge is associated with a clay settling reservoir and, as such, water is released only in response to extreme high rainfall events. The "sedimentation" and "impoundment" treatment classifications typically include discharges of recirculating water that tend to be more continuous in nature and of better quality. Discharges associated with the three area phosphate mines are from water streams that have received the latter type of treatment.

Quantities Available and Reliability of Supply - The industrial wastewaters from Fort Green, Payne Creek, and Fort Meade mines are all continuous in nature. As noted in Table 3-3, minimum average daily flow from the Fort Green mine is 0.92 mgd; 9.3 mgd for the Payne Creek mine; and 16.4 mgd for the Fort Meade mine. It is noted that phosphate mining can be a highly volatile industry and periods of several years can pass when minimal activity occurs. As such, the long term reliability of this potentially source cannot be considered high.

Water Quality and Variability of Quality - Water quality data for the several industrial dischargers near HPS are presented in Tables 3-4 through 3-8. Data for the Fort Meade Mine are shown in Tables 3-4 (outfall number 001) and 3-5 (outfall number 002). As seen in these tables, the discharges from the Fort Meade mine can have low to moderate TSS concentrations, high phosphorus concentrations, and a fairly neutral pH.

Data for the Payne Creek mine are shown in Table 3-6 (outfall number 001). As seen in this table, the discharges from the Payne Creek mine has low TSS concentrations, low to moderate phosphorus concentrations, and a fairly neutral pH.

Data for the Fort Green mine are shown in Tables 3-7 (outfall number 001) and 3-8 (outfall number 002). As seen in these tables, the discharges from the Fort Green mine has low TSS concentrations, low to moderate phosphorus concentrations, and a neutral to slightly basic pH.

Pretreatment Requirements - Stormwater, the main component of wastewater effluent from nearby phosphate mines, can have highly variable levels of TSS, phosphates, and pH. While the cooling reservoir could, in theory, act as a sedimentation basin for the treatment of TSS, such a use of the reservoir would ultimately require periodic dredging of portions of the reservoir. Additionally, at least a fraction of the TSS can be expected to be in the colloidal size range and thus would not settle in the reservoir and could ultimately create water quality problems when the reservoir discharges. Also, using the cooling reservoir would have no treatment effect on phosphate or pH contaminants which may be present in the runoff water.

The following treatment scheme would be required if runoff water from clay settling areas were to be used:

1. Sedimentation basin--for removal of the larger TSS particles;
2. Coagulation and sedimentation basins--for removal of colloidal TSS particles;
3. Phosphate precipitation--a treatment train of coagulation and sedimentation basins for the removal of phosphates;
4. pH adjustment--a mixing chamber and contact basin for pH neutralization; and
5. Solids handling system--the first three process steps identified above would generate sludges that would have to be dewatered and the solids disposed of offsite.

3.6 FLORIDAN AQUIFER WELLS

Source Description - The Floridan aquifer is the predominate source of industrial groundwater in the vicinity of the HPS site. Three Floridan wells (depths of approximately 1,300 ft) are in use for the existing HPS units each with a permitted pumping rate of 2,000 gpm. The purpose of new Floridan wells would be to provide stand-by capacity to the existing wells and not to increase capacity.

Quantities Available and Reliability of Supply - The existing wells are equipped with 2,000 gpm pumps and are each capable of producing 2.88 mgd for a combined maximum withdrawal rate of 8.64 mgd. The wells are currently licensed for 3.8 mgd on a monthly average basis and 8.64 mgd for a daily maximum. Addition of the proposed Hardee Unit 3 would not require increasing these withdrawal rates.

The Floridan aquifer is a productive water-bearing unit. Data from a total of 11 pump tests within a 24-km (15-mile) radius of the site were obtained from SWFWMD (SWFWMD, 1988, Table 4). These tests indicated that for the Floridan aquifer, T equals 133,000 square ft per day, S equals 0.0014, and L equals 0.00015 ft³ per day per ft². The ratio of horizontal to vertical hydraulic conductivity is on the order of 2. Groundwater modeling associated with the original 1989 SCA showed an average drawdown of less than 0.2 ft at the HPS site boundary. This modeling also showed that under worst-case withdrawal and recharge conditions, drawdowns of less than 3 ft were predicted. Since the purpose of the additional wells is to provide stand-by capacity only, no additional drawdowns would be associated with their construction.

Water Quality and Variability of Quality - Floridan aquifer water quality is dominated by calcium and magnesium carbonate compounds with small amounts of sodium and potassium compounds; the TDS content of the water is approximately 350 mg/L. Trace amounts of nutrients and heavy metals are found in the water. The Floridan aquifer under the HPS site meets all state of Florida primary and secondary drinking water standards. The aquifer's water quality is very stable and is not expect to vary by ± 10 percent of the next several decades.

Pretreatment Requirements - There are no use limitations for the Floridan aquifer water. As such, no pretreatment is required.

3.7 DEEP FLORIDAN AQUIFER (>2,000 FT) WELLS

Source Description - The Floridan aquifer below 2,000 ft (i.e., the deep Floridan) has not been extensively studied. Available data indicate that while this portion of the aquifer may have prolific water-bearing properties, the water quality of the water is highly mineralized (e.g., TDS concentrations greater than 2,000 mg/L) and this limits its usage.

The nearest available boring into the deep Floridan aquifer is located in Polk City (Polk County), about 45 miles north-northeast of HPS. Hydraulic properties of the deep Floridan include hydraulic conductivities ranging from 0.0004 to 1.1 feet per day (compared to 0.0025 to 4.2 feet per day for the lower Floridan aquifer). Based on these limited data, aquifer performance of the deep Floridan aquifer can reasonably be expected to be from 10 percent to 25 percent of the lower Floridan.

Quantities Available and Reliability of Supply - While definitive data do not exist, the deep Floridan can be considered to be a reliable source of water for the Hardee Unit 3 requirements. Given the deep Floridan's poor water quality, it is unlikely that there would be few competing demands on its usage.

Water Quality and Variability of Quality - As noted in the sections above, the deep Floridan aquifer is highly mineralized (i.e., TDS greater than 2,000 mg/L) and water quality data from the borehole in Polk City show similar TDS values. As with the upper Floridan aquifer, water quality in this formation is expected to be stable and not change appreciably over the next several decades.

Pretreatment Requirements - The water from deep Floridan wells will be high in TDS but is expected to be low in TSS. As such, the following treatment scheme is recommended to bring the high TDS water into conformity with cooling reservoir requirements:

1. Reverse osmosis--a reverse osmosis (RO) treatment train can reduce the TDS to acceptable levels (i.e., less than 300 mg/L);
2. RO reject water treatment--the RO system will generate a "reject" stream that has a TDS concentration approximately 10 times the concentration of the feed water (i.e., in the 20,000 to 30,000 mg/L range). This reject water could be disposed of either by deep-well injection or by evaporating the reject water to create a "salt" solid waste. Deep-well injection would be a problematic disposal option given that these types of wells typically discharge into the geologic formation from which the source water would be withdrawn. Evaporation of the reject water can be accomplished using waste heat from the power plant but the resulting solid waste (which is soluble) must be disposed of offsite. Finding a suitable disposal site for this solid waste may be difficult given its physical and chemical properties.

4.0 ENVIRONMENTAL EVALUATION OF ALTERNATIVE COOLING WATER SOURCES

4.1 IMPACTS TO SURFACE WATERS AND/OR WETLANDS FROM RUNOFF

Cropping of stormwater runoff would likely create minimal adverse impacts on the nearby wetlands because the wetland community most likely affected is the Payne Creek floodplain. The Payne Creek floodplain is sufficiently large that reduction in flows from cropping up to 1,250 acres would likely have only a very localized effect during minor runoff events. For larger runoff events, the Creek and associated floodplain will tend to experience higher water stages and thus, little or no impact. See Section 6.0 for additional discussions on potential surface water and wetland impacts for the individual options.

The Peace River, into which Payne Creek flows, has experienced decreased flow over the past several decades because of the basin area lost to phosphate mine-related impoundments. Any additional "removal" of uplands or reclaimed lands from the basin would reduce the overall volume of runoff into the river.

4.2 IMPACTS FROM TREATMENT AND DISPOSAL OPERATIONS

Several of the proposed cooling water sources would require pretreatment prior to releasing the water into the cooling reservoir. The types of waste treatment byproducts requiring disposal would either be solid or liquid. A discussion of these potential wastestreams follows.

4.2.1 SOLID WASTE DISPOSAL

The following types of solid wastes could be generated by the several treatment processes discussed above.

1. Inert inorganic solids--these wastes would typically be comprised of the settleable solids removed in sedimentation and/or coagulation/sedimentation basins (see Sections 3.4.1 and 3.4.4). These types of wastes are not uncommon (i.e., they may be generated at municipal potable water treatment plants and a variety of industrial facilities) and typically pose no hazardous threats. Their disposal does however require landfill volume and, in the case of phosphate precipitation solid wastes, lined landfills are recommended to ensure preservation of groundwater quality standards.

2. Inert organic solids--these wastes would be vegetative in nature and collected in bar screens to prevent their entry into the cooling reservoir (see Section 3.4.3). These types of wastes typically pose no hazardous threats. Their disposal does however require landfill volume and/or composting for volume reduction.
3. Active inorganic solids--the solids generated by evaporating RO reject (see Section 3.4.6) are active solids in the sense that they can be highly soluble in water. Landfilling of these solids would require multiple lining of the landfill as well as impermeable landfill cover to minimize the potential of re-introducing the solids into the water table.

4.2.2 LIQUID WASTES

The only potential liquid waste would be if RO reject were to be disposed of by deep-well injections rather than crystallization. As noted previously, deep-well injection is typically made into the deep Floridan aquifer. Since RO would be required only if deep Floridan water were used as a potential source, the potential would exist of cross-contamination between the production and disposal wells. Assuming that this potential problem could be controlled with proper design, the use of deep-well injection does represent a viable disposal option. Long-term potential impacts associated with deep-well injection may include upwelling of high TDS water into potable production zones of the Floridan aquifer.

5.0 BUDGETARY COST ESTIMATES

5.1 BASIS FOR BUDGETARY COST ESTIMATES

Section 3 of this report presents detailed discussions of the facilities required for the various candidate water sources. The required facilities are summarized below by source.

5.1.1 EXISTING FLORIDAN AQUIFER WELLS

There are no water quality induced limitations on the use of the existing well water. As such, no facilities are required for its use at Hardee Unit 3.

5.1.2 WATER CROPPING FROM THE ADJACENT RECLAIMED PHOSPHATE LANDS

As noted in Section 3.2, water from the adjacent reclaimed areas may be expected to have highly variable levels of TSS, phosphates, and pH. While the required flow equalization (i.e., holding) reservoir can serve as a sedimentation basin for the treatment of TSS, such a use of the reservoir will ultimately require periodic dredging. Additionally, at least a fraction of the TSS can be expected to be in the colloidal size range and thus would not settle in the reservoir and could ultimately create water quality problems when the reservoir discharges.

As such, the following treatment scheme may be required to assure that water from this area is compatible with existing reservoir quality:

1. A 25-acre holding reservoir with an average depth of 5 ft;
2. Coagulation and sedimentation basins--for removal of colloidal TSS particles;
3. Phosphate precipitation--a treatment train of coagulation and sedimentation basins for the removal of phosphates;
4. pH adjustment--a mixing chamber and contact basin for pH neutralization; and
5. Solids handling system--the first three process steps identified above would generate sludges that would have to be dewatered and the solids disposed of offsite.

5.1.3 ADDITIONAL WATER CROPPING FROM HPS LANDS

As noted in Section 3.3, water from the adjacent reclaimed areas may be expected to have highly variable levels of TSS, phosphates, and pH. While the holding reservoir can serve as a sedimentation basin for the treatment of TSS, such a use of the reservoir will ultimately require periodic dredging of portions of the reservoir. Additionally, at least a fraction of the TSS can be

expected to be in the colloidal size range and thus would not settle in the reservoir and could ultimately create water quality problems when the reservoir discharges.

As such, the following treatment scheme may be required to assure that water from this area is compatible with existing reservoir quality:

1. A 5-acre holding reservoir with an average depth of 5 ft;
2. Coagulation and sedimentation basins--for removal of colloidal TSS particles;
3. Phosphate precipitation--a treatment train of coagulation and sedimentation basins for the removal of phosphates;
4. pH adjustment--a mixing chamber and contact basin for pH neutralization; and
5. Solids handling system--the first three process steps identified above would generate sludges that would have to be dewatered and the solids disposed of offsite.

5.1.4 TREATED MUNICIPAL SEWAGE EFFLUENT FROM THE CITY OF BOWLING GREEN

The available information on the Bowling Green STP effluent indicate that pretreatment would be required prior to its addition to the cooling reservoir. The potential for treatment plant upsets and/or high bacterial counts in the water suggest the following treatment steps as precautions to maintaining reservoir quality.

1. Polishing reservoir--a polishing reservoir with a 10-day detention time would serve both as a flow equalization basin (to minimize any "shocks" associated with POTW plant upsets) and would also further reduce BOD and suspended solids concentrations in the effluent. Influent into the polishing reservoir would be monitored daily to ensure proper water quality is delivered to the plant; and
2. Contact chlorination chamber--the contact chlorination chamber would be located downstream of the polishing reservoir and would assure proper biocidal treatment is received by the effluent prior to release into the reservoir.

5.1.5 WASTEWATER EFFLUENTS FROM THE FORT GREEN, PAYNE CREEK, AND/OR FORT MEADE MINES

Stormwater, the main component of wastewater effluents from nearby phosphate mines, may be expected to have highly variable levels of TSS, phosphates, and pH. While the cooling reservoir could, in theory, act as a sedimentation basin for the treatment of TSS, such a use of the reservoir

would ultimately require periodic dredging of portions of the reservoir. Additionally, at least a fraction of the TSS can be expected to be in the colloidal size range and thus would not settle in the reservoir and could ultimately create water quality problems when the reservoir discharges. Also, using the cooling reservoir would have no treatment effect on phosphate or pH contaminants which may be present in the runoff water.

As such, the following treatment scheme would be required if runoff water from clay settling areas were to be used:

1. Sedimentation basin--for removal of the larger TSS particles;
2. Coagulation and sedimentation basins--for removal of colloidal TSS particles;
3. Phosphate precipitation--a treatment train of coagulation and sedimentation basins for the removal of phosphates;
4. pH adjustment--a mixing chamber and contact basin for pH neutralization; and
5. Solids handling system--the first three process steps identified above would generate sludges that would have to be dewatered and the solids disposed of offsite.

5.1.6 NEW FLORIDAN AQUIFER WELLS

A new 1,300-ft deep well with the associated pump, electrical hookups, and mechanical controls would need to be constructed for this option. There are no water quality limitations for the Floridan aquifer water. As such, no pretreatment is required.

5.1.7 DEEP FLORIDAN AQUIFER (>2,000 FT) WELLS

The water from deep Floridan wells will be high in TDS but is expected to be low in TSS. As such, the following treatment scheme is recommended to bring the high TDS water into conformity with cooling reservoir requirements:

1. Well--a 2,000-ft production well into the lower Floridan aquifer formation;
2. Reverse osmosis--a RO treatment train can reduce the TDS to acceptable levels (i.e., less than 300 mg/L);
3. RO reject water treatment--the RO system will generate a "reject" stream that has a TDS concentration approximately 10 times the concentration of the feed water (i.e., in the 20,000 to 30,000 mg/L range). Evaporation of the reject water can be accomplished using waste heat from the power plant but the resulting solid waste (which is soluble) must be disposed of offsite. Finding a suitable disposal site for this

solid waste may be difficult given its physical and chemical properties. In spite of its potential limitations, crystallization of the RO reject stream is considered to be the more cost effective techniques given the availability of waste heat from the power plant.

5.2 BUDGETARY COST ESTIMATES

The treatment costs are based on the facility requirements described in Section 3 and summarized in Section 5.1, above, and in Table 5-1. The budgetary capital cost estimates for the various treatment processes are presented in Table 5-2. The sources of the costing information include various EPA development documents and vendor-supplied information. All costs are lump sum items normalized to 1994 dollars and are inclusive of the items noted in the table. The stated costs have a range of -15 to +30 percent. Operating and maintenance (O&M) costs were not estimated for the several supply alternatives. It is noted that O&M costs can be high (e.g., > \$500,000 per year) for the more treatment-intensive options.

The distances from the industrial and/or mine sources evaluated were presented in Table 3-3. The conceptual pipeline routings from the three mine/IWW dischargers and the municipal STP (i.e., Bowling Green) are shown in Figures 5-1 through 5-4. These conceptual routings were aligned along existing public rights-of-way (typically roads) for this screening level analysis. The pipeline budgetary cost estimates are presented in Table 5-3 (for the mine and/or IWW dischargers) and Table 5-4 (for the STP pipeline routing). All costs are lump sum items normalized to 1994 dollars and are inclusive of the items noted in the table. The stated costs have a range of -15 to +30 percent.

The combined cost estimates for the various alternatives are presented in Table 5-5. This table also includes a unit cost estimate of the water (by source) that was calculated by dividing the water supply developmental cost (i.e., pipelines plus other facilities) by the average daily water supply available from the source. The estimated unitary costs for the various options are:

Existing wells	\$0 per mgd
New Floridan well	\$189,500 per mgd
Effluents from the Payne Creek mine	\$974,900 per mgd
Deep Floridan aquifer wells	\$1,354,200 per mgd
Effluents from the Fort Meade mine	\$1,840,200 per mgd

Water cropping from the adjacent reclaimed area	\$4,233,400 per mgd
Effluents from the Fort Green mine	\$4,582,500 per mgd
Municipal sewage effluent from Bowling Green	\$16,774,400 per mgd
Additional HPS site water cropping	\$21,133,300 per mgd

Table 5-1. Summary of Potential Treatment Processes for the Various Alternative Makeup Water Sources

Alternative Source	Water Treatment Process					
	Sedimentation	Coagulation	Phosphate Treatment	pH Adjustment	Polishing Reservoir	Chlorination
Water Cropping	Yes	Yes	Yes	Yes	No	No
Municipal Sewage Effluent	No	No	No	No	Yes	Yes
HPS Stormwater Runoff	Yes	No	No	No	No	No
Phosphate Mine Effluents	Yes	Yes	Yes	Yes	No	No
Floridan Aquifer Wells	No	No	No	No	No	No
Deep Floridan Aquifer Wells	No	No	No	No	No	No

Note: 1. See Section 3 for a description of the pretreatment systems for the alternative makeup sources.

2. A solids handling system would be required for all alternatives including coagulation and sedimentation basins.

3. Deep Floridan aquifer well water may require treatment by reverse osmosis for reducing the dissolved solids concentrations.

Source: KBN, 1994.

Table 5-2. Budgetary Capital Cost Estimates of Pretreatment Processes for the Various Alternative Makeup Water Sources

Alternative Source	Cost (\$) for Each Water Pretreatment Process						Total Estimated Budgetary Cost (\$)
	Sedimentation	Coagulation	Phosphate Treatment	pH Adjustment	Polishing Reservoir	Chlorination	
Water Cropping	428,000	914,000	571,000	50,000	0	0	1,963,000
Municipal Sewage Effluent	0	0	0	0	371,000	50,000	421,000
HPS Stormwater Runoff	428,000	0	0	0	0	0	428,000
Phosphate Mine Effluents	428,000	914,000	571,000	50,000	0	0	1,963,000
Floridan Aquifer Wells	0	0	0	0	0	0	0
Deep Floridan Aquifer Wells	0	0	0	0	0	0	450,000*

Note: 1. See Section 3.4 for a description of the pretreatment systems for the alternative makeup sources.

2. Solids handling system costs are included for alternatives requiring coagulation and sedimentation basins.

3. Costs are for the stated unit process items only. Costs for engineering design of the unit processes and plant associated facilities are not included. Other costs not included are retrofitting plant design, foundation requirements, and integrated controls.

* Reverse osmosis system cost for the deep Floridan aquifer well water supply is included in the Total figure.

Source: KBN, 1994.

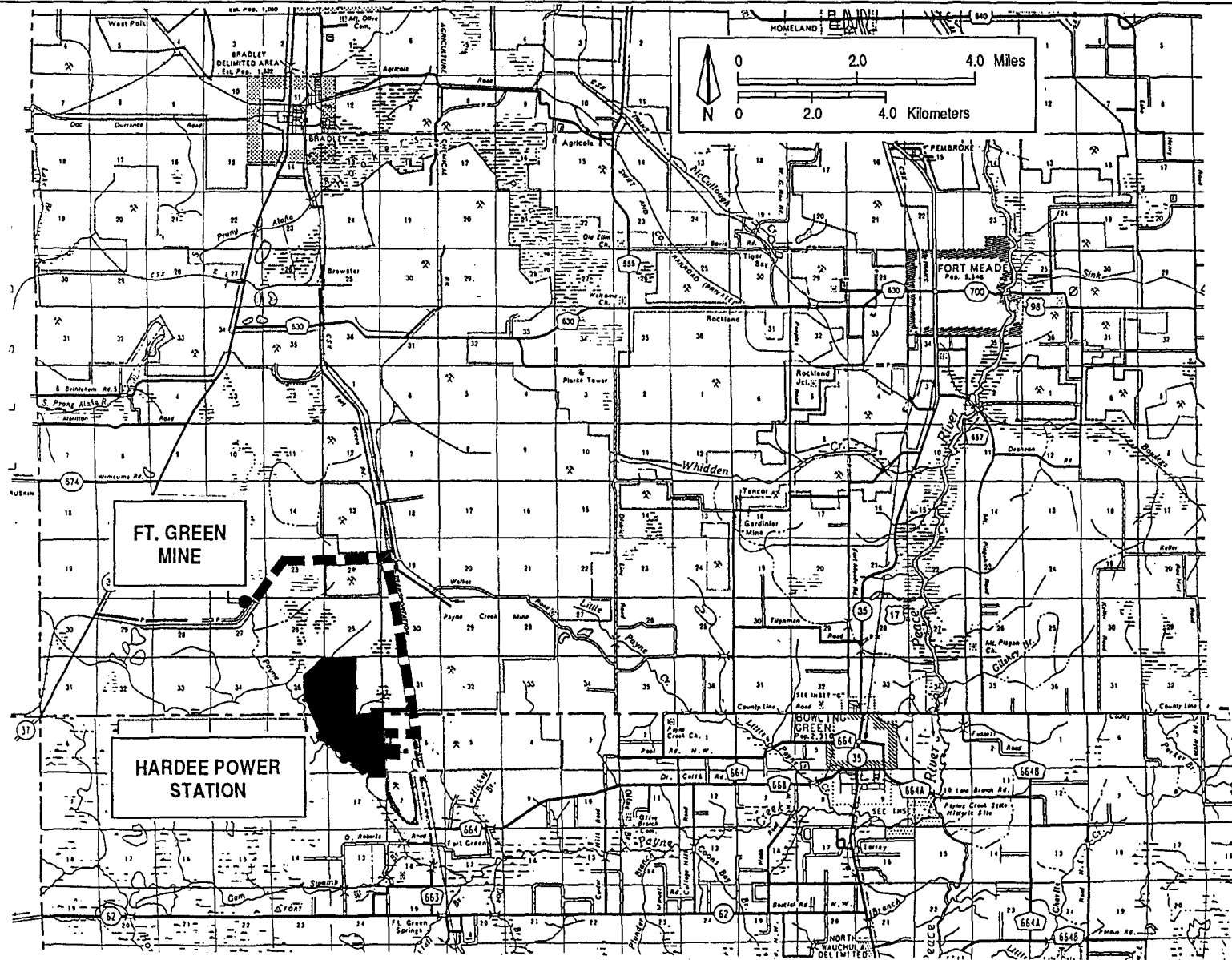


Figure 5-1
Conceptual Pipeline Routing from the Fort Green Mine to the HPS site

Sources: FDOT, 1990 and 1992; KBN, 1994.



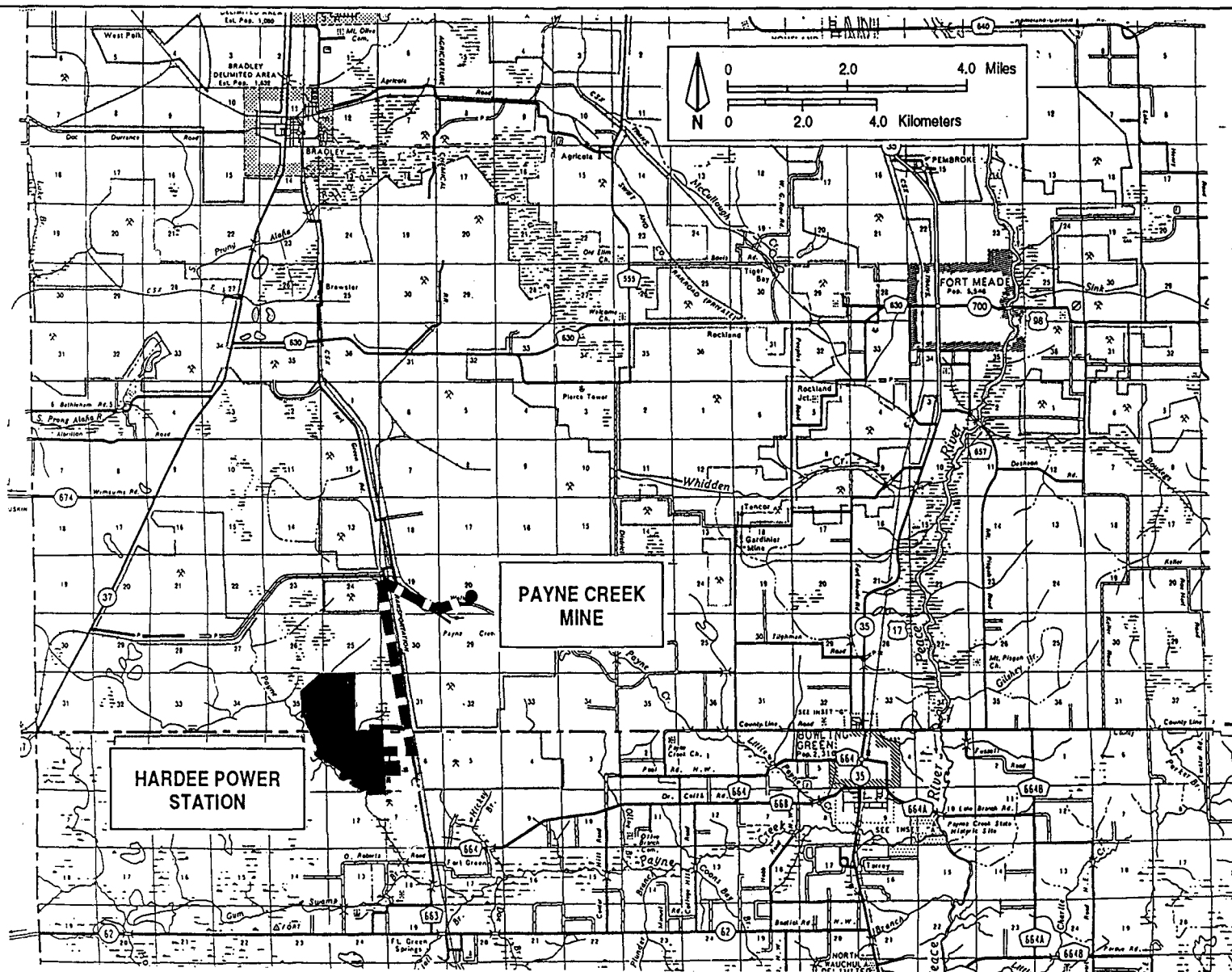


Figure 5-2
Conceptual Pipeline Routing from the Payne Creek Mine to the HPS site

Sources: FDOT, 1990 and 1992; KBN, 1994.



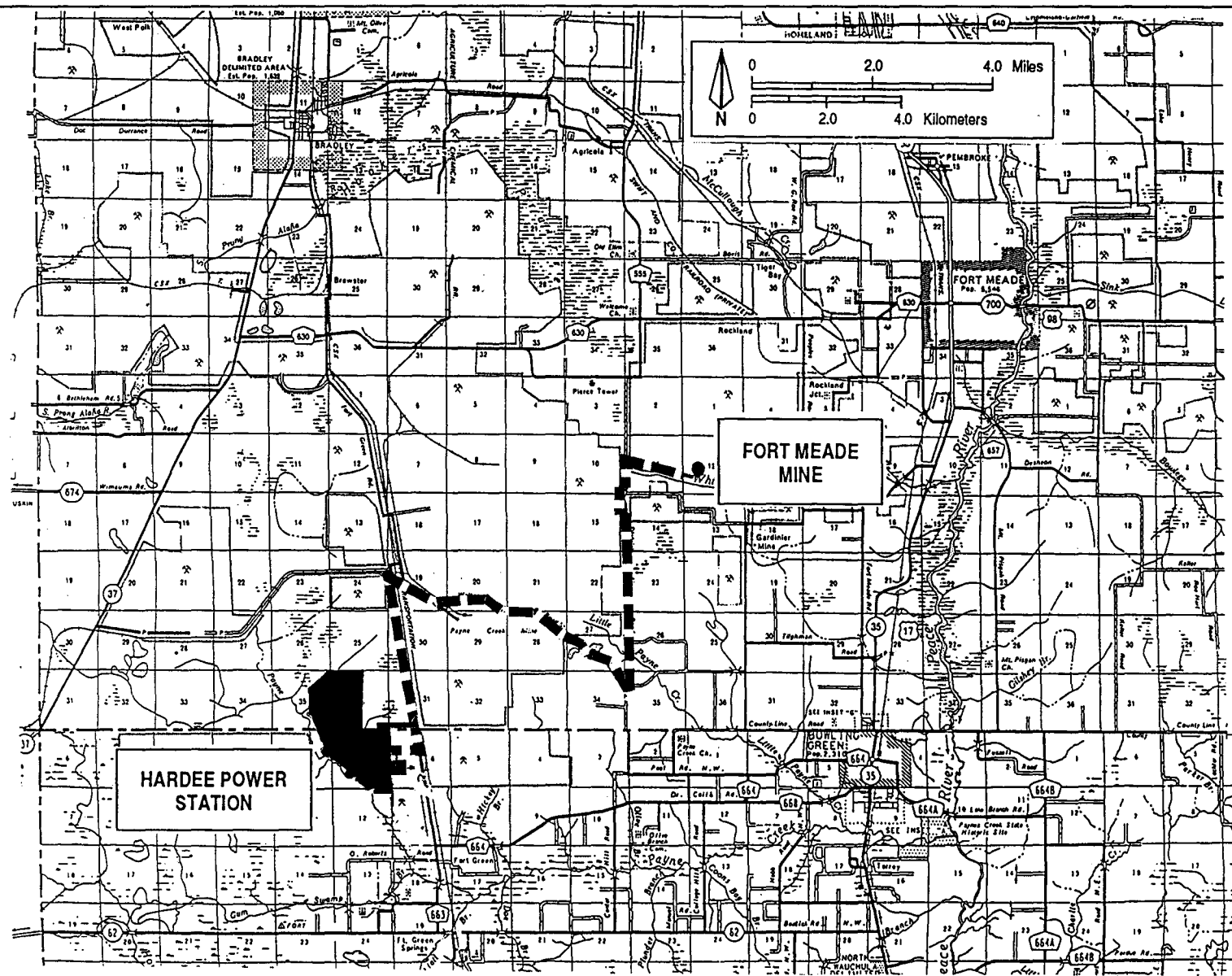


Figure 5-3
Conceptual Pipeline Routing from the Fort Meade Mine to the HPS site

Sources: FDOT, 1990 and 1992; KBN, 1994.



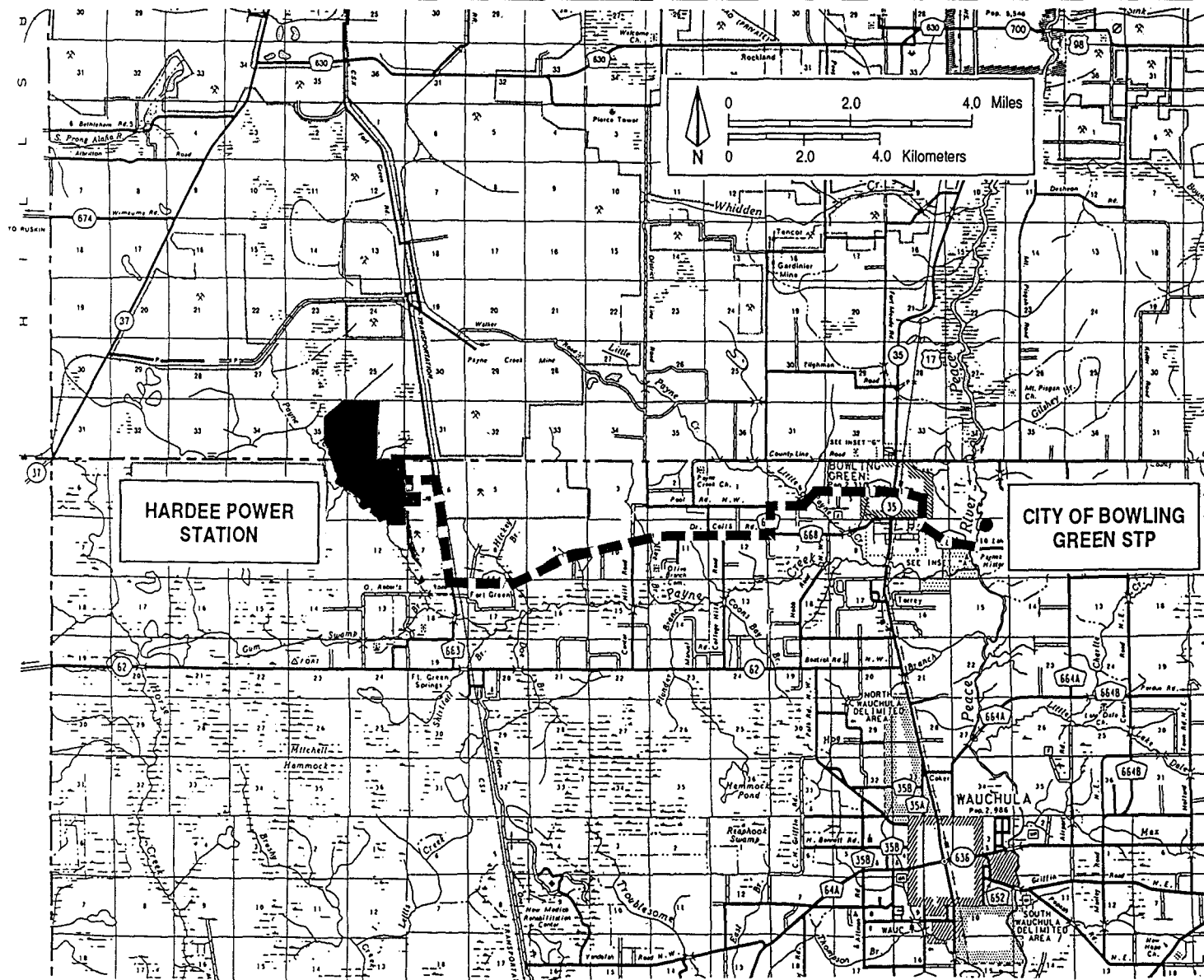


Figure 5-4
Conceptual Pipeline Routing from the City of Bowling Green Sewage Treatment Plant
to the HPS Site

Sources: FDOT, 1990 and 1992; KBN, 1994.



Table 5--3. Pipeline Budgetary Cost Estimates from Mine and/or Industrial Areas to the HPS Site

Item/Service	Description/Type	IMC--Agrico Fort Green Mine	IMC--Agrico Payne Creek Mine	Gardinier Fort Meade Mine
PVC Water Pipe	12 inch Class 150 AWWA C900	\$1,677,400	\$1,284,300	\$3,774,300
Excavation	Crawler--mounted Wheel Type, 150 HP trencher (to 24" wide and 9 ft deep), heavy soils	\$19,500	\$17,000	\$38,900
Backfill	Backfill trenches from pile, no compaction D-7 Crawler Dozer	\$15,200	\$13,300	\$30,400
Compaction	Air tamp in 8" layers	\$87,500	\$76,500	\$174,900
Truck Hauling	12 CY dump truck, 3 mi haul at 30 mph	\$2,700	\$2,300	\$5,300
Contingency (25%)		\$450,600	\$348,400	\$1,006,000
Total		\$2,252,900	\$1,741,800	\$5,029,800

Note: Cubic yard calculations based on a 24" wide and 4' deep trench
Truck hauling based on excess backfill soil due to volume (cubic yards) of 12 inch pipeline
Unit Costs includes material (when applicable), equipment, and labor
Cost does not include right-of-way acquisition fees and mobilization/demobilization
Units costs have been increased at a rate of 5% per year to reflect 1994 dollars

Source: 1990 National Construction Estimator, 1989.

Table 5-4. Budgetary Costs for Pipeline from POTWs to the HPS Site

Item/Service	Description/Type	City of Bowling Green STP
PVC Water Pipe	12 inch Class 150 AWWA C900	\$2,830,700
Excavation	Crawler-mounted Wheel Type, 150 HP trencher (to 24" wide and 9 ft deep), heavy soils	\$29,300
Backfill	Backfill trenches from pile, no compaction D-7 Crawler Dozer	\$22,900
Compaction	Air tamp in 8" layers	\$131,200
Truck Hauling	12 CY dump truck, 3 mi haul at 30 mph	\$4,000
Contingency (25%)		\$754,500
Total		\$3,772,600

Note: Estimated pipe length required for Bowling Green's STP was 12 mi.

Cubic yard calculations based on a 24" wide and 4' deep trench.

Truck hauling based on excess backfill soil due to volume (cubic yards) of 12 inch pipeline

Cost includes material (when applicable), equipment, and labor.

Cost does not include right-of-way acquisition fees and mobilization/demobilization

Unit Costs have been increased at a rate of 5% per year to reflect 1994 dollars

Source: 1990 National Construction Estimator, 1989.

Table 5-5. Summary of Firm Supply Volumes and Associated Costs

Alternative	Average Daily Supply (mgd)	Development Cost	Development Cost per Unit Flow (\$/mgd)
Existing wells	3.80	\$0	\$0
New Floridan aquifer well	1.90	\$360,000	\$189,500
Water cropping from adjacent reclaimed area	0.78	\$4,383,000	\$5,619,200
Additional HPS site runoff water cropping	0.03	\$634,000	\$21,133,300
Municipal sewage effluent from Bowling Green	0.25	\$4,193,600	\$16,774,400
Effluents from Fort Green phosphate mine	0.92	\$4,215,900	\$4,582,500
Effluents from Payne Creek phosphate mine	3.80	\$3,704,800	\$974,900
Effluents from Fort Meade phosphate mine	3.80	\$6,992,800	\$1,840,200
Deep Floridan aquifer wells	1.44	\$1,950,000	\$1,354,200

Source: KBN, 1994.

6.0 ENVIRONMENTAL REGULATION CONSIDERATIONS

6.1 PERMITTING REQUIREMENTS

Table 6-1 shows the environmental regulatory considerations that may potentially need to be addressed for each water source alternative. Regulatory issues that may require resolution are discussed in detail in the following sections.

The proposed expansion for the Hardee Unit 3 at HPS will require no change in the 3.8 mgd average monthly makeup water demand or the 8.64 mgd maximum daily demand. Continued use of the existing Floridan wells is not discussed further because it is already allowed under the existing certification conditions and, therefore, requires no regulatory action.

6.1.1 ADJACENT RECLAIMED MINE AREA FOR WATER CROPPING AND STORAGE

Water that is collected from the adjacent reclaimed phosphate mine area, estimated to cover 1,250 acres, would be impounded and pumped to the cooling reservoir; therefore, it is likely that SWFWMD would have jurisdiction over the use of this cropped water. Since the volume of water to be intercepted from the area is 780,000 gpd, agency concern is expected to be moderate. Most of the agency concerns will likely center on the reduction in water volume currently flowing to the Peace River.

This alternative would require periodic dredging of associated new settling basins and disposal of sludge from phosphate precipitation and pH adjustment that would be needed for pretreatment of the cropped water. Disposal considerations for these byproducts are discussed in Section 6.3.1.

Construction of the pipeline from the runoff holding reservoir to the cooling reservoir will involve at least a temporary alteration of a forested wetland areas and thus, would required dredge and fill permitting. Additionally, since the wetland crossing would occur in an unreleased reclaimed wetlands, a variance from the reclamation plan would be required from FDEP's Bureau of Mine Reclamation. Finally, this option would result in impacts due to the excavation of the 5-acre holding basin and the assumed offsite disposal of the 40,000 cubic yards of overburden.

Table 6-1. Regulatory Considerations for Water Use Alternatives, Hardee Unit 3

Alternative	Water Use (SWFWMD)	Industrial Waste Disposal (FDEP)	Surface Water Management (SWFWMD/FDEP)	Dredge and Fill (FDEP/SWFWMD /USACE)	NPDES Stormwater: Construction (EPA)	NPDES Stormwater: Operation (EPA)	Variance from Bureau of Mine Reclamation (FDEP)
Water Cropping: Adjacent Reclaimed Area	P	X	X	X	X	M	P
Using Municipal STP Effluent	X	X	X	P	X		P
Water Cropping from Site	P	X	X	P	X	M	P
SW/IWW from Mines	X	X	X	P	X	M	
Floridan Wells	X						
Deep Floridan Wells	X	X					

Note: M = Requires modification of present stormwater pollution prevention plan for HPS.
P = Probable involvement by regulatory agencies, depends on actual design.
X = Involvement by regulatory agencies.

Source: KBN, 1994.

Surface water management design would consist of the collection, routing, and storage structures needed to convey water from the runoff holding reservoir to the cooling reservoir, along with any necessary changes in topography. No alterations within the offsite reclaimed areas themselves are anticipated. Since the design of the surface water management system would be in compliance with SWFWMD regulations, only a low level of concern is expected within the regulatory agency for the design aspect of the project.

6.1.2 TREATED MUNICIPAL SEWAGE EFFLUENT

The use of treated wastewater from the city of Bowling Green is an attractive alternative from a regulatory standpoint, especially given the current emphasis on water reuse in the SWFWMD's Southern Water Use Caution Area (SWUCA). However, given the low average effluent flow from the STP (i.e., 0.21 mgd), the overall water conservation benefits are not great. A discussion of the SWUCA implications of this alternative is presented in more detail in Section 6.2.

The pipeline construction for this alternative is conceptually designed to follow existing rights-of-way. While this routing scheme will minimize wetlands impacts, such impacts will still occur at crossing of any water bodies as well as other locations. Pipeline construction activities in wetlands will occur and, therefore, the effect of these activities will be of concern to regulatory agencies. Dredge or fill within wetlands will be transitory events but may still require mitigation other than replanting. Potential erosion and sedimentation impacts associated with construction can be addressed through appropriate sediment and erosion control practices. Overall regulatory concern regarding dredge and fill activities (e.g., removal of woody and/or herbaceous wetland plants during construction) and erosion/sedimentation control (e.g., maintenance of water quality standards) will likely be moderate.

Regulatory concern is expected to be moderate for this option and, while regulatory agencies may encourage the use of this water source to conserve water, construction impacts may outweigh the small water saving.

6.1.3 CROPPING/IMPOUNDING ADDITIONAL RUNOFF FROM HPS SITE

The environmental regulatory considerations for this water source alternative are similar to those for collecting runoff from the adjacent reclaimed mine area discussed in Section 6.1.1, above.

The use of runoff from the HPS site would be subject to the jurisdiction of the SWFWMD since it would be impounded and pumped from a newly constructed holding reservoir that is pumped into the cooling reservoir. Concern over the impact of water cropping on flow regimes in Payne Creek would need to be addressed.

This alternative would require periodic dredging of associated new holding reservoirs and disposal of sludge from phosphate removal processes and pH adjustment that would be needed for pretreatment of the cropped water. Disposal considerations for these byproducts are discussed in Section 6.3.3.

Construction of the pipeline from the runoff holding reservoir to the cooling reservoir will involve at least a temporary alteration of wetland areas and thus, would require dredge and fill permitting. Surface water management design would consist of the collection, routing, and storage structures needed to convey water from the runoff holding reservoir to the cooling reservoir, along with any necessary changes in topography. No alterations within the reclaimed areas themselves are anticipated. If the design of the surface water management system is in compliance with SWFWMD regulations, only a low level of concern is expected within the regulatory agency.

6.1.4 WATER REUSE FROM NEIGHBORING PHOSPHATE MINE DISCHARGES

From a regulatory standpoint, the reuse of industrial wastewater from phosphate mines would be regarded favorably given the current emphasis on water reuse in the SWUCA. However, use of this water source would reduce existing point source discharges to the Peace River and/or its tributaries. In addition, the "cropping" of these discharge streams would raise concerns similar to those for the other water cropping alternatives discussed previously, since surface inflow and shallow groundwater discharge to Payne Creek could be affected.

Implementation of this alternative would require periodic dredging of associated new settling basins and disposal of sludge from phosphate precipitation and pH adjustment that would be needed for pretreatment of the cropped water. Disposal considerations for these byproducts are discussed in Section 6.3.4. Because a greater degree of phosphate precipitation would be needed compared to the other water cropping options, the volume of sludge that would require disposal would be larger.

Dredge and fill concerns related to pipeline construction would raise issues similar to those discussed in Section 6.1.2.

6.1.5 FLORIDAN AQUIFER WELLS

The primary regulatory constraint to this water use alternative is the fact that the site lies within the SWFWMD's newly declared SWUCA, which was formed because of concerns over saltwater intrusion and low lake levels. SWUCA encompasses the eight southern counties of the District. Rulemaking is now in progress within the area through the adoption of a management plan drafted by the District. If additional Floridan aquifer wells were installed, they would not increase authorized groundwater withdrawals from the site.

The Hardee Unit 3 site is located approximately 12 miles to the east of the region referred to as the Most Impacted Area (MIA), which lies in the western portions of Hillsborough and Manatee counties. Within the MIA, the potentiometric surface of the Floridan aquifer is thought to be below sea level under existing conditions, which suggests a high risk of saltwater intrusion into the potable water of the upper Floridan aquifer. Under existing SWFWMD regulations, even applications for water users outside the MIA are required to demonstrate that their proposed water use will not affect the MIA boundary. As demonstrated in the 1989 SCA (TPS/SECI, 1989), the average withdrawal at HPS creates a drawdown of less than 0.2 ft at the property boundary. Since this drawdown is estimated to occur at the property boundary and the MIA is 12 miles west of HPS, it can be concluded that no drawdown due to HPS will be observed at the MIA boundary. Further, since there is no proposed increase in groundwater withdrawals, this review is not triggered.

6.1.6 DEEP FLORIDAN AQUIFER (> 2,000 FT) WELLS

The deep Floridan aquifer has high total dissolved solids concentrations. Therefore, use of treated lower Floridan aquifer water would constitute an "alternative" use and would be looked upon more favorably by SWFWMD than the use of upper Floridan aquifer water. Extensive aquifer testing of the deep Floridan formations would be required (due to the paucity of regional data) prior to drawdown modeling that would determine if this source would trigger any SWUCA related restrictions.

6.2 ENVIRONMENTAL BENEFITS FROM USING WASTEWATER

The reuse of STP and/or industrial effluent is currently being encouraged by SWFWMD, and the emphasis on reuse is expected to continue. The HPS site is in the SWUCA and is not far (i.e., approximately 12 miles) from the boundary of the MIA of the SWUCA. Therefore, any reuse of water is beneficial in that it removes the need for additional groundwater withdrawals to satisfy the need for water.

The Bowling Green STP and several phosphate mines discharge treated wastewater to the Peace River or its immediate tributaries. Use of treated effluent by Hardee Unit 3 would remove point source discharges to the river. Diversion of these point sources also would prevent these water flows from entering the river; and thereby exacerbate the Peace Rivers' already reduced flows because of mining related surface water impoundments.

Information indicates that reclaimed water from either the STP or the industrial dischargers could, after pretreatment, be used as makeup to the cooling reservoir. However, none of these candidate sources represents a viable supply of plant service water because their quality variability exceeds the capabilities of the HPS site's process treatment system and could jeopardize the ability of the system to meet boiler feed water requirements.

6.3 ENVIRONMENTAL CONSIDERATIONS FOR DISPOSAL OF TREATMENT BYPRODUCTS

Table 6-2 shows treatment byproducts for each of the six water source alternatives. Details of the disposal considerations for each alternative are discussed below. The disposal of wastes for the various options would be under FDEP jurisdiction. At present, treatment byproducts of the types described in this study are routinely deposited in local county landfills, and it is assumed that landfilling will continue to be viable for these types of solid wastes.

6.3.1 WATER CROPPING FROM ADJACENT RECLAIMED PHOSPHATE MINE

As noted in Section 3, water from adjacent reclaimed phosphate areas may need treatment for the removal of suspended solids and phosphate, and possible pH adjustment. Treatment would require sediment and coagulation basins, which will need periodic excavation to remove accumulated material. The material removed would consist of inert inorganic solids and smaller

Table 6-2. Water Treatment Byproduct Types Associated With Alternative Water Sources, Hardee Unit 3

Water Source	Organic/ Inorganic Solids	Sludge from Phosphorus and pH Treatment	Chemical Pretreatment Wastes
Clay Settling Areas	X	X	
Treated Municipal Effluent	X		
Water Cropping from HPS Site	X	X	
Wastewater/Runoff from Mines	X	X	X
Floridan Wells			
Deep Floridan Wells			X

Source: KBN, 1994.

amounts of organic solids which are not expected to contain hazardous components. These materials might require landfilling if they were not suitable as fill or topsoil.

The sludge and solid byproducts generated by these treatment processes can be disposed of by a licensed waste disposal company. However, the byproducts may be accepted for disposal at local county landfills providing they meet toxicity characteristic leaching procedure (TCLP) testing requirements. Additionally, experience in the disposal of inert solids from cogeneration plants in Pasco, Polk, and Lake counties indicates that landfills may be reluctant to accept these types of solid wastes. Trucking the materials to landfills would be a fairly frequent occurrence and trucking distances as far as 120 miles have been experienced.

6.3.2 TREATED MUNICIPAL SEWAGE EFFLUENT FROM BOWLING GREEN

Contact chlorination does not produce solid or liquid byproducts, so the only materials generated would be organic solids and smaller amounts of inorganic solids that would be removed from the polishing reservoir during periodic maintenance. These byproducts are typically disposed of in a landfill, subject to TCLP testing requirements. As noted in Section 6.3.1, trucking requirements for solid waste disposal can be considerable.

6.3.3 CROPPING/IMPOUNDING RUNOFF FROM HPS SITE

Treatment for this option would be the same as for the adjacent reclaimed phosphate mine areas (see Section 6.3.1), and disposal considerations are therefore the same.

6.3.4 INDUSTRIAL WASTEWATER FROM NEIGHBORING PHOSPHATE MINES

The same byproducts would be generated for this option as for the water cropping areas and HPS runoff, but in addition there might be a need for more extensive pretreatment for the industrial wastewater portion of this water source. Depending on the nature of the wastewater, treatment trains could be at least as involved as those outlined for the water cropping areas.. Byproducts generated from this type of a treatment, and the limited disposal options, would be similar in scope to those outlined in Section 6.3.1.

6.3.5 FLORIDAN AQUIFER WELLS

No pretreatment would be needed for this water source; therefore, there would be no treatment byproducts.

6.3.6 DEEP FLORIDAN (>2,000 FT) AQUIFER WELLS

Water from the lower Floridan aquifer is high in TDS, which would require removal prior to use as makeup to the cooling reservoir. Treatment would be accomplished through RO, which produces a reject water that has very high TDS (20,000 to 30,000 mg/L). The disposal of reject water through deep-well injection is not likely to be viewed favorably by regulatory agencies. In addition, deep-well injection is not recommended because the injection zone would be the lower Floridan aquifer, so there would be long-term potential to increase the TDS of the source water, thereby increasing the need for and cost of pretreatment.

Evaporation of RO reject water can be accomplished using some form of crystallizer in combination with waste heat from the plant. The resulting brine salts can be disposed of in a lined landfill or removed by a licensed hauler. RO reject salts from similar treatment systems currently in operation are routinely disposed of in local landfills once they have passed TCLP testing requirements. As noted in Section 6.3.1, disposal of these types of crystallizer salts can be problematic.

7.0 RATING AND RANKING OF ALTERNATIVES

7.1 METHODOLOGY

The alternative water sources considered most feasible for the Hardee Unit 3 Project (identified in Section 3.1) were evaluated using an analytical technique that rates each alternative against specific technical, economic, and other criteria. To reflect the relative importance of each criterion, weights were developed for use as multipliers for each criterion rating. Individually weighted criterion ratings were then summed for all criteria to develop an overall ranking.

Each alternative was ranked with respect to the specific criteria using the technique described by Motayed (1980). The methodology differs from most rating schemes, which usually involve assigning absolute numbers to each alternative to indicate its strength or weakness against subjectively weighted criteria. Rather, this technique attempts to reduce subjectivity by comparing the alternatives, two at a time, with respect to the different criteria. Judgments such as poor, excellent, or how much better one water source is than another are not made. The only necessary determination is which alternative is better, or if the sources are generally equal when assessed with respect to a given criterion. Figure 7-1 and Table 7-1 present a detailed step-by-step description of the process.

Source coefficients were determined for each potential water source to indicate the acceptability of the source with respect to each criterion. For each criterion, the coefficients were calculated by comparing the alternatives, two at a time. For example, the source option that is determined to be more suitable or superior with respect to the given criteria was assigned one point; the other source option (i.e., the inferior source relative to the criterion) was assigned zero points. If the two source options were determined to be roughly equal, each was assigned one-half point. This pairwise source comparison was conducted for all combinations of alternatives. So that no source option received a zero rating, a dummy source option was included that, by definition, was inferior to all the others (see Table 7-2, Part A).

For each source, the results of the alternative comparisons (i.e., comparison ratings) were summed. The unweighted coefficients were then calculated by dividing the sums by the total number of comparisons (see Table 7-2, Part B). As a result, the unweighted coefficients for each potential source are all less than one.

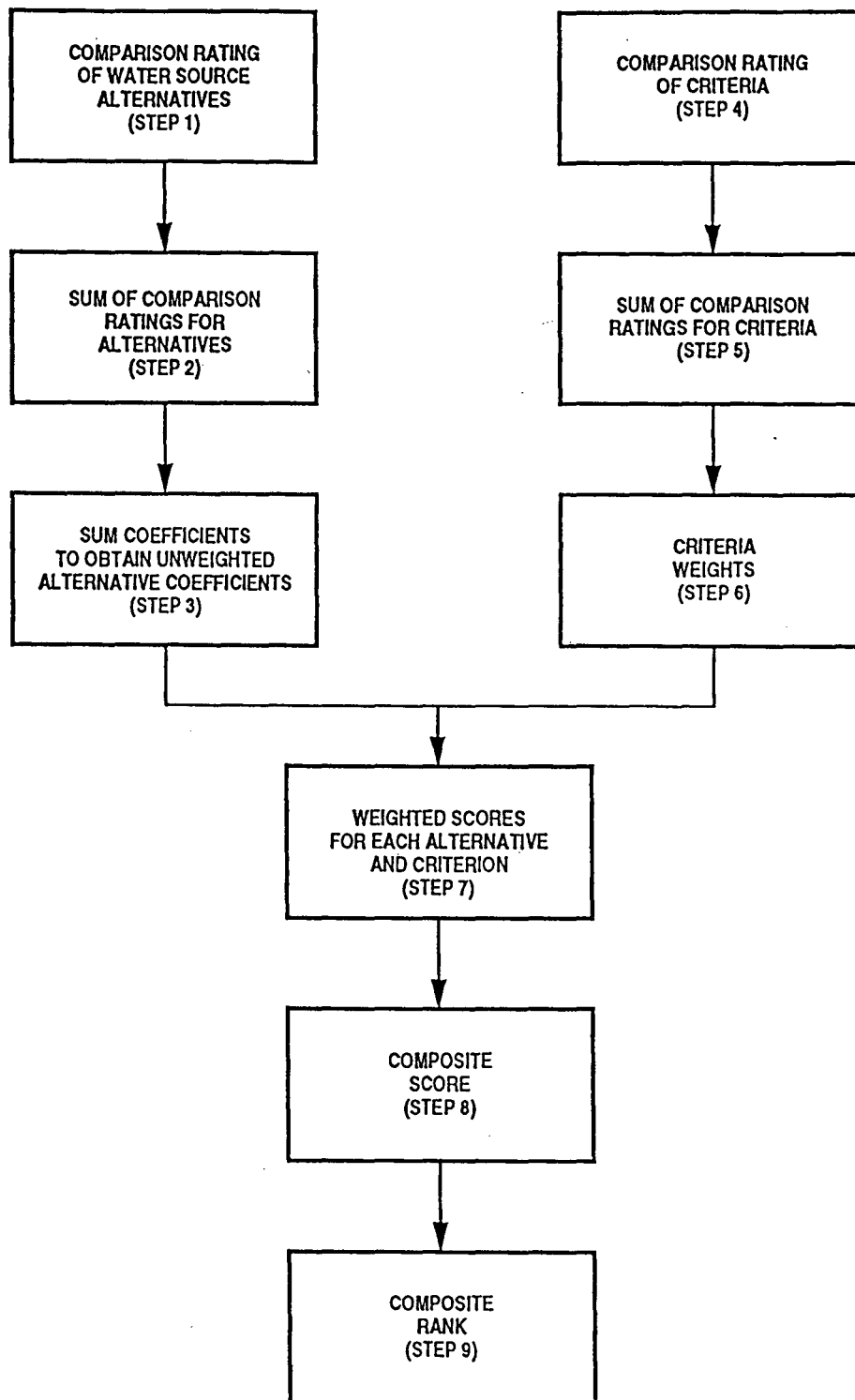


Figure 7-1
Alternative Analysis Procedure

Source: KBN, 1994.



Table 7-1. Alternative Analysis Procedure

Step	Description
1	Perform one-to-one comparison of all alternatives for each criterion to determine ratings
2	Sum comparison ratings for each alternative
3	Obtain unweighted discipline coefficient for each criterion by dividing sum of comparison ratings for each alternative (Step 2) by the total sum over all alternatives for each criterion
4	Perform one-to-one comparison rating of all criteria
5	Sum comparison rating for each criterion
6	Obtain criterion weight by dividing sum of comparison ratings for each criterion (Step 5) by total sum over all criteria
7	For each alternative, multiply the unweighted alternative coefficient for each criterion (Step 3) by the corresponding criterion weight (Step 6) to obtain weighted scores for each alternative and criterion
8	Sum weighted scores to obtain composite score
9	Rank alternatives in order of increasing composite score

Source: KBN, 1994.

Table 7-2. Illustrative Example of Rating and Ranking Procedure Used in Analysis of Potential Water Sources (Page 1 of 2)

A. Criterion Rating for Alternative Source X1

Potential Source	Source Comparison Ratings						Sum	Unweighted Coefficient
A	1	1	1				3	$3/6 = 0.5$
B	0			0.5	1		1.5	$1.5/6 = 0.25$
C		0		0.5		1	1.5	$1.5/6 = 0.25$
Dummy			0	0	0	0	<u>0.0</u>	
							6.0	

B. Summing Source Coefficients

Potential Source	Source Criteria			Sum	Unweighted Criteria
	X1	X2 ^a	X3 ^a		
A	0.5	0.25	0.25	1.0	$1/3 = 0.33$
B	0.25	0.5	0.5	1.25	$1.25/3 = 0.42$
C	0.25	0.25	0.25	<u>0.75</u>	$.75/3 = 0.25$
Total				3.0	

C. Weights for Criteria (Steps 4 to 6)

Criteria	Criterion Comparison Ratings						Sum	Criteria Weight
X	1	0	1				2.0	$2/6 = 0.33$
Y	0			0	1		1.0	$1/6 = 0.17$
Z		1		1		1	3.0	$3/6 = 0.50$
Dummy			0		0	0	<u>0.0</u>	$0/6 = 0.00$
							6.0	

Table 7-2. Illustrative Example of Rating and Ranking Procedure Used in Analysis of Potential Water Sources (Page 2 of 2)

D. Summation of Source Rating for Each Potential Source

Criterion	Potential Site Source		
	A	B	C
Unweighted:			
X	0.33	0.42	0.25
Y	0.42	0.33	0.25
Z	0.42	0.25	0.33
Composite Rating:	1.17	1.00	0.83
Ranking	1	2	3
Weighted:			
X	0.11	0.14	0.08
Y	0.07	0.06	0.04
Z	0.21	0.13	0.17
Composite Rating	0.39	0.33	0.29
Ranking	1	2	3

^a Criterion ratings are not shown.

Source: KBN, 1994.

Each criterion was compared in a similar manner to obtain the criteria weights (see Table 7-2, Part C). The resultant weighted scores were summed for each potential source to determine the composite ratings (see Table 7-2, Part D) and an overall rank.

7.2 ALTERNATIVE CRITERIA

Six criteria were identified to evaluate the selection of a potential water source for the Hardee Unit 3 Project. These criteria reflect the major environmental, engineering, economic, regulatory, and other considerations that can influence the suitability of a particular source. Criteria definitions are summarized in Table 7-3.

7.2.1 AVAILABILITY AND RELIABILITY OF SUPPLY

Each potential source was evaluated as to its sufficiency to supply HPS with the 3.8 mgd monthly average and 8.64 mgd daily average total makeup supply (i.e., for cooling reservoir makeup and plant service water). To the extent that the quantity of water required for the project is available and its continued availability is not in question, it will be assessed with relatively higher ranking. Sources that can supply only part of the demand were ranked lower.

In addition, the reliability of each water source alternative also must be considered in assessing a potential water source. For example, while water cropping may provide a sufficient quantity of water on an annual basis, it is an inherently unreliable means of obtaining water without major storage provisions.

7.2.2 QUALITY AND CONSISTENCY OF SUPPLY

In order to be a useful water source for the purpose of condenser cooling at a steam electric power generating facility, a consistently high water quality is desirable. To the extent that certain sources of water may provide water of poor and/or variable quality in terms of dissolved or suspended solids or organic loading, such waters would be of less utility to the project without additional capital expenditure and consequently receive a lower ranking.

7.2.3 ENVIRONMENTAL IMPACT

Each of the proposed water source alternatives includes inherent environmental impacts associated with their implementation. Several of the evaluated alternatives may require construction of pipelines or other conveyance features in sensitive areas; others would require significant storage

Table 7-3. Summary of Criteria Definitions

Criterion	Criterion Definitions
Availability and Reliability	Sources with a sufficient quantity of water on a day-to-day basis are ranked higher than other sources
Quality and Consistency	Sources with higher and more consistent quality with respect to dissolved solids, suspended solids, and organic loadings are ranked higher than other sources
Environmental	Sources whose implementation causes less environmental impact are ranked higher than other sources
Engineering	Sources that require less constructed facilities are ranked higher than other sources
Cost	Sources with higher cost are ranked lower than other sources
Regulatory	Sources that incur more regulatory agency purview and concern are ranked lower than other sources

Source: KBN, 1994.

facilities or other structures related to runoff management. Sources utilizing groundwater may contribute to impacts to the source aquifer.

7.2.4 ENGINEERING CONSIDERATIONS

Engineering considerations include the extent and complexity of pretreatment requirements for the proposed source water, compatibility with the existing systems design, and any ancillary facilities which would be required for implementation of the source option. The greater the pretreatment requirements or modifications to the existing system which are required, the less favorable ranking would be applied to a given source option

7.2.5 COST

Cost considerations are directly dependent on engineering considerations. To the extent that a water source option includes greater costs which are associated with extensive pretreatment systems or other constructed facilities, it will be less highly ranked.

7.2.6 REGULATORY CONSIDERATIONS

Each water source option will entail environmental permitting for certain aspects of the required implementation activity. These regulatory considerations can pose significant scheduling obstacles for the Hardee Unit 3 Project implementation.

7.3 WATER SOURCE RANKINGS

7.3.1 OVERVIEW

The water source ranking consisted of two tasks that determined the overall suitability of each potential water source. Task 1 involved an evaluation to determine if any of the proposed water sources had any constraints that would preclude development for the project. This involved an evaluation of potential costs and other factors associated with each water source.

Task 2 involved source evaluations as described in Section 7.1. In this task, sources were compared two at a time using the criteria established to distinguish source benefits or drawbacks.

7.3.2 SOURCE EVALUATIONS

The results of the source evaluations for each criterion are presented in Table 7-4. This table lists both unweighted and weighted ratings and rankings. The detailed source evaluations are presented in Attachment C.

Supply and Reliability

In the supply and reliability category, use of the existing Floridan wells, installing additional Floridan aquifer wells and deep Floridan aquifer were tied for the highest rating. These three potential sources offer the most reliable supply of water for the proposed expansion on a day to day basis. The water cropping options followed these groundwater options due to rainfall variability. Wastewater recovery from both industrial and municipal sources were rated lowest due to the low flow available from the municipal sources and the uncertain status of phosphate mining activities over the expected project life.

Quality and Consistency

The highest rated water source options with respect to water quality and as well as quality consistency were those utilizing the upper Floridan aquifer. Use of either treated industrial effluent and the two water cropping options were in the second tier of ratings. Water quality issues associated with these options were rated lower due to the expected higher magnitude of quality fluctuations from those options. Use of deep Floridan aquifer water was rated last due to its higher dissolved solids content than any other source water option.

Environmental Impacts

Use of the existing Floridan wells had the highest rating for the environmental impact criterion because it represents no change of an existing minimal impact use. Additional Floridan wells were rated second because although new well(s) would be drilled, no additional pumping would occur. The use of treated effluents or cropped water were the lower rated options because the potential impacts of watershed flow reduction, construction impacts, and operational solid waste management issues were deemed to outweigh the water reuse benefits.

Engineering

For the engineering criterion, maintenance of the existing withdrawals from the upper Floridan aquifer and installation of additional Floridan wells were rated well above all other water source

Table 7-4. Source Ratings and Rankings

Rating Criteria	Weights	Potential Sources						
		Existing Floridan Wells	Adjacent Areas Water Cropping	Treated Sewage Effluent	Site Water Cropping	Industrial Effluent	New Floridan Aquifer Wells	Deep Floridan Aquifer Wells
<u>Unweighted</u>								
Water Availability		0.21	0.11	0.04	0.13	0.09	0.21	0.21
Water Quality		0.23	0.13	0.09	0.14	0.14	0.23	0.04
Environmental Characteristics		0.25	0.07	0.11	0.07	0.13	0.21	0.16
Engineering Considerations		0.25	0.11	0.11	0.11	0.09	0.21	0.13
Capital Costs		0.25	0.11	0.04	0.11	0.11	0.21	0.18
Regulatory Considerations		0.25	0.04	0.14	0.11	0.14	0.18	0.14
Sum of Criteria Scores		1.45	0.55	0.52	0.66	0.70	1.27	0.86
Unweighted Source Ranking		1	6	7	5	4	2	3
<u>Weighted</u>								
Water Availability	0.29	0.06	0.03	0.01	0.04	0.03	0.06	0.06
Water Quality	0.19	0.04	0.02	0.02	0.03	0.03	0.04	0.01
Environmental Characteristics	0.14	0.04	0.01	0.02	0.01	0.02	0.03	0.02
Engineering Considerations	0.07	0.02	0.01	0.01	0.01	0.01	0.02	0.01
Capital Costs	0.17	0.04	0.02	0.01	0.02	0.02	0.04	0.03
Regulatory Considerations	0.14	0.04	0.01	0.02	0.02	0.02	0.03	0.02
Sum of Criteria Scores	1.00	0.24	0.10	0.08	0.11	0.12	0.21	0.15
Weighted Source Ranking		1	6	7	5	4	2	3

Source: KBN, 1994.

options. These options present little, if any, need for modifications to the existing physical plant at the site. All other options were rated significantly lower and fairly closely together because they all would require the construction of significant pretreatment and solid waste handling facilities as well as varying lengths of pipelines.

Cost

The least expensive (and, highest rated) option was use of the existing Floridan wells because no incremental costs are needed for its implementation. This and all other options were rated based on the unitary development costs (\$/mgd) as developed in Section 3.

Regulatory

Using the existing Floridan aquifer wells was rated highest for the regulatory criterion because it represents a continued use of an already licensed, minimal impact water use. Installing additional Floridan wells was rated second because no additional water use (and, thus, no operational impacts) are required for this option. Reuse of treated effluents and deep Floridan wells were all rated third because all represent a water use benefit (in the form of using non-traditional sources) but also have construction and/or operational impacts. The two water cropping options were rated lowest based on their resulting reduction in streamflow from the Peace River, construction impacts to wetlands, and potential operational impacts.

Summary

The overall source unweighted rating indicates that maintenance of the original water source configuration has the highest combined rating and thus the highest ranking.

The criteria weights, determined using the same comparison process as the source evaluations, found the availability criterion to be the most highly weighted. Water quality, followed by cost were rated as the second and third, respectively, important criteria. Environmental impacts and regulatory engineering considerations were rated to be equal and of slightly less significance than the above mentioned criteria. Engineering considerations were rated last of the evaluation criteria.

The application of weights to the source evaluations did not alter the source rankings. In both the unweighted and weighted rankings, use of the existing Floridan aquifer wells was ranked first,

followed by additional Floridan wells and deep Floridan wells. The rankings are rounded out by use of industrial effluent, site water cropping, water cropping from the adjacent reclaimed area, with use of treated sewage effluent ranked last.

8.0 RECOMMENDATION

The recommended water source for the Hardee Unit 3 Project is to utilize the existing certified cooling reservoir configuration and groundwater consumptive use allocation for the HPS. The reasons for this selection include:

1. The existing cooling reservoir was originally designed with sufficient safety margins that allow for the incremental increase in power generation from 660 MW to 880 MW; and
2. Use of the existing cooling reservoir and groundwater allocation results in the lowest overall environmental impacts while optimizing the use of available water resources.

In summary, the recommended alternative of using the existing certified cooling reservoir and consumptive use allocation to supply all water needs for the Hardee Unit 3 Project is at once the most environmentally sound and cost-effective alternative available.

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ATTACHMENT A
DESCRIPTION OF THE HEAT BUDGET MODEL

ATTACHMENT A

DESCRIPTION OF THE HEAT BUDGET MODEL

The basis for the cooling reservoir thermal analysis is the equilibrium temperature model presented by Sonnichsen (1975), as follows:

$$T_A = E + (T_i - E) e^{(-KA/\rho Q_p C_p)}$$

where:

- T_A = Reservoir temperature (°F),
- E = Equilibrium temperature (°F),
- T_i = Reservoir inlet temperature (°F),
- K = Thermal exchange coefficient (Btu/ft²-°F-day),
- A = Area (ft²),
- ρ = Weight of water (lb/ft³),
- Q_p = Pumping rate (ft³/day), and
- C_p = Specific heat of water (Btu/lb-°F).

Tetra Tech (1980) presented the following method for estimating equilibrium temperature, E :

$$E = \frac{0.05E^2}{K} + \frac{H_R - 1801}{K} + \frac{K - 15.7}{K(0.26+B)} [e_a - C(B) + 0.26T_{air}]$$

where:

- H_R = Net incoming short- and long-wave radiation (Btu/ft²-day),
- T_{air} = Air temperature (°F),
- e_a = Water vapor of air at air temperature,
- B = Proportionality coefficient (mmHg/°F), and
- $C(B)$ = Dependent value of B (mmHg) with the other variables defined as in this listing.

B is defined as:

$$B = 0.255 - 0.0085 T_{air} + 0.000204 (T_{air})^2$$

C(B) was determined from regression analysis of tabular data included in Tetra Tech (1980), and is presented in Table A-1.

The thermal exchange coefficient, K, is defined as:

$$K = 15.7 + (0.26 + B)f(u)$$

where: $f(u)$ = windspeed function.

The windspeed function is defined as:

$$f(u) = 70 + 0.7 u^2$$

where: U = average windspeed (mph).

Given the interrelated nature of these equations, the equilibrium temperature was calculated iteratively from the various monthly data.

Using this equilibrium temperature, the Sonnichsen (1975) model was applied. For the purpose of this analysis, the 570-acre cooling reservoir was mathematically segmented into ten 57-acre cells; plug flow was assumed through these cells. The temperature calculated for any given cell was then used as the inlet temperature for the next cell.

The differences between the original model and the model used in this analysis are the form of the regression analysis used to estimate C(B) and meteorological data used in the computations.

The regression analysis used in the original model consisted in several successive regressions of data presented in Table A-1 for different temperature increments. The regressions used in the original modeling exercise were as follows:

<u>Temperature Range</u>	<u>Regression Equation</u>
< 60.99	$-242.174 + 63.25\ln(T)$
62 - 71.99	$-139 + 38.104\ln(T)$
72 - 76.99	$-0.9096e^{(0.0456T)}$
77 - 83.99	$-0.172e^{(0.067T)}$
84 - 89.99	$-1424 + 332.77\ln(T)$
> 90	$-1303 + \ln(T)$

Table A-1. Volumes of B and C(B) as Functions of Temperature

Temperature (°F)	B (mmHg/°F)	C(B) (mmHg)	Temperature (°F)	B (mmHg/°F)	C(B) (mmHg)
45	0.286	-5.5	70	0.660	-22.9
46	0.296	-4.5	71	0.680	-23.6
47	0.306	-4.1	72	0.701	-24.4
48	0.317	-4.2	73	0.722	-25.4
49	0.328	-4.6	74	0.743	-26.5
50	0.340	-5.4	75	0.765	-27.8
51	0.352	-6.3	76	0.787	-29.3
52	0.365	-7.5	77	0.810	-31.0
53	0.378	-8.7	78	0.833	-33.0
54	0.391	-10.0	79	0.857	-35.1
55	0.405	-11.2	80	0.881	-37.6
56	0.419	-12.5	81	0.905	-40.3
57	0.433	-13.6	82	0.930	-43.2
58	0.448	-14.7	83	0.955	-46.4
59	0.464	-15.8	84	0.980	-49.7
60	0.479	-16.7	85	1.006	-53.3
61	0.496	-17.6	86	1.033	-57.1
62	0.512	-18.3	87	1.060	-61.0
63	0.529	-19.0	88	1.087	-64.9
64	0.547	-19.6	89	1.114	-68.9
65	0.564	-20.1	90	1.142	-72.9
66	0.583	-20.7	91	1.171	-76.7
67	0.601	-21.2	92	1.200	-80.4
68	0.620	-21.7	93	1.229	-83.8
69	0.640	-22.3	94	1.259	-86.8
			95	1.289	-89.3

Note: B = Proportionality coefficient (mmHg/°F).
C(B) = Dependent value of B (mmHg) with the other variables as defined.

The regressions used in this modeling exercise are:

$$\text{For } T < 60 \quad C(B) = a + bT^{0.5} + cT^{0.5} + d[\ln(T)]/T \quad r^2 = 0.997; \text{ and}$$

$$\text{For } T > 60 \quad C(B) = a + bT + cT^2 + d/T + e/T^2 \quad r^2 = 0.999$$

The regression coefficients are:

Coefficient	T < 60	T > 60
a	49,187.661	28,920.0743
b	-1,624.6574	-244.66582
c	-648,322.63	0.74747392
d	689,900.71	28,008,800

The net result from using the new regression analysis are C(B) values that more closely approximated in the 77 - 83.99°F temperature range (see Figure A-1). And, the majority of the estimated water temperature values fall within that temperature range. It should be noted both the original and this new regression analyses provide very accurate estimates of the temperature versus C(B) relationship (see Figure A-2).

The climatological data based used in the previous analysis was from several stations near (i.e., < 50 miles) the plant site. The climatological data used in this analysis is from the Orlando International Airport (MCO) weather station. The MCO database was considered the preferred data set because of its completeness and the ability easily trace individual data points back to their daily (or hourly) records. These data provide a 37-year monthly record for modeling analysis.

A check on the heat budget model accuracy was made by comparing the model's predicted water temperature against measured water temperature. Figure A-3 shows a comparison of estimated equilibrium temperatures with measured lake temperatures. The lake temperatures shown include several lakes from the Lakeland and Lake Wales areas. Several lakes were used in this comparison because no one lake had a sufficient data base to make a meaningful comparison. The lake and equilibrium average temperature comparison shows that equilibrium temperature is approximately 4.2 percent less than the average lake temperature. The majority of this difference is a result of the high lake temperatures measured in the summers of 1974 through 1977.

A-5

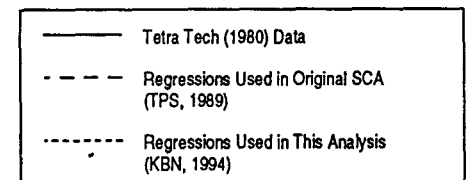
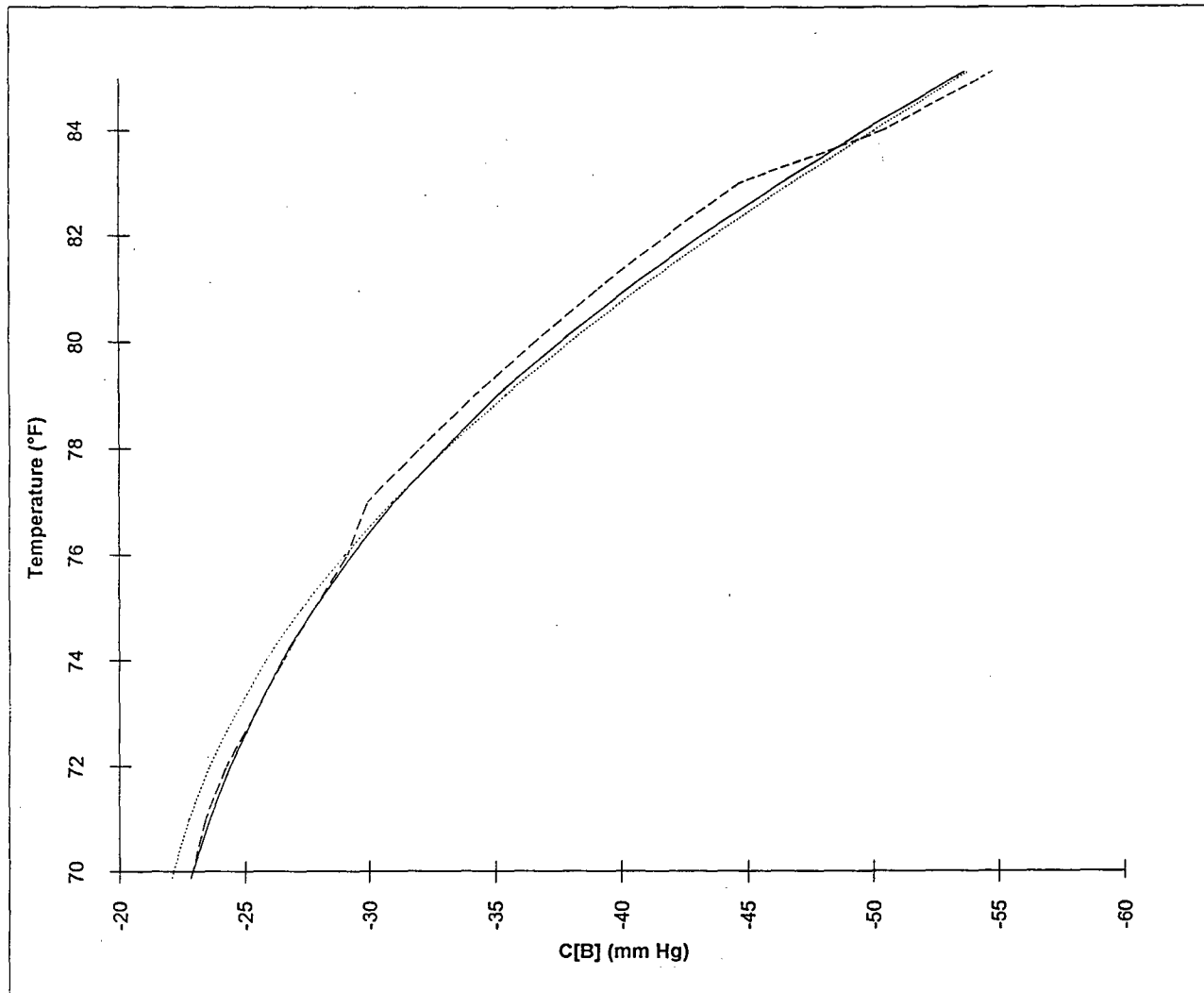


Figure A-1
Temperature versus C(B) Relationship for Temperature Range
From 70°F to 84°F

A-6

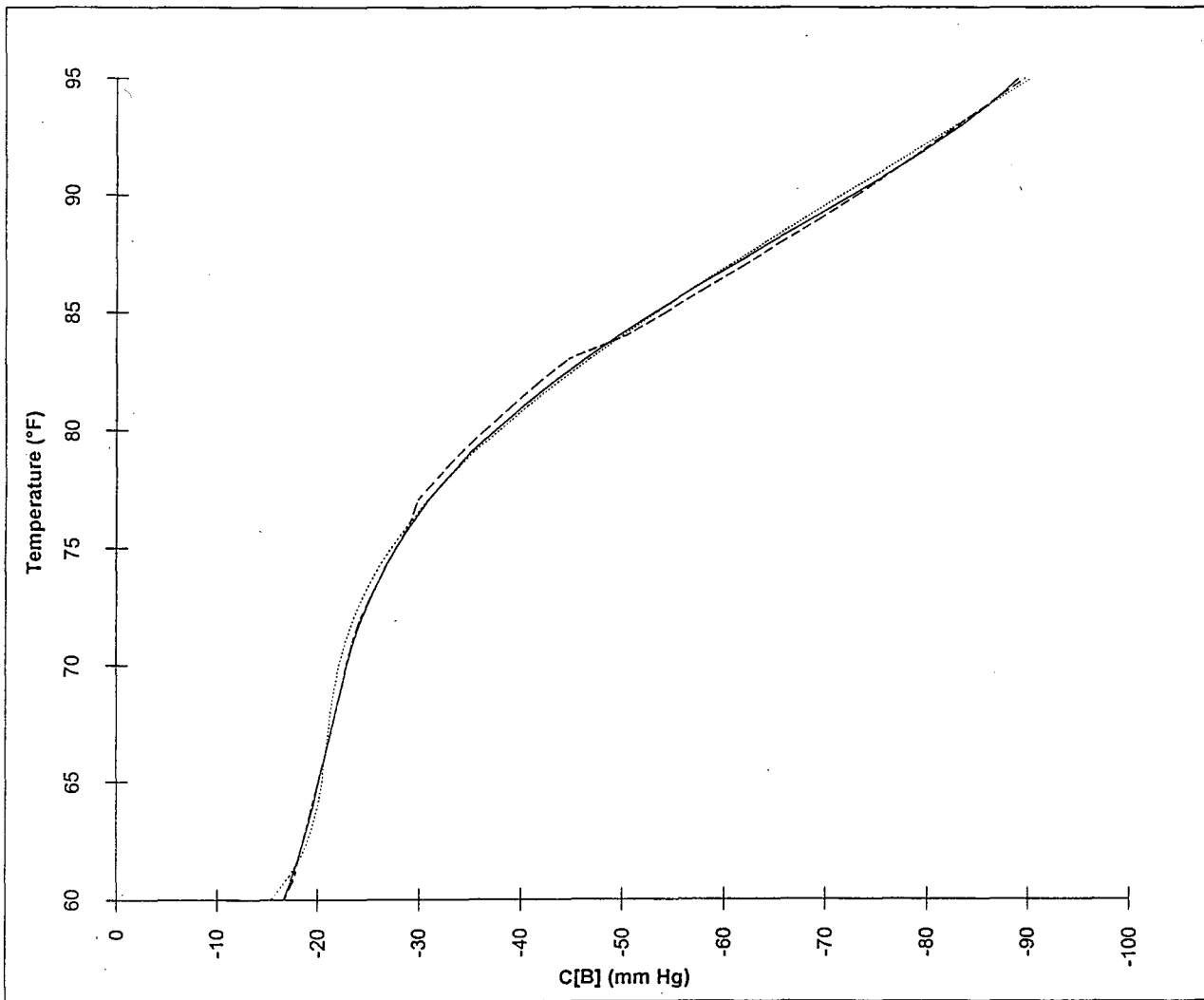
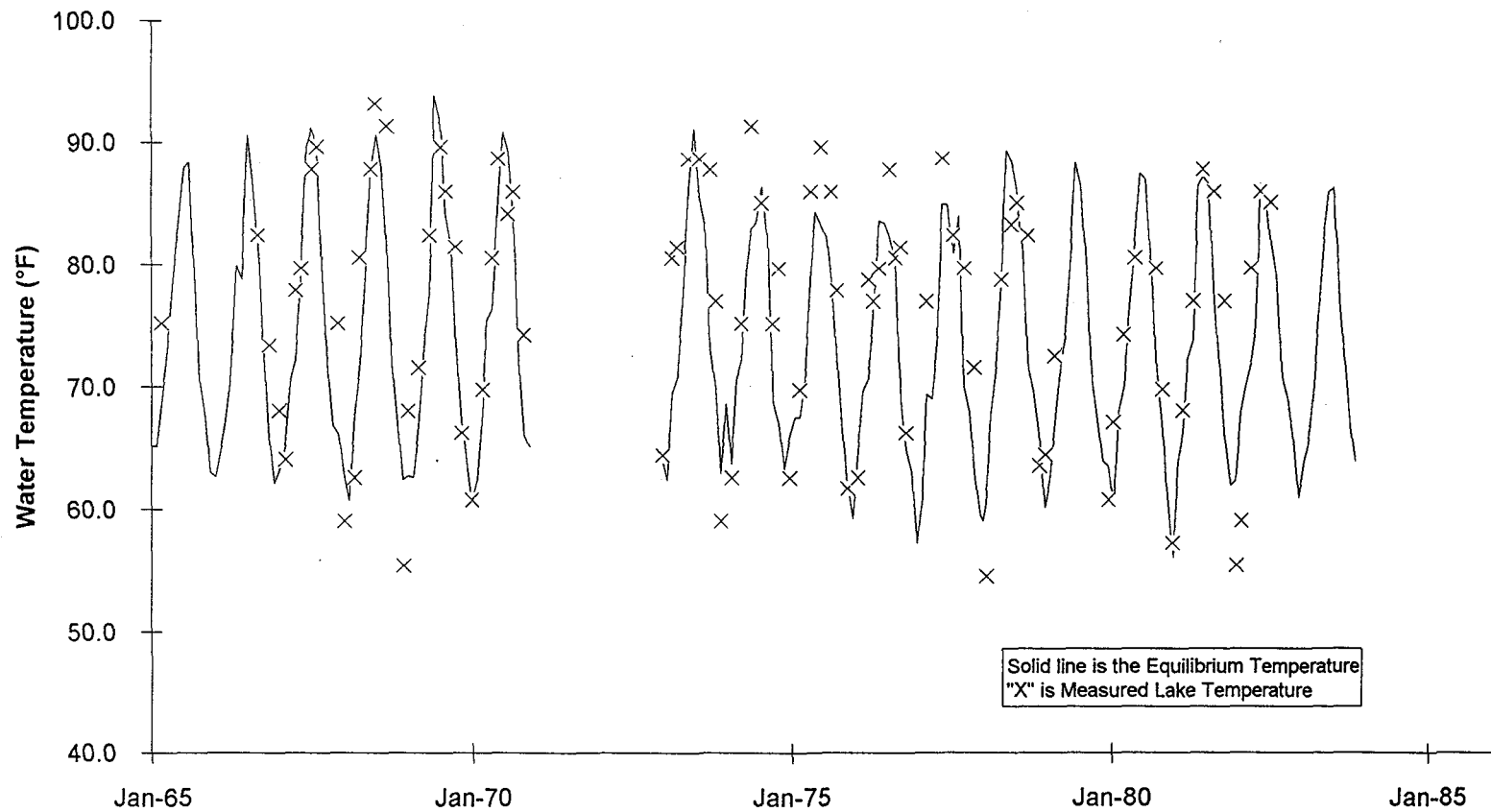


Figure A-2
Temperature versus C(B) Relationship for Temperature Range
From 60°F to 95°F

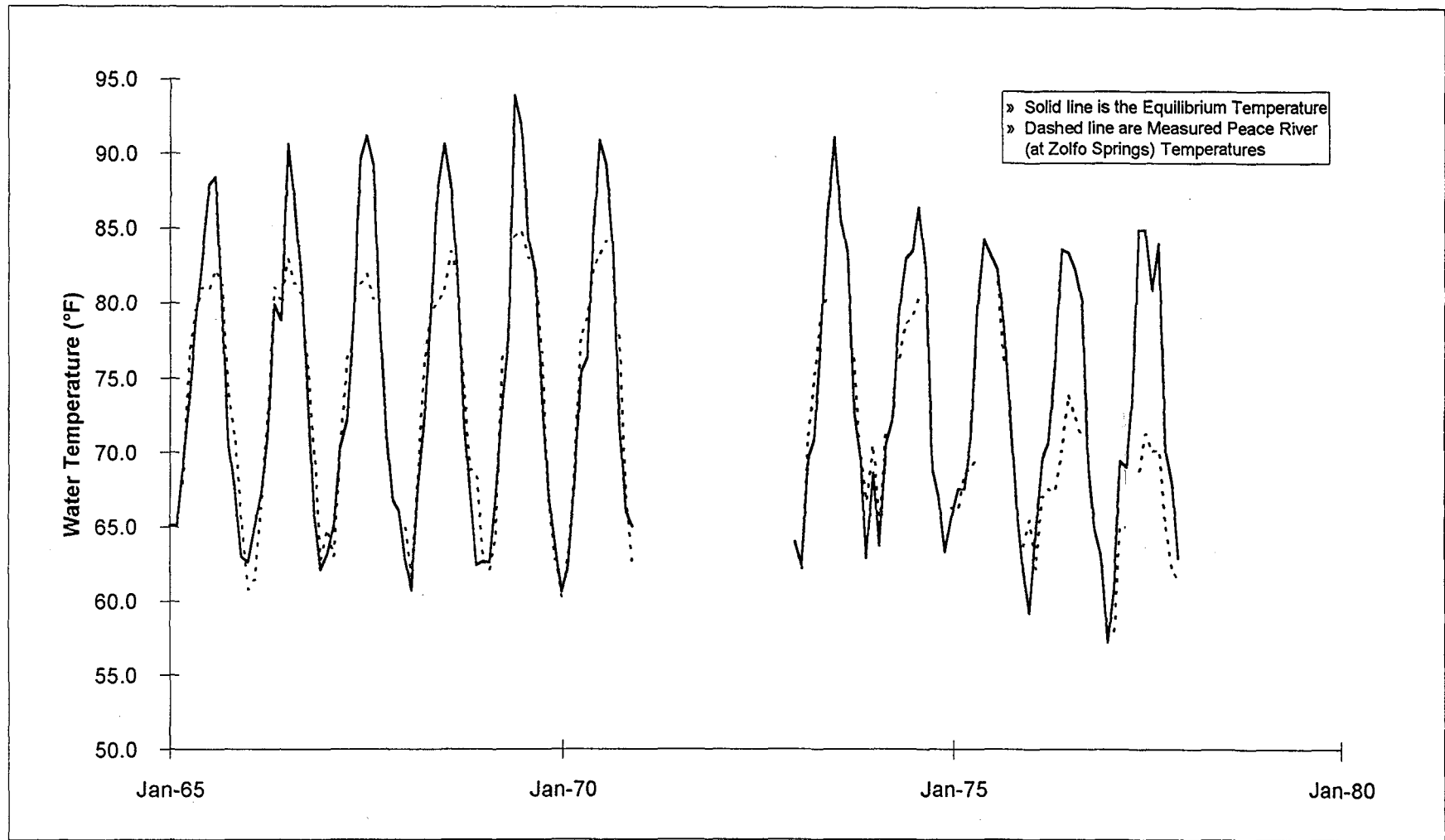
A-7



Note: Equilibrium temperature averages 4.2% less than the measured lake temperatures.

Figure A-3
Comparison of Estimated Equilibrium Temperature with Measured Lake
Temperature, Real-Time Basis

8-A



Note: Equilibrium temperature averages 2.1% higher than the measured Peace River water temperatures.

Figure A-4
Comparison of Estimated Equilibrium Temperature with Measured Peace River Temperatures, Real-Time Basis



Figure A-4 shows the comparison of the estimated equilibrium temperature with measured Peace River (at Zolfo Springs) temperatures. In this comparison, the estimated average equilibrium temperature is approximately 2.1 percent greater than the average river temperature. This difference is a result summer river temperatures being lower than the estimated equilibrium temperatures; a difference that is probably due to trees shading the river.

Based on these comparisons, the revised heat budget model was deemed to be accurate and sufficient for the subsequent modeling.

ATTACHMENT B

**DETERMINE RESERVOIR WATER NEEDS FOR "RESERVOIR ONLY"
COOLING**

ATTACHMENT B

DETERMINE RESERVOIR WATER NEEDS FOR "RESERVOIR ONLY" COOLING

The makeup water requirements for the cooling reservoir were estimated using a water balance methodology. This water balance approach considers all the water inflows to and outflows from the cooling reservoir in order to calculate monthly water makeup and discharge requirements.

The water balance of the cooling reservoir can be summarized as the following:

$$\Delta Q = Q_P + Q_R + Q_{SA} + Q_D + Q_{DW} - Q_E - Q_L - Q_{BS} - Q_{SD}$$

where:

ΔQ = Gain or loss in reservoir volume over a specified unit of time

Q_P = Precipitation on the reservoir

Q_R = Upland runoff into reservoir

Q_{SA} = Surficial aquifer seepage into the reservoir

Q_D = Effluents discharged the reservoir

Q_{DW} = Deep well makeup to the reservoir

Q_E = Evaporation

Q_L = Leakance

Q_{BS} = Berm seepage out of the reservoir

Q_{SD} = Surface discharge to Payne Creek

Given monthly variations in rainfall and runoff into the reservoir, monthly variations in reservoir levels are calculated. If the reservoir level exceeds the control elevation (124 ft-msl), the required discharge quantity is calculated and mathematically subtracted from the reservoir. If the reservoir level drops below the minimum allowable elevation (122 ft-msl), the required deep well makeup quantity is calculated and mathematically added to the reservoir in order to maintain it at the minimum elevation. By tracking and maintaining this monthly balance in reservoir water levels, the long term water makeup and discharge requirements are calculated for various operational (load) scenarios. The various components of the water balance were calculated as described below.

Direct Rainfall

Precipitation data used in the water balance were monthly values from Wauchula.

Runoff

Monthly runoff was computed by summing estimated of daily runoff for the period of record. The daily estimates were calculated by use of the U.S. Soil Conservation Service (SCS) runoff equation:

$$Q = \frac{(P - I_a)^2}{(P - I_a) + S} \quad (1)$$

where:

Q = runoff (in),

P = rainfall (in),

S = potential maximum retention after runoff begins (in), and

I_a = initial abstraction (in) = $0.2S$.

Initial abstraction includes all losses before runoff begins and is equivalent to a "threshold" precipitation rate. A storm event less than or equal to this threshold will not produce any runoff. I_a is determined from the CN based on soil, cover, and antecedent runoff condition.

Total rainfall for each individual storm event in excess of I_a is used as P in the SCS runoff equation. In Florida, where convective storms of short duration dominate precipitation patterns, it can be assumed that recorded total daily rainfall is a suitable surrogate for absolute segregation of events. On days when this assumption is invalid, the total rainfall that generates runoff will be underestimated, as will the runoff itself. On a monthly basis the effect of this assumption will not be significant.

The daily rainfall was used to generate the estimated daily runoff. The curve number was selected as 75, providing an I_a of 0.67 inches. Days with rainfall below this value were assigned zero runoff. Days with rainfall in excess of the threshold were input to the SCS equation to determine runoff. The daily results were then summed to obtain monthly values.

Other Water Inflows

Surficial aquifer seepage into the reservoir was assumed to be zero. Effluents discharged into the reservoir were based on the design engineers water budget. Water makeup into the reservoir was calculated only the reservoir elevation was estimated to be below 122.0 ft-msl and the amount added was only the amount needed to restore the water elevation to that minimum level.

Evaporation

Evaporation from the reservoir was estimated using the available meteorological data and calculated average reservoir water temperature (calculated using the previously described equilibrium temperature method).

Evaporation was calculated using the algorithm suggested by Brady (1969):

$$Q_E = f(u) (e_H - e_a) A$$

where:

Q_E = Evaporative water loss from the reservoir (Btu/ft²-day)

$f(u)$ = windspeed function, previously defined as $70 + 0.7\mu^2$, where μ is windspeed in mph

e_H = saturated vapor pressure at the reservoir temperature calculated for the given month (mmHg)

e_a = vapor pressure of the ambient air for the given month (mmHg)

A = reservoir area.

Leakance

At the project site, the vertical movement of water out of the reservoir/surficial aquifer system into deeper, underlying aquifers (i.e., leakance) is dominated by hydraulic/hydrologic properties of existing, in-place geologic materials. In the immediate region of the site, the Bone Valley formation of the Hawthorne Group constitutes the confining layer that separates the unconfined, near-surface ground waters (i.e., the surficial aquifer) from the underlying aquifer.

This Bone Valley formation contains the commercial phosphate deposits which are, or will be, mined. The phosphate deposits occur primarily in the upper portions of the confining unit. Near the middle of the unit, a "hardpan" or zone of limestone and calcareous cement is encountered.

This material is difficult to excavate and effectively marks the depth of profitable mining. This hardpan is referred to as "pit bottom" by mining personnel.

After mining, a minimum of 10 to 15 ft of the original 20 to 50 ft of the confining unit remains intact. This material contains expansive clays and is very low in permeability (to 6.7×10^{-6} to 7.4×10^{-9} cm/sec). The expansive clays have been identified as montmorillonite. This undisturbed portion of the confining unit forms the aquitard which separates the aquifers.

Vertical leakance out of the bottom of the reservoir was calculated based on the physical properties of this aquitard. The following equation was used:

$$Q = (H - h) C_L A$$

where:

Q = net leakance through the base of the reservoir (negative is out, positive is in);

H = average elevation of the potentiometric surface of the upper Floridan aquifer (dynamic, steady state, accounting for drawdown due to pumping the water supply wells) calculated to be 96.9 ft-msl;

h = water surface elevation in the reservoir, at an elevation of 124 ft-msl;

C = aquitard leakance coefficient estimated to be 5×10^{-4} gpd/ft³;

A = reservoir area, estimated at 570 acres = 2.48×10^7 ft².

Based on these factors, vertical leakance is estimated at approximately 336,000 gpd.

Under these conditions, leakance is dominated by materials which will be left undisturbed and in place. This is fundamentally different than the horizontal seepage through the constructed berm, which will be dominated by the properties and placement of the reclaimed materials. With respect to leakance, there is very little source of variability in the factors which will control leakance other than the natural variability associated with any in place geologic material. To account for this potential natural variability, a reasonable but conservative leakance coefficient was used; this value was developed based on the extensive and accepted literature available for the project area.

Seepage Losses

Both the width of the dike and the elevation of the water table vary around the perimeter of the reservoir. This means that the side seepage rate will also vary around the perimeter. The approach was to model 2-dimensional seepage through many discrete profile sections through the dike and natural soils around the reservoir perimeter.

Each discrete section was modeled using an equation based on Dupuit's simplifying assumptions concerning unconfined seepage. The equation is:

$$Q = \left[\frac{H^2 - h^2}{2L} \right] \times K$$

where:

- H = height of water table at outside base of dike,
- h = height of reservoir water level at inside contact with dike (i.e., at the shoreline),
- L = average horizontal length of soil through saturated portion of dike,
- K = average hydraulic conductivity of the soil, and
- Q = quantity rate of seepage through the discrete section.

This reservoir seepage analysis was intended to be conservative and was performed to provide a critical component of the water balance equation used for the original assessment of the consumptive use requirements.

This reservoir seepage analysis was based on the assumption that the reservoir dikes will be constructed from the tailings of the phosphate mining operation, and that this material would be relatively clean sand. The important value of permeability for this material was estimated using Freeze and Cherry (Groundwater, 1979, p. 29) to be 100 gallon per day per foot square or 5×10^{-3} cm/sec. A typical hydrogeologic profile published by Dames & Moore (Consumptive-Use Application Supporting Report, Hardee County Phosphate Project, CF Industries, Inc., Vol. II) for a site adjacent to the HPS was also used. This report supported the 100 gpd/ft² permeability estimate for the surficial soils, and the subsurface profile indicated on approximate thickness of 40 ft for the surficial aquifer.

Based on this seepage value, seepage losses from the reservoir were estimated, using the previously discussed methodology, as 920,000 gpd.

Based on these data, the permeability value of 5×10^{-3} cm/sec and the associated seepage value of 920,000 gpd were used in the SCA water balance analysis. Based on the anticipated materials for berm construction and the measured permeability values for the reservoir, this permeability value and the associated seepage value was estimated to be a conservative approximation of the then future and anticipated conditions (with respect to water use and makeup requirements).

In December 1988, monitoring wells were installed to the south of the power block area. Slug tests were performed in these shallow wells to measure field permeability. In addition, laboratory tests measuring grain size distribution and index properties were conducted on soil samples from the foundation borings drilled by Black & Veatch. Both the slug tests and the laboratory tests showed that the permeability of the existing and in place surficial aquifer material was approximately 2×10^{-4} cm/sec. It is noted that the solute transport model (conducted to demonstrate compliance with groundwater quality criteria) used this measured permeability of 2×10^{-4} plus a typical thickness for the surficial aquifer of 30 ft, which is an average between thickness from the test borings and thickness listed in the Dames & Moore report.

In the fall of 1993, the hydraulic conductivity of the dikes were measured using falling head tests on several shallow wells installed in the dike. The falling head test showed an average hydraulic conductivity of approximately 10^{-4} cm/sec. These measured hydraulic conductivity values coupled with limited reservoir water data show that the 920,000 gpd seepage rate is a reasonable estimation of dike seepage losses.

ATTACHMENT C
WATER SOURCE EVALUATIONS

Table C-1 Water Source Availability Evaluation

Potential Source	Comparison Ratings																												Sum	Unweighted Coefficient	
Maintain Existing Wells	1.0	1.0	1.0	1.0	0.5	0.5	1.0																						6.0	0.21	
Reclaimed Area Water Cropping	0.0							1.0	0.5	0.5	0.0	0.0	1.0																	3.0	0.11
Municipal Treated Effluent		0.0						0.0						0.0	0.0	0.0	0.0	1.0												1.0	0.04
Site Water Cropping			0.0						0.5					1.0					1.0	0.0	0.0	1.0								3.5	0.13
Industrial Wastewater Recovery				0.0						0.5					1.0				0.0				0.0	0.0	1.0					2.5	0.09
New Floridan Aquifer Wells					0.5						1.0					1.0				1.0				1.0			0.5	1.0		6.0	0.21
Deep Floridan Wells						0.5						1.0					1.0				1.0			1.0			0.5		1.0	6.0	0.21
Dummy							0.0						0.0					0.0				0.0			0.0		0.0	0.0	0.0	0.0	
																													28.0	1.00	

Table C-2 Water Source Quality Evaluation

Potential Source	Comparison Ratings																												Sum	Unweighted Coefficient	
Maintain Existing Wells	1.0	1.0	1.0	1.0	0.5	1.0	1.0																						6.5	0.23	
Reclaimed Area Water Cropping	0.0							0.5	0.5	0.5	0.0	1.0	1.0																	3.5	0.13
Municipal Treated Effluent		0.0						0.5						0.0	0.0	0.0	1.0	1.0												2.5	0.09
Site Water Cropping			0.0					0.5						1.0					0.5	0.0	1.0	1.0								4.0	0.14
Industrial Wastewater Recovery				0.0					0.5						1.0				0.5				0.0	1.0	1.0					4.0	0.14
New Floridan Aquifer Wells					0.5						1.0					1.0				1.0			1.0			1.0	1.0			6.5	0.23
Deep Floridan Wells						0.0					0.0						0.0			0.0			0.0		0.0		1.0			1.0	0.04
Dummy							0.0					0.0					0.0				0.0			0.0		0.0	0.0			0.0	
																													28.0	1.00	

Table C-3 Water Source Environmental Evaluation

Potential Source	Comparison Ratings																										Sum	Unweighted Coefficient		
Maintain Existing Wells	1.0	1.0	1.0	1.0	1.0	1.0	1.0																					7.0	0.25	
Reclaimed Area Water Cropping	0.0							0.5	0.5	0.0	0.0	0.0	1.0																2.0	0.07
Municipal Treated Effluent		0.0						0.5						0.5	0.5	0.0	0.5	1.0											3.0	0.11
Site Water Cropping			0.0						0.5					0.5					0.0	0.0	0.0	1.0							2.0	0.07
Industrial Wastewater Recovery				0.0						1.0					0.5				1.0				0.0	0.0	1.0				3.5	0.13
New Floridan Aquifer Wells					0.0						1.0					1.0			1.0			1.0			1.0	1.0			6.0	0.21
Deep Floridan Wells						0.0						1.0				0.5				1.0			1.0		0.0		1.0		4.5	0.16
Dummy							0.0						0.0				0.0				0.0			0.0		0.0	0.0		0.0	
																											28.0	1.00		

Table C-4 Water Source Engineering Considerations

Potential Source	Comparison Ratings																												Sum	Unweighted Coefficient	
Maintain Existing Wells	1.0	1.0	1.0	1.0	1.0	1.0	1.0																						7.0	0.25	
Reclaimed Area Water Cropping	0.0							0.5	0.5	0.5	0.0	0.5	1.0																	3.0	0.11
Municipal Treated Effluent		0.0						0.5						0.5	0.5	0.0	0.5	1.0												3.0	0.11
Site Water Cropping			0.0						0.5					0.5					0.5	0.0	0.5	1.0								3.0	0.11
Industrial Wastewater Recovery				0.0						0.5					0.5				0.5				0.0	0.0	1.0					2.5	0.09
New Floridan Aquifer Wells					0.0						1.0					1.0			1.0			1.0			1.0	1.0			6.0	0.21	
Deep Floridan Wells						0.0						0.5					0.5			0.5			1.0		0.0		1.0		3.5	0.13	
Dummy							0.0						0.0					0.0			0.0			0.0		0.0	0.0	0.0		0.0	
																													28.0	1.00	

Table C-5 Water Source Cost Evaluation

Potential Source	Comparison Ratings																								Sum	Unweighted Coefficient				
Maintain Existing Wells	1.0	1.0	1.0	1.0	1.0	1.0	1.0																					7.0	0.25	
Reclaimed Area Water Cropping	0.0							1.0	0.0	1.0	0.0	0.0	1.0																3.0	0.11
Municipal Treated Effluent		0.0						0.0						0.0	0.0	0.0	0.0	1.0											1.0	0.04
Site Water Cropping			0.0						1.0					1.0					0.0	0.0	0.0	1.0							3.0	0.11
Industrial Wastewater Recovery				0.0						0.0					1.0				1.0				0.0	0.0	1.0				3.0	0.11
New Floridan Aquifer Wells					0.0						1.0					1.0				1.0			1.0			1.0	1.0		6.0	0.21
Deep Floridan Wells						0.0						1.0				1.0				1.0			1.0		0.0		1.0		5.0	0.18
Dummy							0.0						0.0					0.0				0.0			0.0	0.0	0.0		0.0	
																									28.0	1.00				

Table C-6 Water Source Regulatory Evaluation

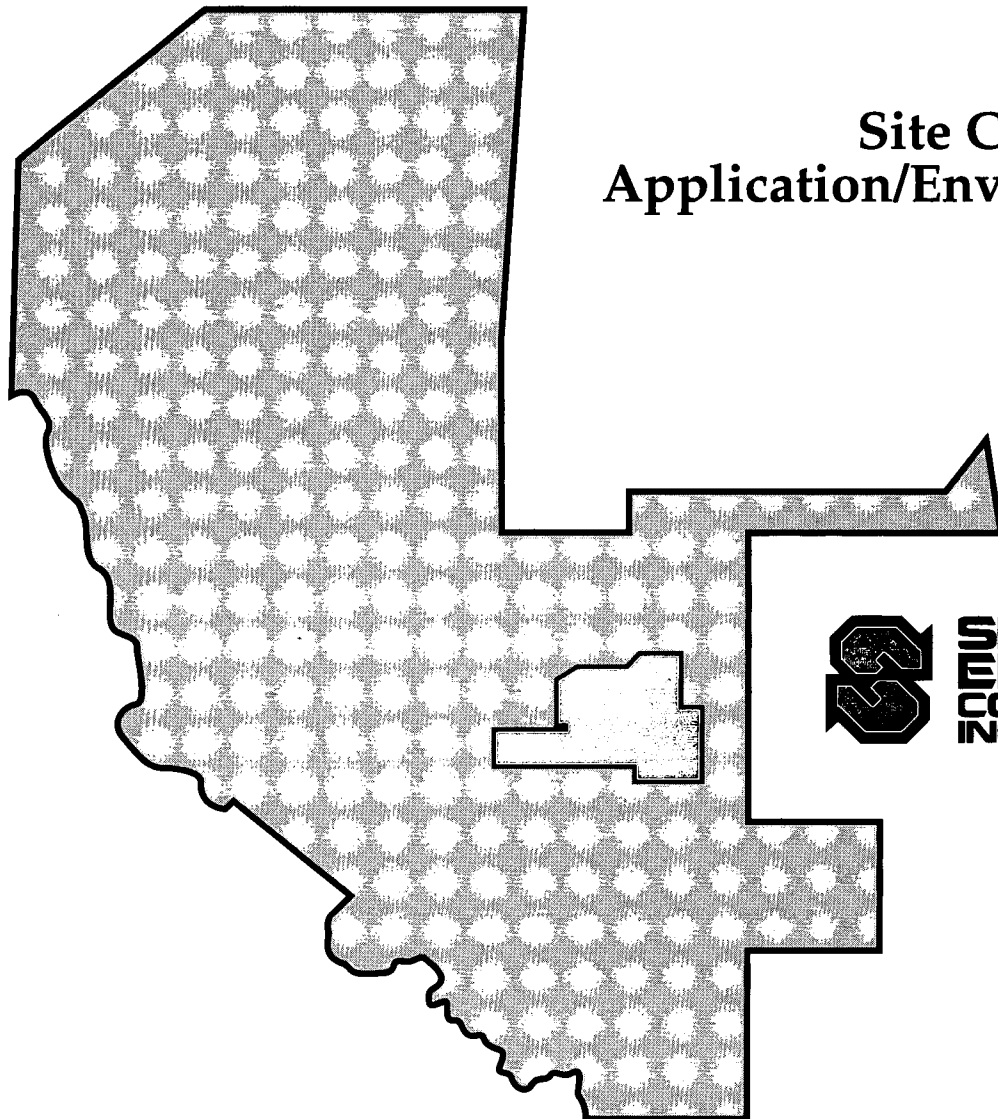
Potential Source	Comparison Ratings																												Sum	Unweighted Coefficient		
Maintain Existing Wells	1.0	1.0	1.0	1.0	1.0	1.0	1.0																							7.0	0.25	
Reclaimed Area Water Cropping	0.0							0.0	0.0	0.0	0.0	0.0	1.0																		1.0	0.04
Municipal Treated Effluent		0.0						1.0						1.0	0.0	0.0	1.0	1.0													4.0	0.14
Site Water Cropping			0.0						1.0					0.0					0.5	0.0	0.5	1.0									3.0	0.11
Industrial Wastewater Recovery				0.0						1.0					1.0				0.5				0.0	0.5	1.0						4.0	0.14
New Floridan Aquifer Wells					0.0						1.0					1.0				1.0			1.0			0.0	1.0				5.0	0.18
Deep Floridan Wells						0.0						1.0					0.0				0.5			0.5		1.0		1.0			4.0	0.14
Dummy							0.0						0.0					0.0				0.0			0.0		0.0	0.0			0.0	
																													28.0	1.00		

Table C-7 Water Source Criteria Evaluation

Criterion	Comparison Ratings																				Sum	Unweighted Coefficient
Availability	1.0	1.0	1.0	1.0	1.0	1.0															6.0	0.29
Quality	0.0						1.0	0.5	0.5	1.0	1.0										4.0	0.19
Environmental Impacts		0.0					0.0					1.0	0.5	0.5	1.0						3.0	0.14
Engineering			0.0					0.5				0.0				0.0	0.0	1.0			1.5	0.07
Cost				0.0					0.5				0.5			1.0			0.5	1.0	3.5	0.17
Regulatory					0.0					0.0				0.5			1.0		0.5	1.0	3.0	0.14
Dummy						0.0					0.0				0.0			0.0		0.0	0.0	0.00
Total																					21.0	1.00

HARDEE UNIT 3

Site Certification
Application/Environmental
Analysis



Appendix 10.11



APPENDIX 10.11

STATE PERMIT APPLICATIONS OR APPROVALS

APPENDIX 10.11.1

MANAGEMENT AND STORAGE OF SURFACE WATERS

**Application Form Provided for Informational Purposes;
Separate Permit not Required**



PERMIT APPLICATION

SWFWMD USE ONLY

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

2379 BROAD STREET • BROOKSVILLE, FL 34609-6899
(904) 796-7211 or FLORIDA WATS 1 (800) 423-1476

SURFACE WATER MANAGEMENT — CONCEPTUAL PERMIT

PERMITS ARE REQUIRED PURSUANT TO SECTION 373.413, FLORIDA STATUTES (F.S.) AND RULES 40D-4.041, 40D-40.041 AND 40D-40.042, FLORIDA ADMINISTRATIVE CODE (F.A.C.) THIS APPLICATION WILL BE PROCESSED IN ACCORDANCE WITH THE PROCEDURE DESCRIBED IN RULE 40D-1.603 F.A.C. WITHIN 30 DAYS AFTER RECEIPT OF THIS APPLICATION, THE DISTRICT WILL NOTIFY YOU IF THE APPLICATION IS COMPLETE OR MAY REQUEST ADDITIONAL INFORMATION NECESSARY TO COMPLETE THE APPLICATION. IF YOU HAVE ANY QUESTIONS REGARDING THE APPLICATION, YOU ARE ENCOURAGED TO SCHEDULE A PRE-APPLICATION CONFERENCE WITH THE DISTRICT STAFF BY CALLING THE APPROPRIATE DISTRICT PERMITTING DIVISION WHICH HANDLES PERMITS FOR PROJECTS WITHIN YOUR COUNTY.

- PROVIDE ALL APPLICABLE INFORMATION BELOW. ATTACH ADDITIONAL INFORMATION IF NECESSARY.
- PLEASE SUBMIT FOUR COPIES OF APPLICATION, DRAWINGS, CALCULATIONS, ETC.
- A PROCESSING FEE IS REQUIRED WITH THIS APPLICATION IN ACCORDANCE WITH RULE 40D-0.201.

I. GENERAL INFORMATION			
PLEASE CHECK APPROPRIATE BOX: ☐ CONCEPTUAL PERMIT ☐ MODIFICATION OF EXISTING PERMIT, NO.:			
OWNER(S) OF LAND:		AGENT OF OWNER, AUTHORIZED TO SECURE PERMIT (IF APPLICABLE):	
NAME		NAME	
ADDRESS		ADDRESS	
CITY, STATE, ZIP		CITY, STATE, ZIP	
TELEPHONE ()		TELEPHONE ()	
PERSON WHO PREPARED PLANS AND SPECIFICATIONS:		PERSON WHO WILL CONSTRUCT PROPOSED WORK (IF KNOWN):	
NAME		NAME	
ADDRESS		ADDRESS	
CITY, STATE, ZIP		CITY, STATE, ZIP	
COMPANY		TELEPHONE ()	
DESCRIPTION OF LAND			
COUNTY:	SECTION	TOWNSHIP	RANGE
Hardee	1	22S	23E
PROJECT NAME (INCLUDING PHASE):			
Hardee Power Station Unit 3			
TOTAL LAND AREA (ACRES):		PROJECT SIZE (ACRES) IF DIFFERENT THAN TOTAL LAND AREA	
1300 acres		50 acres	
BRIEF DESCRIPTION OF PROJECT: (TYPE, LAND USE, ETC.)			
The Hardee Unit 3 Project will consist of a 440-megawatt combined cycle unit to be constructed			
at the previously certified Hardee Power Station (HPS) site, adjacent to the HPS existing units.			
See Section 1.3 of the Site Certification Application (SCA).			
HAVE YOU HAD A PRE-APPLICATION CONFERENCE WITH DISTRICT STAFF?		DATE OF CONFERENCE WITH WHOM?	
☒ YES ☐ NO		1 / 12 / 94	

II. CONTENT OF APPLICATION - 40D-4.101

INSTRUCTIONS: THE FOLLOWING INFORMATION IS NECESSARY TO PROPERLY EVALUATE YOUR PERMIT APPLICATION. THE APPLICANT SHOULD SUBMIT AS MUCH OF THE INFORMATION LISTED AS THE COMPLEXITY OF THE PROJECT AND SENSITIVITY OF THE AREA NECESSITATES. A CONCEPTUAL PERMIT DOES NOT GENERALLY REQUIRE THE SAME LEVEL OF DETAIL AS A CONSTRUCTION PERMIT. PROVIDING A GREATER LEVEL OF DETAIL MAY, HOWEVER, REDUCE THE NEED FOR ADDITIONAL INFORMATION BEING REQUIRED AT A LATER DATE.

- Respond to each item leaving no blanks.
- If you feel that an item **DOES NOT** apply to your project, write "NOT APPLICABLE" or "N/A" in that space.
- Your response to each item must indicate where the requested information can be found in the accompanying plans, maps, reports, etc.
- Please be specific when identifying the plan sheet number(s), map(s), report(s), page(s), etc. that contain all supporting information.

A SITE INFORMATION - 40D-4.101(2)(a)	
1	40D-4.101(2)(a) 1 Provide a location sketch of sufficient detail to allow someone to locate the project for a site visit. See figure 1.3-1 in the SCA.
2	40D-4.101(2)(a) 7 Provide recent aerial photo map(s), legible for photo interpretation with a scale no smaller than 1" = 800'; with total land area, project area, and any on-site wetlands delineated. See figure 2.3.5-2 in the SCA.
3	40D-4.101(2)(a) 3 Provide a hydrologic features map of the overall area showing existing runoff patterns and size, location, topography, and land use of off-site areas which drain through, onto, and from the project. Map provided with Stormwater Management Plan to FDEP and SWFWMD.
4	40D-4.101(2)(a) 2 Provide a detailed topographic map (with contours) of the site and adjacent hydrologically related areas, which shall include the location and description of bench marks (minimum of one per major water control structure). Map provided with Stormwater Management Plan submitted to FDEP and SWFWMD.
5	40D-4.101(2)(a) 6 Provide a description of vegetative cover. Location of wetland areas in and adjacent to the project area are to be identified. Quantify the acreage of existing on-site wetlands. If activities are proposed in wetlands, provide a description of wetland type and functions, and an analysis of impact alternatives that were considered. The Hardee Unit 3 site is reclaimed pasture land with an adjacent unnamed tributary to Payne Creek. See Sections 2.3.5, 2.6.1, and 2.3.6.2 of the SCA.
6	40D-4.101(2)(a) 5 If the project is in the known floodplain of a stream or other watercourse, the floodplain should be identified and approximate flooding elevations determined. The 100 year flood plain elevation and limits are to be identified. If no 100 year flood plain exists on site, please state below. The 100-year floodplain for Payne Creek is 109 ft above sea level. The proposed Hardee Unit 3 project will not be within this floodplain. See Section 2.3.4 of the SCA.
7	40D-4.101(2)(a) 4 Provide identification of wet season high water table elevations, including normal pool and seasonal high elevations in wetlands. The seasonal highwater elevation at the project site ranges for 119.8 to 124.4 ft above mean sea level.
8	40D-4.101(2)(a) 9 Provide soils information representative of actual conditions; including percolation tests, if effluent filtration, percolation or exfiltration systems are proposed. Soils at the site contain a high percentage of clay as a result of mining and reclamation activities. See Stormwater Management Plan and Section 2.3.1.1 of the SCA.
B MASTER DRAINAGE PLAN 40D-4.101(2)(b)	
1	40D-4.101(2)(b) 1 Provide the location of all water bodies with details of size, side slopes, elevations and depths used for water quantity, quality and environmental functions, including compensation plan details for wetland impacts and floodplain encroachment. See Sections 2.3.4, 2.3.6, 4.2.1, and 4.4.1 of the SCA and the Stormwater Management Plan, available upon request from SECI.
2	40D-4.101(2)(b) 2 Provide the location and site details of all major water control structures, including design elevations of the discharge structures along with any seasonal water level fluctuation or drawdown schedules. This information is provided in the Stormwater Management Plan, available upon request from SECI.
3	40D-4.101(2)(b) 4 Provide the locations of roads and buildings along with their proposed elevations. This information is provided in the Stormwater Management Plan, available upon request from SECI.

4	40D-4.101(2)(b) 3	Provide drainage basin boundaries showing direction and path of flow, taking into account off-site runoff being routed through or around the project.	This information is provided in the Stormwater Management Plan, available upon request from SECI.
5	40D-4.101(2)(B) 7	Provide the location and description of any nearby existing off-site water resource facilities which might be affected by the proposed construction or development. The names and addresses of the owners of such facilities should also be submitted.	No off-site water resource facilities will be affected by the Hardee Unit 3 project.
C DRAINAGE CALCULATIONS 40D-4.101(2)(C)			
1	40D-4.101(2)(c) 1	Provide the design storms used including depth, duration and distribution.	The 25-year, 24-hour storm was used. See Stormwater Management Plan, available upon request from SECI
2	40D-4.101(2)(c) 2	Provide the details of any off-site inflows.	There are no off-site water courses entering the project site.
3	40D-4.101(2)(c) 4	Provide the acreages and percentages of property proposed as: a. Impervious surfaces (excluding waterbodies); b. Pervious surfaces (green areas); c. Lakes, canals, retention areas, etc.; d. Wetlands; and, e. Total acreage of project.	The above-requested information is contained in the Stormwater Management Plan, available upon request from SECI.
4	40D-4.101(2)(c) 3	Provide the stage-storage computations for the project and stage-discharge computations for the outfall structure(s).	The above-requested information is contained in the Stormwater Management Plan.
5	40D-4.101(2)(c) 5	Provide the runoff calculations signed and sealed by the design engineer showing pre-and post-development discharges, elevations, and volumes retained and/or detained during applicable storm events; including the hydrologic parameters and modeling input and output data. Mathematical computations may be required to demonstrate that the proposed development will not significantly alter net storage from the project area for events up to the required design storm nor cause adverse affects due to floodplain encroachment up to the 100 year event.	The above-requested information is provided in the Stormwater Management Plan.
6	40D-4.101(2)(c) 6	Provide the calculations required for determination of minimum building flood and road elevations.	
D LEGAL AND INSTITUTIONAL INFORMATION 40D-4.101(2)(d)			
1	40D-4.101(2)(d) 4	Provide the identification of agencies and organizations contacted in connection with the project. Include meeting summaries and/or responses. Give the status of local approvals indicating if site plan and/or subdivision approval has been granted, final plats recorded and building or construction permits issued.	A list of agency contacts is provided in Chapter 9 of the SCA. The Hardee Unit 3 Project is consistent with all Hardee County requirements.
2	40D-4.101(2)(d) 6	Provide a copy of the boundary survey and/or a legal description and acreage of the total land area of contiguous property owned or controlled by the applicant adjacent to and including the project. Also provide a legal description and acreage of the project area required to construct, operate and maintain the system; if different from the total land area. Provide a copy of the deed or other evidence of ownership.	A legal description of the project site is attached. The Hardee Unit 3 Project will occupy approximately 50 acres.
3	40D-4.101(2)(d) 5	Provide the present zoning classification and status of any DRI application or proposed zoning reclassification.	The project site is zoned I-1, Light Industrial. There are no DRI applications associated with the project. For additional information, see Section 2.2 of the SCA.
4	40D-4.101(2)(d) 3	Provide indication of how water and wastewater service will be supplied. Letters of intended commitment from off-site suppliers must be included.	Water and wastewater service will be supplied by on-site facilities. Discussions of these facilities are provided in Sections 3.5, 3.6.3, and 5.2 of the SCA.
5	40D-4.101(2)(d) 7	Provide documentation of legal and physical availability of the receiving water system to receive project discharge, if such is not evident.	

6	40D-4.101(2)(d) 1	Identify the entity to be responsible for operation and maintenance of the Surface Water Management System upon completion of construction
Seminole Electric Cooperative Incorporated		
7	40D-4.101(2)(d) 2	Provide a letter or other evidence of potential acceptance by the operation and maintenance entity, if the entity is to be a public body such as a city or drainage district. If the entity is a homeowners or other association, documents verifying either the present or imminent existence of such an organization and its ability to accept operation and maintenance responsibility are required.
Seminole Electric Cooperative Incorporated is an existing Electric Cooperative incorporated in the State of Florida. Additional information is provided in Section 1.1.1 of the SCA.		
E OTHER INFORMATION		
1	40D-4.321(1)(a)	Provide a Master Plan of the Surface Water Management System identifying the phases and sequence for development of the project.
The above-requested information is provided in the attached Stormwater Management Plan.		
2	17-21.10(4)	If there are any existing wells located within the project site, please indicate how they will be utilized or properly abandoned by a licensed water well contractor in accordance with Rules 40D-3 and 17-21.10(4), F.A.C.
There are currently no existing wells located within the Hardee Unit 3 project site.		
3		Are there existing Consumptive Use Permits from Southwest Florida Water Management District within the total land area? If so, provide the permit number(s).
The existing consumptive use authorization was obtained through the original HPS Site Certification (Certification Number PA 89-25).		
4		Provide letter or other certification from the owner clearly identifying and authorizing the agent who is applying for the permit to sign for and bind the owner, if applicable.
5	40D-4.101(3)	The application must be signed by the owner or his authorized agent, and submitted to the District with four copies of all information required in subsections 40D-4.101 (1) and (2).

COMMENTS:		

APPLICATION CERTIFICATIONS

• STATEMENT BY PROFESSIONAL ENGINEER REGISTERED IN FLORIDA •

This is to certify that the engineering features of this Surface Water Management System, designed by me or under by responsible charge, are designed in my professional opinion in conformity with sound engineering principles and in accordance with all applicable rules and specifications of Chapters 40D-4 and 40D-40, Florida Administrative Code (F.A.C.), including the "Basis of Review for Surface Water Management Permit Applications" referenced in Rule 40D-4.091, F.A.C.

ENGINEER'S NAME (TYPE OR PRINT)	FL REGISTRATION NO.	• AFFIX SEAL •
COMPANY NAME Black and Veatch		
ADDRESS		
CITY, STATE, ZIP	PHONE ()	
ENGINEER'S SIGNATURE X	DATE / /	

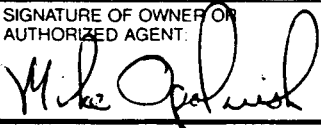
• STATEMENTS BY APPLICANT •

A. I hereby acknowledge that:

1. A Conceptual Permit does not authorize any construction.
2. Construction of any portion of this project prior to receiving a District Construction Permit is a violation of Section 373.413, Florida Statutes (F.S.), and Rules 40D-4.041, 40D-40.041 and 40D-40.042, Florida Administrative Code.
3. The District has the authority, pursuant to Chapter 373, F.S., to enter and inspect the property described in this application for the purpose of determining compliance with District rules.

B. By executing this application the applicant states that the property legally described in the survey drawing and/or legal description of the total land area is owned/controlled by the undersigned applicant and encompasses the project area referenced in the permit application.

C. I hereby certify that the information contained herein is true and accurate and that I have legal authority to execute this application to perform the proposed activities on the property identified herein.

OWNER'S NAME (PRINT) Seminole Electric Cooperative Incorporated	NAME OF PERSON SIGNING APPLICATION (PRINT) Mike Opalinski
SIGNATURE OF OWNER OR AUTHORIZED AGENT 	TITLE (IF APPLICABLE) Manager of Environmental Affairs
DATE 4/23/94	COMPANY NAME (IF APPLICABLE) Seminole Electric Cooperative Incorporated

PAGE 5 OF 5



**Southwest Florida Water
Management District**

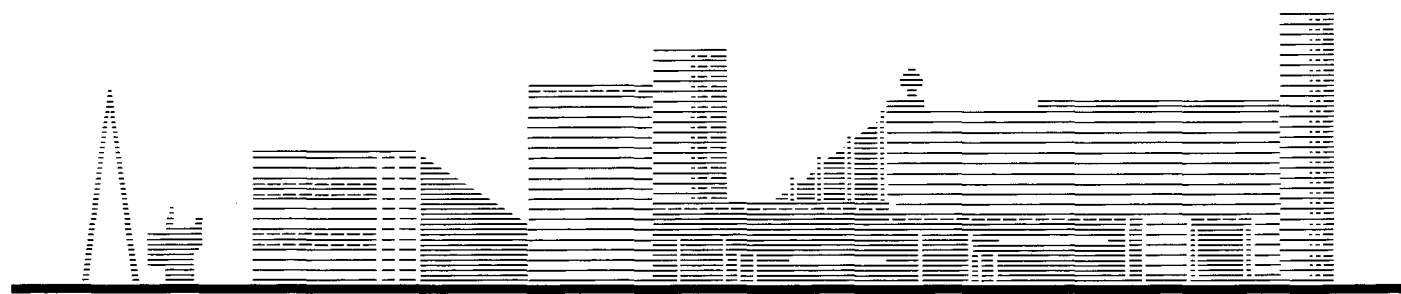
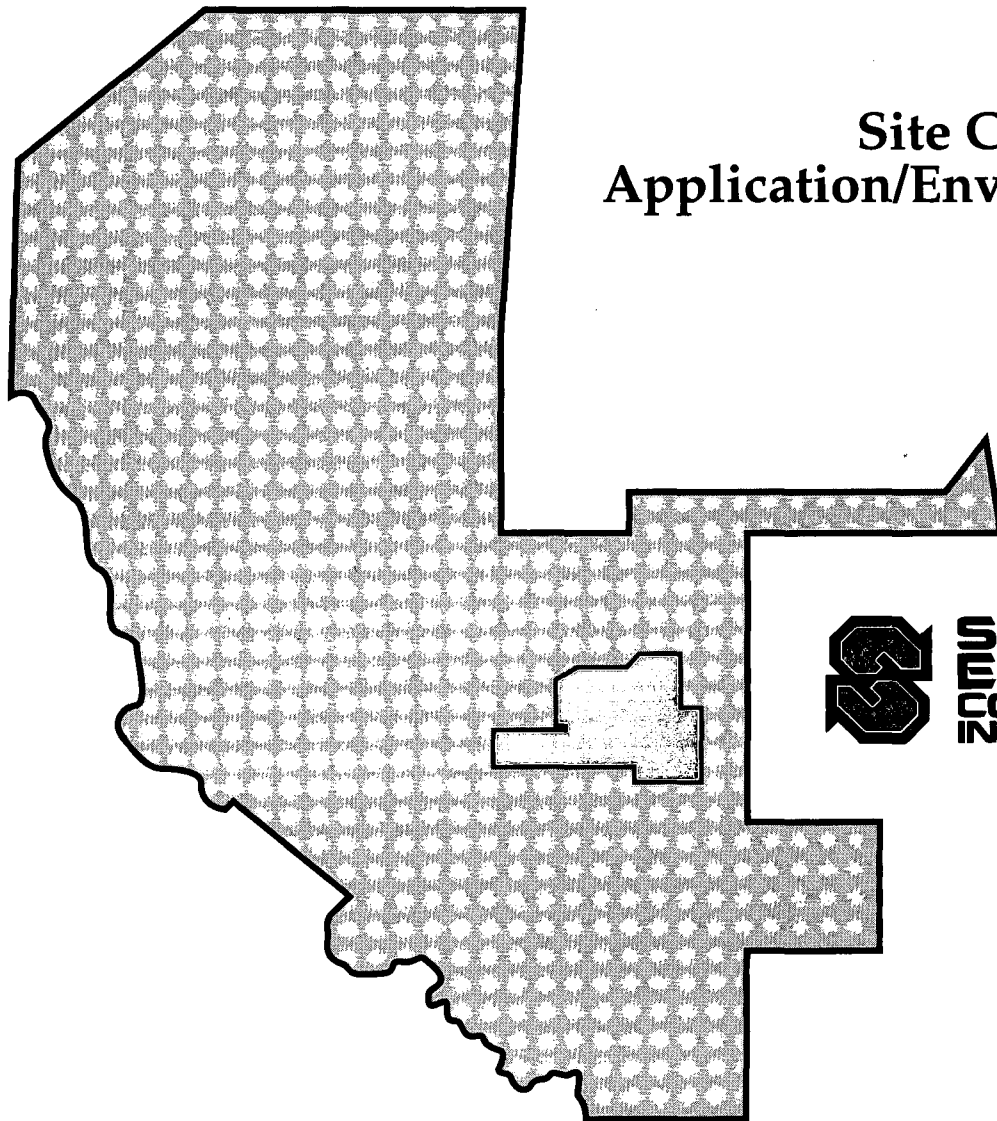


STORMWATER MANAGEMENT PLAN

**The Stormwater Management Plan has been Provided to the
Florida Department of Environmental Protection
and the Southwest Florida Water Management District
Under a Separate Cover and is Available upon Request from SECI**

HARDEE UNIT 3

Site Certification
Application/Environmental
Analysis



Appendix 10.12

APPENDIX 10.12

**1985 HIGHWAY CAPACITY SYSTEM (HCS)
COMPUTER PRINTOUT REPORTS**

APPENDIX 10.12.1

1997 BACKGROUND LINK ANALYSIS

1985 HCM:TWO-LANE HIGHWAYS

FACILITY LOCATION.... Fort Green Road from HPS to CR 630
 ANALYST..... KBN
 TIME OF ANALYSIS..... PM Peak Hour
 DATE OF ANALYSIS..... 02-22-1994
 OTHER INFORMATION.... Background 1997

A) ADJUSTMENT FACTORS

 PERCENTAGE OF TRUCKS..... 14
 PERCENTAGE OF BUSES..... 0
 PERCENTAGE OF RECREATIONAL VEHICLES..... 4
 DESIGN SPEED (MPH)..... 60
 PEAK HOUR FACTOR..... 1
 DIRECTIONAL DISTRIBUTION (UP/DOWN)..... 50 / 50
 LANE WIDTH (FT)..... 12
 USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)... 6
 PERCENT NO PASSING ZONES..... 15

B) CORRECTION FACTORS

 LEVEL TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	2	1.8	2.2	1	1	.84
B	2.2	2	2.5	1	1	.81
C	2.2	2	2.5	1	1	.81
D	2	1.6	1.6	1	1	.86
E	2	1.6	1.6	1	1	.86

C) LEVEL OF SERVICE RESULTS

 INPUT VOLUME(vph): 70
 ACTUAL FLOW RATE: 70

LOS	SERVICE FLOW RATE	V/C
A	283	.12
B	547	.24
C	889	.39
D	1491	.62
E	2405	1

LOS FOR GIVEN CONDITIONS: A

1985 HCM:TWO-LANE HIGHWAYS

FACILITY LOCATION.... CR 630 from SR 37 to Fort Green Road
 ANALYST..... KBN
 TIME OF ANALYSIS..... PM Peak Hour
 DATE OF ANALYSIS..... 02-22-1994
 OTHER INFORMATION.... Background 1997

A) ADJUSTMENT FACTORS

 PERCENTAGE OF TRUCKS..... 14
 PERCENTAGE OF BUSES..... 0
 PERCENTAGE OF RECREATIONAL VEHICLES..... 4
 DESIGN SPEED (MPH)..... 60
 PEAK HOUR FACTOR..... 1
 DIRECTIONAL DISTRIBUTION (UP/DOWN)..... 50 / 50
 LANE WIDTH (FT)..... 12
 USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)... 6
 PERCENT NO PASSING ZONES..... 10

B) CORRECTION FACTORS

 LEVEL TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	2	1.8	2.2	1	1	.84
B	2.2	2	2.5	1	1	.81
C	2.2	2	2.5	1	1	.81
D	2	1.6	1.6	1	1	.86
E	2	1.6	1.6	1	1	.86

C) LEVEL OF SERVICE RESULTS

 INPUT VOLUME(vph): 255
 ACTUAL FLOW RATE: 255

LOS	SERVICE FLOW RATE	V/C
A	354	.15
B	616	.27
C	980	.43
D	1540	.64
E	2405	1

LOS FOR GIVEN CONDITIONS: A

1985 HCM:TWO-LANE HIGHWAYS

FACILITY LOCATION.... CR 630 from Fort Green Road to CR 555
 ANALYST..... KBN
 TIME OF ANALYSIS..... PM Peak Hour
 DATE OF ANALYSIS..... 02-22-1994
 OTHER INFORMATION.... Background 1997

A) ADJUSTMENT FACTORS

 PERCENTAGE OF TRUCKS..... 14
 PERCENTAGE OF BUSES..... 0
 PERCENTAGE OF RECREATIONAL VEHICLES..... 4
 DESIGN SPEED (MPH)..... 60
 PEAK HOUR FACTOR..... 1
 DIRECTIONAL DISTRIBUTION (UP/DOWN)..... 50 / 50
 LANE WIDTH (FT)..... 12
 USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)... 6
 PERCENT NO PASSING ZONES..... 10

B) CORRECTION FACTORS

 LEVEL TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	2	1.8	2.2	1	1	.84
B	2.2	2	2.5	1	1	.81
C	2.2	2	2.5	1	1	.81
D	2	1.6	1.6	1	1	.86
E	2	1.6	1.6	1	1	.86

C) LEVEL OF SERVICE RESULTS

 INPUT VOLUME(vph): 339
 ACTUAL FLOW RATE: 339

LOS	SERVICE FLOW RATE	V/C
A	354	.15
B	616	.27
C	980	.43
D	1540	.64
E	2405	1

LOS FOR GIVEN CONDITIONS: A

1985 HCM:TWO-LANE HIGHWAYS

FACILITY LOCATION.... CR 630 from CR 555 to US 17/SR 35
 ANALYST..... KBN
 TIME OF ANALYSIS..... PM Peak Hour
 DATE OF ANALYSIS..... 03-14-1994
 OTHER INFORMATION.... Background 1997

A) ADJUSTMENT FACTORS

 PERCENTAGE OF TRUCKS..... 14
 PERCENTAGE OF BUSES..... 0
 PERCENTAGE OF RECREATIONAL VEHICLES..... 4
 DESIGN SPEED (MPH)..... 60
 PEAK HOUR FACTOR..... 1
 DIRECTIONAL DISTRIBUTION (UP/DOWN)..... 50 / 50
 LANE WIDTH (FT)..... 12
 USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)... 6
 PERCENT NO PASSING ZONES..... 15

B) CORRECTION FACTORS

 LEVEL TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	2	1.8	2.2	1	1	.84
B	2.2	2	2.5	1	1	.81
C	2.2	2	2.5	1	1	.81
D	2	1.6	1.6	1	1	.86
E	2	1.6	1.6	1	1	.86

C) LEVEL OF SERVICE RESULTS

 INPUT VOLUME(vph): 434
 ACTUAL FLOW RATE: 434

LOS	SERVICE FLOW RATE	V/C
A	283	.12
B	547	.24
C	889	.39
D	1491	.62
E	2405	1

LOS FOR GIVEN CONDITIONS: B

1985 HCM:TWO-LANE HIGHWAYS

FACILITY LOCATION.... SR 37 from CR 630 to Old Highway 37
 ANALYST..... KBN
 TIME OF ANALYSIS..... PM Peak Hour
 DATE OF ANALYSIS..... 02-22-1994
 OTHER INFORMATION.... Background 1997

A) ADJUSTMENT FACTORS

 PERCENTAGE OF TRUCKS..... 14
 PERCENTAGE OF BUSES..... 0
 PERCENTAGE OF RECREATIONAL VEHICLES..... 4
 DESIGN SPEED (MPH)..... 60
 PEAK HOUR FACTOR..... 1
 DIRECTIONAL DISTRIBUTION (UP/DOWN)..... 50 / 50
 LANE WIDTH (FT)..... 12
 USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)... 6
 PERCENT NO PASSING ZONES..... 10

B) CORRECTION FACTORS

 LEVEL TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	2	1.8	2.2	1	1	.84
B	2.2	2	2.5	1	1	.81
C	2.2	2	2.5	1	1	.81
D	2	1.6	1.6	1	1	.86
E	2	1.6	1.6	1	1	.86

C) LEVEL OF SERVICE RESULTS

 INPUT VOLUME(vph): 281
 ACTUAL FLOW RATE: 281

LOS	SERVICE FLOW RATE	V/C
A	354	.15
B	616	.27
C	980	.43
D	1540	.64
E	2405	1

LOS FOR GIVEN CONDITIONS: A

1985 HCM:TWO-LANE HIGHWAYS

FACILITY LOCATION.... SR 37 from Old Highway 37 to CR 640
 ANALYST..... KBN
 TIME OF ANALYSIS..... PM Peak Hour
 DATE OF ANALYSIS..... 02-22-1994
 OTHER INFORMATION.... Background 1997

A) ADJUSTMENT FACTORS

 PERCENTAGE OF TRUCKS..... 14
 PERCENTAGE OF BUSES..... 0
 PERCENTAGE OF RECREATIONAL VEHICLES..... 4
 DESIGN SPEED (MPH)..... 60
 PEAK HOUR FACTOR..... 1
 DIRECTIONAL DISTRIBUTION (UP/DOWN)..... 50 / 50
 LANE WIDTH (FT)..... 12
 USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)... 6
 PERCENT NO PASSING ZONES..... 10

B) CORRECTION FACTORS

 LEVEL TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	2	1.8	2.2	1	1	.84
B	2.2	2	2.5	1	1	.81
C	2.2	2	2.5	1	1	.81
D	2	1.6	1.6	1	1	.86
E	2	1.6	1.6	1	1	.86

C) LEVEL OF SERVICE RESULTS

 INPUT VOLUME(vph): 241
 ACTUAL FLOW RATE: 241

LOS	SERVICE FLOW RATE	V/C
A	354	.15
B	616	.27
C	980	.43
D	1540	.64
E	2405	1

LOS FOR GIVEN CONDITIONS: A

1985 HCM:TWO-LANE HIGHWAYS

FACILITY LOCATION.... CR 663 from HPS to SR 62
 ANALYST..... KBN
 TIME OF ANALYSIS..... PM Peak Hour
 DATE OF ANALYSIS..... 03-11-1994
 OTHER INFORMATION.... Background 1997

A) ADJUSTMENT FACTORS

 PERCENTAGE OF TRUCKS..... 14
 PERCENTAGE OF BUSES..... 0
 PERCENTAGE OF RECREATIONAL VEHICLES..... 4
 DESIGN SPEED (MPH)..... 60
 PEAK HOUR FACTOR..... 1
 DIRECTIONAL DISTRIBUTION (UP/DOWN)..... 50 / 50
 LANE WIDTH (FT)..... 12
 USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)... 6
 PERCENT NO PASSING ZONES..... 20

B) CORRECTION FACTORS

 LEVEL TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	2	1.8	2.2	1	1	.84
B	2.2	2	2.5	1	1	.81
C	2.2	2	2.5	1	1	.81
D	2	1.6	1.6	1	1	.86
E	2	1.6	1.6	1	1	.86

C) LEVEL OF SERVICE RESULTS

 INPUT VOLUME(vph): 122
 ACTUAL FLOW RATE: 122

LOS	SERVICE FLOW RATE	V/C
A	283	.12
B	547	.24
C	889	.39
D	1491	.62
E	2405	1

LOS FOR GIVEN CONDITIONS: A

APPENDIX 10.12.2

1997 CONSTRUCTION LINK ANALYSIS

1985 HCM:TWO-LANE HIGHWAYS

FACILITY LOCATION.... Fort Green Road from HPS to CR 630
 ANALYST..... KBN
 TIME OF ANALYSIS..... PM Peak Hour
 DATE OF ANALYSIS..... 02-22-1994
 OTHER INFORMATION.... Construction

A) ADJUSTMENT FACTORS

 PERCENTAGE OF TRUCKS..... 14
 PERCENTAGE OF BUSES..... 0
 PERCENTAGE OF RECREATIONAL VEHICLES..... 4
 DESIGN SPEED (MPH)..... 60
 PEAK HOUR FACTOR..... 1
 DIRECTIONAL DISTRIBUTION (UP/DOWN)..... 50 / 50
 LANE WIDTH (FT)..... 12
 USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)... 6
 PERCENT NO PASSING ZONES..... 15

B) CORRECTION FACTORS

----- LEVEL TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	2	1.8	2.2	1	1	.84
B	2.2	2	2.5	1	1	.81
C	2.2	2	2.5	1	1	.81
D	2	1.6	1.6	1	1	.86
E	2	1.6	1.6	1	1	.86

C) LEVEL OF SERVICE RESULTS

 INPUT VOLUME(vph): 342
 ACTUAL FLOW RATE: 342
 SERVICE

LOS	FLOW RATE	V/C
A	283	.12
B	547	.24
C	889	.39
D	1491	.62
E	2405	1

LOS FOR GIVEN CONDITIONS: B

1985 HCM:TWO-LANE HIGHWAYS

FACILITY LOCATION.... CR 630 from SR 37 to Fort Green Road
 ANALYST..... KBN
 TIME OF ANALYSIS..... PM Peak Hour
 DATE OF ANALYSIS..... 03-31-1994
 OTHER INFORMATION.... Construction

A) ADJUSTMENT FACTORS

 PERCENTAGE OF TRUCKS..... 14
 PERCENTAGE OF BUSES..... 0
 PERCENTAGE OF RECREATIONAL VEHICLES..... 4
 DESIGN SPEED (MPH)..... 60
 PEAK HOUR FACTOR..... 1
 DIRECTIONAL DISTRIBUTION (UP/DOWN)..... 50 / 50
 LANE WIDTH (FT)..... 12
 USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)... 6
 PERCENT NO PASSING ZONES..... 15

B) CORRECTION FACTORS

 LEVEL TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	2	1.8	2.2	1	1	.84
B	2.2	2	2.5	1	1	.81
C	2.2	2	2.5	1	1	.81
D	2	1.6	1.6	1	1	.86
E	2	1.6	1.6	1	1	.86

C) LEVEL OF SERVICE RESULTS

 INPUT VOLUME(vph): 377
 ACTUAL FLOW RATE: 377

LOS	SERVICE FLOW RATE	V/C
A	283	.12
B	547	.24
C	889	.39
D	1491	.62
E	2405	1

LOS FOR GIVEN CONDITIONS: B

1985 HCM:TWO-LANE HIGHWAYS

FACILITY LOCATION.... CR 630 from Fort Green Road to CR 555
 ANALYST..... KBN
 TIME OF ANALYSIS..... PM Peak Hour
 DATE OF ANALYSIS..... 03-14-1994
 OTHER INFORMATION.... Construction

A) ADJUSTMENT FACTORS

 PERCENTAGE OF TRUCKS..... 14
 PERCENTAGE OF BUSES..... 0
 PERCENTAGE OF RECREATIONAL VEHICLES..... 4
 DESIGN SPEED (MPH)..... 60
 PEAK HOUR FACTOR..... 1
 DIRECTIONAL DISTRIBUTION (UP/DOWN)..... 50 / 50
 LANE WIDTH (FT)..... 12
 USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)... 6
 PERCENT NO PASSING ZONES..... 15

B) CORRECTION FACTORS

 LEVEL TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	2	1.8	2.2	1	1	.84
B	2.2	2	2.5	1	1	.81
C	2.2	2	2.5	1	1	.81
D	2	1.6	1.6	1	1	.86
E	2	1.6	1.6	1	1	.86

C) LEVEL OF SERVICE RESULTS

 INPUT VOLUME(vph): 470
 ACTUAL FLOW RATE: 470

LOS	SERVICE FLOW RATE	V/C
A	283	.12
B	547	.24
C	889	.39
D	1491	.62
E	2405	1

LOS FOR GIVEN CONDITIONS: B

1985 HCM:TWO-LANE HIGHWAYS

FACILITY LOCATION.... CR 630 from CR 555 tok US 17/SR 35
 ANALYST..... KBN
 TIME OF ANALYSIS..... PM Peak Hour
 DATE OF ANALYSIS..... 03-31-1994
 OTHER INFORMATION.... Construction

A) ADJUSTMENT FACTORS

 PERCENTAGE OF TRUCKS..... 14
 PERCENTAGE OF BUSES..... 0
 PERCENTAGE OF RECREATIONAL VEHICLES..... 4
 DESIGN SPEED (MPH)..... 60
 PEAK HOUR FACTOR..... 1
 DIRECTIONAL DISTRIBUTION (UP/DOWN)..... 50 / 50
 LANE WIDTH (FT)..... 12
 USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)... 6
 PERCENT NO PASSING ZONES..... 15

B) CORRECTION FACTORS

 LEVEL TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	2	1.8	2.2	1	1	.84
B	2.2	2	2.5	1	1	.81
C	2.2	2	2.5	1	1	.81
D	2	1.6	1.6	1	1	.86
E	2	1.6	1.6	1	1	.86

C) LEVEL OF SERVICE RESULTS

 INPUT VOLUME(vph): 542
 ACTUAL FLOW RATE: 542

LOS	SERVICE FLOW RATE	V/C
A	283	.12
B	547	.24
C	889	.39
D	1491	.62
E	2405	1

LOS FOR GIVEN CONDITIONS: B

1985 HCM:TWO-LANE HIGHWAYS

FACILITY LOCATION.... SR 37 from CR 630 to Old Highway 37
 ANALYST..... KBN
 TIME OF ANALYSIS..... PM Peak Hour
 DATE OF ANALYSIS..... 03-31-1994
 OTHER INFORMATION.... Construction

A) ADJUSTMENT FACTORS

 PERCENTAGE OF TRUCKS..... 14
 PERCENTAGE OF BUSES..... 0
 PERCENTAGE OF RECREATIONAL VEHICLES..... 4
 DESIGN SPEED (MPH)..... 60
 PEAK HOUR FACTOR..... 1
 DIRECTIONAL DISTRIBUTION (UP/DOWN)..... 50 / 50
 LANE WIDTH (FT)..... 12
 USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)... 6
 PERCENT NO PASSING ZONES..... 10

B) CORRECTION FACTORS

 LEVEL TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	2	1.8	2.2	1	1	.84
B	2.2	2	2.5	1	1	.81
C	2.2	2	2.5	1	1	.81
D	2	1.6	1.6	1	1	.86
E	2	1.6	1.6	1	1	.86

C) LEVEL OF SERVICE RESULTS

 INPUT VOLUME(vph): 389
 ACTUAL FLOW RATE: 389

LOS	SERVICE FLOW RATE	V/C
A	354	.15
B	616	.27
C	980	.43
D	1540	.64
E	2405	1

LOS FOR GIVEN CONDITIONS: B

1985 HCM:TWO-LANE HIGHWAYS

FACILITY LOCATION.... CR 663 from HPS to SR 62
 ANALYST..... KBN
 TIME OF ANALYSIS..... PM Peak Hour
 DATE OF ANALYSIS..... 03-31-1994
 OTHER INFORMATION.... Construction

A) ADJUSTMENT FACTORS

 PERCENTAGE OF TRUCKS..... 14
 PERCENTAGE OF BUSES..... 0
 PERCENTAGE OF RECREATIONAL VEHICLES..... 4
 DESIGN SPEED (MPH)..... 60
 PEAK HOUR FACTOR..... 1
 DIRECTIONAL DISTRIBUTION (UP/DOWN)..... 50 / 50
 LANE WIDTH (FT)..... 12
 USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)... 6
 PERCENT NO PASSING ZONES..... 20

B) CORRECTION FACTORS

 LEVEL TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	2	1.8	2.2	1	1	.84
B	2.2	2	2.5	1	1	.81
C	2.2	2	2.5	1	1	.81
D	2	1.6	1.6	1	1	.86
E	2	1.6	1.6	1	1	.86

C) LEVEL OF SERVICE RESULTS

 INPUT VOLUME(vph): 171
 ACTUAL FLOW RATE: 171

LOS	SERVICE FLOW RATE	V/C
A	283	.12
B	547	.24
C	889	.39
D	1491	.62
E	2405	1

LOS FOR GIVEN CONDITIONS: A

APPENDIX 10.12.3

1997 BACKGROUND INTERSECTION ANALYSIS

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 55

PEAK HOUR FACTOR..... 1

AREA POPULATION..... 3000

NAME OF THE EAST/WEST STREET..... CR 630

NAME OF THE NORTH/SOUTH STREET..... SR 37

NAME OF THE ANALYST..... KBN

DATE OF THE ANALYSIS (mm/dd/yy)..... 03-11-1994

TIME PERIOD ANALYZED..... PM Peak Hour

OTHER INFORMATION.... Background 1997

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE WESTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
	---	---	---	---
LEFT	--	44	0	87
THRU	--	0	255	76
RIGHT	--	124	99	0

NUMBER OF LANES

	EB	WB	NB	SB
	---	---	---	---
LANES	--	1	1	1

ADJUSTMENT FACTORS

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	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	-----	---	---	-
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	---	---	---
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS				
WB	6.50	6.50	0.00	6.50
MAJOR LEFTS				
SB	5.50	5.50	0.00	5.50
MINOR LEFTS				
WB	8.00	8.00	0.00	8.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... CR 630
NAME OF THE NORTH/SOUTH STREET.... SR 37
DATE AND TIME OF THE ANALYSIS..... 03-11-1994 ; PM Peak Hour
OTHER INFORMATION.... Background 1997

CAPACITY AND LEVEL-OF-SERVICE

Page-3

MOVEMENT	FLOW- RATE v(pcph)	POTEN- TIAL CAPACITY c (pcph) p	ACTUAL MOVEMENT CAPACITY c (pcph) M	SHARED CAPACITY c (pcph) SH	RESERVE CAPACITY c = c - v R SH	LOS
MINOR STREET						
WB LEFT	48	375	343	>	343	> C
				> 518	> 333	> B
RIGHT	136	632	632	>	632	> 495 A
MAJOR STREET						
SB LEFT	96	741	741		741	646 A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... CR 630
NAME OF THE NORTH/SOUTH STREET.... SR 37
DATE AND TIME OF THE ANALYSIS..... 03-11-1994 ; PM Peak Hour
OTHER INFORMATION.... Background 1997

1985 HCM: SIGNALIZED INTERSECTIONS

SUMMARY REPORT

INTERSECTION..CR 640/SR 37

AREA TYPE.....OTHER

ANALYST.....KBN

DATE.....03-11-1994

TIME.....PM Peak Hour

COMMENT.....Background 1997

VOLUMES					GEOMETRY						
	EB	WB	NB	SB		EB	WB	NB	SB		
LT	185	5	71	14	: L	12.0	L	12.0	L	12.0	L
TH	78	119	483	144	: LTR	12.0	LTR	12.0	T	12.0	T
RT	12	74	28	60	:	12.0		12.0	R	12.0	R
RR	1	4	1	3	:	12.0		12.0		12.0	
					:	12.0		12.0		12.0	
					:	12.0		12.0		12.0	

ADJUSTMENT FACTORS									
	GRADE (%)	HV (%)	ADJ Y/N	PKG Nm	BUSES Nb	PHF	PEDS	PED. Y/N	BUT. min T
EB	0.00	6.00	N	0	0	0.90	0	N	20.5
WB	0.00	6.00	N	0	0	0.90	0	N	20.5
NB	0.00	10.00	N	0	0	0.90	0	N	14.5
SB	0.00	10.00	N	0	0	0.90	0	N	14.5

SIGNAL SETTINGS					CYCLE LENGTH = 90.0				
	PH-1	PH-2	PH-3	PH-4		PH-1	PH-2	PH-3	PH-4
EB LT	X				NB LT	X			
TH	X				TH	X			
RT	X				RT	X			
PD					PD				
WB LT	X				SB LT	X			
TH	X				TH	X			
RT	X				RT	X			
PD					PD				
GREEN	30.0	0.0	0.0	0.0	GREEN	48.0	0.0	0.0	0.0
YELLOW	6.0	0.0	0.0	0.0	YELLOW	6.0	0.0	0.0	0.0

LEVEL OF SERVICE							
	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	L	0.362	0.367	16.1	C	15.8	C
	LTR	0.309	0.367	15.6	C		
WB	L	0.009	0.367	13.8	B	15.9	C
	LTR	0.351	0.367	15.9	C		
NB	L	0.123	0.567	6.9	B	9.4	B
	T	0.554	0.567	9.9	B		
	R	0.037	0.567	6.6	B		
SB	L	0.042	0.567	6.6	B	7.0	B
	T	0.165	0.567	7.1	B		
	R	0.077	0.567	6.7	B		

INTERSECTION: Delay = 11.4 (sec/veh) V/C = 0.479 LOS = B

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 55
PEAK HOUR FACTOR..... 1
AREA POPULATION..... 3000
NAME OF THE EAST/WEST STREET..... CR 630
NAME OF THE NORTH/SOUTH STREET..... Fort Green Road
NAME OF THE ANALYST..... KBN
DATE OF THE ANALYSIS (mm/dd/yy)..... 03-11-1994
TIME PERIOD ANALYZED..... PM Peak Hour
OTHER INFORMATION.... Background 1997

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG
MAJOR STREET DIRECTION: EAST/WEST
CONTROL TYPE NORTHBOUND: STOP SIGN
CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
	----	----	----	----
LEFT	7	13	122	8
THRU	144	133	37	10
RIGHT	33	32	72	1

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
	----	----	----	----
LANES	1	1	1	1

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS				
NB	6.50	6.50	0.00	6.50
SB	6.50	6.50	0.00	6.50
MAJOR LEFTS				
EB	5.50	5.50	0.00	5.50
WB	5.50	5.50	0.00	5.50
MINOR THROUGH				
NB	7.50	7.50	0.00	7.50
SB	7.50	7.50	0.00	7.50
MINOR LEFTS				
NB	8.00	8.00	0.00	8.00
SB	8.00	8.00	0.00	8.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... CR 630
NAME OF THE NORTH/SOUTH STREET.... Fort Green Road
DATE AND TIME OF THE ANALYSIS..... 03-11-1994 ; PM Peak Hour
OTHER INFORMATION.... Background 1997

CAPACITY AND LEVEL-OF-SERVICE

Page-3

MOVEMENT	FLOW- RATE v (pcph)	POTEN- TIAL CAPACITY c (pcph) p	ACTUAL MOVEMENT CAPACITY c (pcph) M		SHARED CAPACITY c (pcph) SH		RESERVE CAPACITY c = c - v R SH		LOS
MINOR STREET									
NB LEFT	134	448	435	>	435	>	301	>	B
THROUGH	41	496	489	>	512	>	258	>	C A
RIGHT	79	760	760	>	760	>	680	>	A
MINOR STREET									
SB LEFT	9	382	335	>	335	>	326	>	B
THROUGH	11	496	488	>	416	>	395	>	B A
RIGHT	1	771	771	>	771	>	770	>	A
MAJOR STREET									
EB LEFT	8	927	927		927		919		A
WB LEFT	14	914	914		914		900		A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... CR 630
NAME OF THE NORTH/SOUTH STREET.... Fort Green Road
DATE AND TIME OF THE ANALYSIS..... 03-11-1994 ; PM Peak Hour
OTHER INFORMATION.... Background 1997

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 55

PEAK HOUR FACTOR..... 1

AREA POPULATION..... 3000

NAME OF THE EAST/WEST STREET..... CR 630

NAME OF THE NORTH/SOUTH STREET..... CR 555

NAME OF THE ANALYST..... KBN

DATE OF THE ANALYSIS (mm/dd/yy)..... 02-23-1994

TIME PERIOD ANALYZED..... PM Peak Hour

OTHER INFORMATION.... Background 1997

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
	----	----	----	----
LEFT	38	19	1	159
THRU	68	156	5	10
RIGHT	2	24	2	146

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
	----	----	----	----
LANES	1	1	1	1

ADJUSTMENT FACTORS

Page-2

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS				
NB	6.50	6.50	0.00	6.50
SB	6.50	6.50	0.00	6.50
MAJOR LEFTS				
EB	5.50	5.50	0.00	5.50
WB	5.50	5.50	0.00	5.50
MINOR THROUGH				
NB	7.50	7.50	0.00	7.50
SB	7.50	7.50	0.00	7.50
MINOR LEFTS				
NB	8.00	8.00	0.00	8.00
SB	8.00	8.00	0.00	8.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... CR 630
NAME OF THE NORTH/SOUTH STREET.... CR 555
DATE AND TIME OF THE ANALYSIS..... 02-23-1994 ; PM Peak Hour
OTHER INFORMATION.... Background 1997

CAPACITY AND LEVEL-OF-SERVICE

Page-3

MOVEMENT	FLOW- RATE v (pcph)	POTEN- TIAL CAPACITY c (pcph) p	ACTUAL MOVEMENT CAPACITY c (pcph) M		SHARED CAPACITY c (pcph) SH		RESERVE CAPACITY c = c - v R SH	LOS

MINOR STREET								
NB LEFT	1	378	304	>	304	>	303	> B
THROUGH	6	526	505	>	515	>	506	>A A
RIGHT	2	851	851	>	851	>	849	> A
MINOR STREET								
SB LEFT	175	489	465	>	465	>	291	> C
THROUGH	11	534	513	>	567	>	221	>C A
RIGHT	161	752	752	>	752	>	591	> A
MAJOR STREET								
EB LEFT	42	911	911		911		869	A
WB LEFT	21	997	997		997		976	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... CR 630
 NAME OF THE NORTH/SOUTH STREET.... CR 555
 DATE AND TIME OF THE ANALYSIS..... 02-23-1994 ; PM Peak Hour
 OTHER INFORMATION.... Background 1997

1985 HCM: SIGNALIZED INTERSECTIONS

SUMMARY REPORT

INTERSECTION..CR 630/US 17/98

AREA TYPE.....OTHER

ANALYST.....KBN

DATE.....03-11-1994

TIME.....PM Peak Hour

COMMENT.....Background 1997

VOLUMES					:	GEOMETRY				
	EB	WB	NB	SB	:	EB	WB	NB	SB	
LT	134	62	43	188	: L	12.0	12.0	L	12.0	L
TH	119	62	329	425	: T	12.0	12.0	T	12.0	T
RT	124	137	54	81	: R	12.0	12.0	T	12.0	T
RR	4	7	3	4	:	12.0	12.0	R	12.0	R
					:	12.0	12.0		12.0	
					:	12.0	12.0		12.0	

ADJUSTMENT FACTORS											
	GRADE	HV	ADJ	PKG	BUSES	PHF	PEDS	PED.	BUT.	ARR.	TYPE
	(%)	(%)	Y/N	Nm	Nb			Y/N	min T		
EB	0.00	5.00	N	0	0	0.90	20	N	19.8		3
WB	0.00	5.00	N	0	0	0.90	20	N	19.8		3
NB	0.00	5.00	N	0	0	0.90	20	N	19.8		3
SB	0.00	5.00	N	0	0	0.90	20	N	19.8		3

SIGNAL SETTINGS								CYCLE LENGTH = 150.0			
		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2	PH-3	PH-4
EB	LT	X	X			NB	LT	X	X		
	TH		X				TH		X		
	RT		X				RT		X		
	PD						PD				
WB	LT	X	X			SB	LT	X	X		
	TH		X				TH		X		
	RT		X				RT		X		
	PD						PD				
GREEN		12.0	50.0	0.0	0.0	GREEN		12.0	60.0	0.0	0.0
YELLOW		4.0	4.0	0.0	0.0	YELLOW		4.0	4.0	0.0	0.0

LEVEL OF SERVICE							
	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	L	0.277	0.447	20.1	C	24.6	C
	T	0.222	0.340	26.9	D		
	R	0.264	0.340	27.3	D		
WB	LT	0.267	0.340	27.4	D	27.5	D
	R	0.284	0.340	27.6	D		
NB	L	0.101	0.513	14.2	B	21.5	C
	T	0.269	0.407	22.6	C		
	R	0.094	0.407	20.9	C		
SB	L	0.395	0.513	17.7	C	21.7	C
	T	0.347	0.407	23.4	C		
	R	0.142	0.407	21.3	C		

INTERSECTION: Delay = 23.1 (sec/veh) V/C = 0.322 LOS = C

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 55

PEAK HOUR FACTOR..... 1

AREA POPULATION..... 3000

NAME OF THE EAST/WEST STREET..... SR 62

NAME OF THE NORTH/SOUTH STREET..... CR 663

NAME OF THE ANALYST..... KBN

DATE OF THE ANALYSIS (mm/dd/yy)..... 02-28-1994

TIME PERIOD ANALYZED..... PM Peak Hour

OTHER INFORMATION.... Background 1997

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
	----	----	----	----
LEFT	19	92	--	69
THRU	139	92	--	0
RIGHT	0	34	--	38

NUMBER OF LANES

	EB	WB	NB	SB
	----	----	----	----
LANES	1	1	--	1

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	-----	---	---	-
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	---	---	---
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS				
SB	6.50	6.50	0.00	6.50
MAJOR LEFTS				
EB	5.50	5.50	0.00	5.50
MINOR LEFTS				
SB	8.00	8.00	0.00	8.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... SR 62
 NAME OF THE NORTH/SOUTH STREET.... CR 663
 DATE AND TIME OF THE ANALYSIS..... 02-28-1994 ; PM Peak Hour
 OTHER INFORMATION.... Background 1997

CAPACITY AND LEVEL-OF-SERVICE

Page-3

MOVEMENT	FLOW- RATE v(pcph)	POTEN- TIAL CAPACITY c (pcph) p	ACTUAL MOVEMENT CAPACITY c (pcph) M		SHARED CAPACITY c (pcph) SH		RESERVE CAPACITY c = c - v R SH	LOS
MINOR STREET								
SB LEFT	76	516	510	>	510	>	434	> A
				>	587	>	469	>A
RIGHT	42	811	811	>	811	>	769	> A
MAJOR STREET								
EB LEFT	21	968	968		968		947	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... SR 62
 NAME OF THE NORTH/SOUTH STREET.... CR 663
 DATE AND TIME OF THE ANALYSIS..... 02-28-1994 ; PM Peak Hour
 OTHER INFORMATION.... Background 1997

APPENDIX 10.12.4

1997 CONSTRUCTION INTERSECTION ANALYSIS

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 55

PEAK HOUR FACTOR..... 1

AREA POPULATION..... 3000

NAME OF THE EAST/WEST STREET..... CR 630

NAME OF THE NORTH/SOUTH STREET..... SR 37

NAME OF THE ANALYST..... KBN

DATE OF THE ANALYSIS (mm/dd/yy)..... 03-31-1994

TIME PERIOD ANALYZED..... PM Peak Hour

OTHER INFORMATION.... Construction

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE WESTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
	----	----	----	----
LEFT	--	134	99	87
THRU	--	0	255	76
RIGHT	--	152	99	0

NUMBER OF LANES

	EB	WB	NB	SB
	----	----	----	----
LANES	--	1	1	1

ADJUSTMENT FACTORS

Page-2

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	-----	---	---	-
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	---	---	---
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS				
WB	6.50	6.50	0.00	6.50
MAJOR LEFTS				
SB	5.50	5.50	0.00	5.50
MINOR LEFTS				
WB	8.00	8.00	0.00	8.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... CR 630
NAME OF THE NORTH/SOUTH STREET.... SR 37
DATE AND TIME OF THE ANALYSIS..... 03-31-1994 ; PM Peak Hour
OTHER INFORMATION.... Construction

CAPACITY AND LEVEL-OF-SERVICE

Page-3

MOVEMENT	FLOW- RATE v (pcph)	POTEN- TIAL CAPACITY c (pcph) p	ACTUAL MOVEMENT CAPACITY c (pcph) M		SHARED CAPACITY c (pcph) SH	RESERVE CAPACITY c = c - v R SH	LOS
MINOR STREET							
WB LEFT	147	375	343	>	343	>	196 > D
				>	453	>	139 >D
RIGHT	167	632	632	>	632	>	464 > A
MAJOR STREET							
SB LEFT	96	741	741		741		646 A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... CR 630
 NAME OF THE NORTH/SOUTH STREET.... SR 37
 DATE AND TIME OF THE ANALYSIS..... 03-31-1994 ; PM Peak Hour
 OTHER INFORMATION.... Construction

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT

INTERSECTION..CR 640/SR 37
AREA TYPE.....OTHER
ANALYST.....KBN
DATE.....03-31-1994
TIME.....PM Peak Hour
COMMENT.....Construction

VOLUMES					GEOMETRY						
	EB	WB	NB	SB	:	EB	WB	NB	SB		
LT	170	6	66	22	:	L	12.0	L	12.0	L	12.0
TH	72	102	442	140	:	TR	12.0	TR	12.0	T	12.0
RT	14	29	24	55	:		12.0		12.0	R	12.0
RR	1	1	1	3	:		12.0		12.0		12.0
					:		12.0		12.0		12.0
					:		12.0		12.0		12.0

ADJUSTMENT FACTORS										
	GRADE (%)	HV (%)	ADJ Y/N	PKG Nm	BUSES Nb	PHF	PEDS	PED. Y/N	BUT. min T	ARR. TYPE
EB	0.00	6.00	N	0	0	0.90	0	N	20.5	3
WB	0.00	6.00	N	0	0	0.90	0	N	20.5	3
NB	0.00	10.00	N	0	0	0.90	0	N	14.5	3
SB	0.00	10.00	N	0	0	0.90	0	N	14.5	3

SIGNAL SETTINGS										CYCLE LENGTH = 90.0
	PH-1	PH-2	PH-3	PH-4		PH-1	PH-2	PH-3	PH-4	
EB LT	X				NB LT	X				
TH	X				TH	X				
RT	X				RT	X				
PD					PD					
WB LT	X				SB LT	X				
TH	X				TH	X				
RT	X				RT	X				
PD					PD					
GREEN	30.0	0.0	0.0	0.0	GREEN	48.0	0.0	0.0	0.0	
YELLOW	6.0	0.0	0.0	0.0	YELLOW	6.0	0.0	0.0	0.0	

LEVEL OF SERVICE							
	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	L	0.414	0.367	16.5	C	15.9	C
	TR	0.151	0.367	14.5	B		
WB	L	0.013	0.367	13.8	B	15.0	B
	TR	0.233	0.367	15.0	C		
NB	L	0.113	0.567	6.9	B	8.9	B
	T	0.507	0.567	9.4	B		
	R	0.031	0.567	6.5	B		
SB	L	0.060	0.567	6.7	B	6.9	B
	T	0.161	0.567	7.1	B		
	R	0.071	0.567	6.7	B		

INTERSECTION: Delay = 10.8 (sec/veh) V/C = 0.470 LOS = B

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 55

PEAK HOUR FACTOR..... 1

AREA POPULATION..... 3000

NAME OF THE EAST/WEST STREET..... CR 630

NAME OF THE NORTH/SOUTH STREET..... Fort Green Road

NAME OF THE ANALYST..... KBN

DATE OF THE ANALYSIS (mm/dd/yy)..... 03-31-1994

TIME PERIOD ANALYZED..... PM Peak Hour

OTHER INFORMATION.... Construction

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
	----	----	----	----
LEFT	7	13	156	7
THRU	144	133	47	9
RIGHT	33	32	203	1

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
	----	----	----	----
LANES	1	1	1	1

ADJUSTMENT FACTORS

Page-2

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS				
NB	6.50	6.50	0.00	6.50
SB	6.50	6.50	0.00	6.50
MAJOR LEFTS				
EB	5.50	5.50	0.00	5.50
WB	5.50	5.50	0.00	5.50
MINOR THROUGH				
NB	7.50	7.50	0.00	7.50
SB	7.50	7.50	0.00	7.50
MINOR LEFTS				
NB	8.00	8.00	0.00	8.00
SB	8.00	8.00	0.00	8.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... CR 630
NAME OF THE NORTH/SOUTH STREET.... Fort Green Road
DATE AND TIME OF THE ANALYSIS..... 03-31-1994 ; PM Peak Hour
OTHER INFORMATION.... Construction

CAPACITY AND LEVEL-OF-SERVICE

Page-3

MOVEMENT	FLOW- RATE v (pcph)	POTEN- TIAL CAPACITY c (pcph) p	ACTUAL MOVEMENT CAPACITY c (pcph) M		SHARED CAPACITY c (pcph) SH		RESERVE CAPACITY c = c - v R SH	LOS
MINOR STREET								
NB LEFT	172	448	436	>	436	>	265	> C
THROUGH	52	496	489	>	563	>	117	437 >D A
RIGHT	223	760	760	>	760	>	536	> A
MINOR STREET								
SB LEFT	8	297	213	>	213	>	205	> C
THROUGH	10	496	488	>	323	>	305	479 >B A
RIGHT	1	771	771	>	771	>	770	> A
MAJOR STREET								
EB LEFT	8	927	927		927		919	A
WB LEFT	14	914	914		914		900	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... CR 630
NAME OF THE NORTH/SOUTH STREET.... Fort Green Road
DATE AND TIME OF THE ANALYSIS..... 03-31-1994 ; PM Peak Hour
OTHER INFORMATION.... Construction

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 55

PEAK HOUR FACTOR..... 1

AREA POPULATION..... 3000

NAME OF THE EAST/WEST STREET..... CR 630

NAME OF THE NORTH/SOUTH STREET..... CR 555

NAME OF THE ANALYST..... KBN

DATE OF THE ANALYSIS (mm/dd/yy)..... 03-31-1994

TIME PERIOD ANALYZED..... PM Peak Hour

OTHER INFORMATION.... Construction

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
	----	----	----	----
LEFT	59	19	1	159
THRU	181	156	5	10
RIGHT	2	24	2	146

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
	----	----	----	----
LANES	1	1	1	1

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS				
NB	6.50	6.50	0.00	6.50
SB	6.50	6.50	0.00	6.50
MAJOR LEFTS				
EB	5.50	5.50	0.00	5.50
WB	5.50	5.50	0.00	5.50
MINOR THROUGH				
NB	7.50	7.50	0.00	7.50
SB	7.50	7.50	0.00	7.50
MINOR LEFTS				
NB	8.00	8.00	0.00	8.00
SB	8.00	8.00	0.00	8.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... CR 630
NAME OF THE NORTH/SOUTH STREET.... CR 555
DATE AND TIME OF THE ANALYSIS..... 03-31-1994 ; PM Peak Hour
OTHER INFORMATION.... Construction

MOVEMENT	FLOW- RATE v(pcph)	POTEN- TIAL CAPACITY c (pcph) p	ACTUAL MOVEMENT CAPACITY c (pcph) M		SHARED CAPACITY c (pcph) SH		RESERVE CAPACITY c = c - v R SH		LOS

MINOR STREET									
NB LEFT	1	297	235	>	235	>	234	>	C
THROUGH	6	430	406	>	415	>	406	>	A A
RIGHT	2	738	738	>	738	>	736	>	A
MINOR STREET									
SB LEFT	175	393	368	>	368	>	193	>	D
THROUGH	11	437	412	>	484	>	138	>	D A
RIGHT	161	752	752	>	752	>	591	>	A
MAJOR STREET									
EB LEFT	65	911	911		911		846		A
WB LEFT	21	908	908		908		887		A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... CR 630
NAME OF THE NORTH/SOUTH STREET.... CR 555
DATE AND TIME OF THE ANALYSIS..... 03-31-1994 ; PM Peak Hour
OTHER INFORMATION.... Construction

1985 HCM: SIGNALIZED INTERSECTIONS

SUMMARY REPORT

INTERSECTION..CR 630/US 17/SR 35

AREA TYPE.....OTHER

ANALYST.....KBN

DATE.....03-31-1994

TIME.....PM Peak Hour

COMMENT.....Construction

VOLUMES					:	GEOMETRY						
	EB	WB	NB	SB	:	EB	LT	WB	L	NB	L	SB
LT	266	62	43	188	:	L	12.0	LT	12.0	L	12.0	12.0
TH	119	62	329	425	:	T	12.0	R	12.0	T	12.0	12.0
RT	125	137	54	81	:	R	12.0		12.0	T	12.0	12.0
RR	6	7	3	4	:		12.0		12.0	R	12.0	12.0
					:		12.0		12.0		12.0	12.0
					:		12.0		12.0		12.0	12.0

ADJUSTMENT FACTORS										
	GRADE	HV	ADJ	PKG	BUSES	PHF	PEDS	PED.	BUT.	ARR. TYPE
	(%)	(%)	Y/N	Nm	Nb			Y/N	min T	
EB	0.00	5.00	N	0	0	0.90	20	N	19.8	3
WB	0.00	5.00	N	0	0	0.90	20	N	19.8	3
NB	0.00	5.00	N	0	0	0.90	20	N	19.8	3
SB	0.00	5.00	N	0	0	0.90	20	N	19.8	3

SIGNAL SETTINGS										CYCLE LENGTH = 150.0
	PH-1	PH-2	PH-3	PH-4		PH-1	PH-2	PH-3	PH-4	
EB LT	X	X			NB LT	X	X			
TH		X			TH		X			
RT		X			RT		X			
PD					PD					
WB LT	X	X			SB LT	X	X			
TH		X			TH		X			
RT		X			RT		X			
PD					PD					
GREEN	12.0	50.0	0.0	0.0	GREEN	12.0	60.0	0.0	0.0	
YELLOW	4.0	4.0	0.0	0.0	YELLOW	4.0	4.0	0.0	0.0	

LEVEL OF SERVICE							
	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	L	0.549	0.447	25.8	D	26.4	D
	T	0.222	0.340	26.9	D		
	R	0.260	0.340	27.3	D		
WB	LT	0.266	0.340	27.4	D	27.5	D
	R	0.284	0.340	27.6	D		
NB	L	0.101	0.513	14.2	B	21.5	C
	T	0.269	0.407	22.6	C		
	R	0.094	0.407	20.9	C		
SB	L	0.395	0.513	17.7	C	21.7	C
	T	0.347	0.407	23.4	C		
	R	0.142	0.407	21.3	C		

INTERSECTION: Delay = 23.7 (sec/veh) V/C = 0.353 LOS = C

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 55

PEAK HOUR FACTOR..... 1

AREA POPULATION..... 3000

NAME OF THE EAST/WEST STREET..... SR 62

NAME OF THE NORTH/SOUTH STREET..... CR 663

NAME OF THE ANALYST..... KBN

DATE OF THE ANALYSIS (mm/dd/yy)..... 03-31-1994

TIME PERIOD ANALYZED..... PM Peak Hour

OTHER INFORMATION.... Construction

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
	----	----	----	----
LEFT	19	0	--	97
THRU	139	92	--	0
RIGHT	0	34	--	51

NUMBER OF LANES

	EB	WB	NB	SB
	----	----	----	----
LANES	1	1	--	1

ADJUSTMENT FACTORS

Page-2

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	-----	---	---	-
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	---	---	---
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS				
SB	6.50	6.50	0.00	6.50
MAJOR LEFTS				
EB	5.50	5.50	0.00	5.50
MINOR LEFTS				
SB	8.00	8.00	0.00	8.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... SR 62
NAME OF THE NORTH/SOUTH STREET.... CR 663
DATE AND TIME OF THE ANALYSIS..... 03-31-1994 ; PM Peak Hour
OTHER INFORMATION.... Construction

MOVEMENT	FLOW- RATE v(pcph)	POTEN- TIAL CAPACITY c (pcph) p	ACTUAL MOVEMENT CAPACITY c (pcph) M		SHARED CAPACITY c (pcph) SH		RESERVE CAPACITY c = c - v R SH	LOS
MINOR STREET								
SB LEFT	107	516	510	>	510	>	403	> A
				>	585	>	422	>A
RIGHT	56	811	811	>	811	>	755	> A
MAJOR STREET								
EB LEFT	21	968	968		968		947	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... SR 62
 NAME OF THE NORTH/SOUTH STREET.... CR 663
 DATE AND TIME OF THE ANALYSIS..... 03-31-1994 ; PM Peak Hour
 OTHER INFORMATION.... Construction

APPENDIX 10.12.5

1999 BACKGROUND LINK ANALYSIS

1985 HCM:TWO-LANE HIGHWAYS

FACILITY LOCATION.... Fort Green Road from HPS to CR 630
 ANALYST..... KBN
 TIME OF ANALYSIS..... PM Peak Hour
 DATE OF ANALYSIS..... 03-11-1994
 OTHER INFORMATION.... Background 1999

A) ADJUSTMENT FACTORS

 PERCENTAGE OF TRUCKS..... 14
 PERCENTAGE OF BUSES..... 0
 PERCENTAGE OF RECREATIONAL VEHICLES..... 4
 DESIGN SPEED (MPH)..... 60
 PEAK HOUR FACTOR..... 1
 DIRECTIONAL DISTRIBUTION (UP/DOWN)..... 50 / 50
 LANE WIDTH (FT)..... 12
 USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)... 6
 PERCENT NO PASSING ZONES..... 20

B) CORRECTION FACTORS

 LEVEL TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	2	1.8	2.2	1	1	.84
B	2.2	2	2.5	1	1	.81
C	2.2	2	2.5	1	1	.81
D	2	1.6	1.6	1	1	.86
E	2	1.6	1.6	1	1	.86

C) LEVEL OF SERVICE RESULTS

 INPUT VOLUME(vph): 76
 ACTUAL FLOW RATE: 76

LOS	SERVICE FLOW RATE	V/C
A	283	.12
B	547	.24
C	889	.39
D	1491	.62
E	2405	1

LOS FOR GIVEN CONDITIONS: A

1985 HCM:TWO-LANE HIGHWAYS

FACILITY LOCATION.... CR 663 between HPS and SR 62
 ANALYST..... KBN
 TIME OF ANALYSIS..... PM Peak Hour
 DATE OF ANALYSIS..... 03-11-1994
 OTHER INFORMATION.... Background 1999

A) ADJUSTMENT FACTORS

 PERCENTAGE OF TRUCKS..... 14
 PERCENTAGE OF BUSES..... 0
 PERCENTAGE OF RECREATIONAL VEHICLES..... 4
 DESIGN SPEED (MPH)..... 60
 PEAK HOUR FACTOR..... 1
 DIRECTIONAL DISTRIBUTION (UP/DOWN)..... 50 / 50
 LANE WIDTH (FT)..... 12
 USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)... 6
 PERCENT NO PASSING ZONES..... 20

B) CORRECTION FACTORS

 LEVEL TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	2	1.8	2.2	1	1	.84
B	2.2	2	2.5	1	1	.81
C	2.2	2	2.5	1	1	.81
D	2	1.6	1.6	1	1	.86
E	2	1.6	1.6	1	1	.86

C) LEVEL OF SERVICE RESULTS

 INPUT VOLUME(vph): 126
 ACTUAL FLOW RATE: 126

LOS	SERVICE FLOW RATE	V/C
A	283	.12
B	547	.24
C	889	.39
D	1491	.62
E	2405	1

LOS FOR GIVEN CONDITIONS: A

APPENDIX 10.12.6

1999 OPERATION LINK ANALYSIS

1985 HCM:TWO-LANE HIGHWAYS

FACILITY LOCATION.... Fort Green Road from HPS to CR 630
 ANALYST..... KBN
 TIME OF ANALYSIS..... PM Peak Hour
 DATE OF ANALYSIS..... 03-14-1994
 OTHER INFORMATION.... Operation

A) ADJUSTMENT FACTORS

 PERCENTAGE OF TRUCKS..... 14
 PERCENTAGE OF BUSES..... 0
 PERCENTAGE OF RECREATIONAL VEHICLES..... 4
 DESIGN SPEED (MPH)..... 60
 PEAK HOUR FACTOR..... 1
 DIRECTIONAL DISTRIBUTION (UP/DOWN)..... 50 / 50
 LANE WIDTH (FT)..... 12
 USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)... 6
 PERCENT NO PASSING ZONES..... 20

B) CORRECTION FACTORS

 LEVEL TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	2	1.8	2.2	1	1	.84
B	2.2	2	2.5	1	1	.81
C	2.2	2	2.5	1	1	.81
D	2	1.6	1.6	1	1	.86
E	2	1.6	1.6	1	1	.86

C) LEVEL OF SERVICE RESULTS

 INPUT VOLUME(vph): 100
 ACTUAL FLOW RATE: 100

LOS	SERVICE FLOW RATE	V/C
A	283	.12
B	547	.24
C	889	.39
D	1491	.62
E	2405	1

LOS FOR GIVEN CONDITIONS: A

1985 HCM:TWO-LANE HIGHWAYS

FACILITY LOCATION.... CR 663 from HPS to SR 62
 ANALYST..... KBN
 TIME OF ANALYSIS..... PM Peak Hour
 DATE OF ANALYSIS..... 03-14-1994
 OTHER INFORMATION.... Operation

A) ADJUSTMENT FACTORS

 PERCENTAGE OF TRUCKS..... 14
 PERCENTAGE OF BUSES..... 0
 PERCENTAGE OF RECREATIONAL VEHICLES..... 4
 DESIGN SPEED (MPH)..... 60
 PEAK HOUR FACTOR..... 1
 DIRECTIONAL DISTRIBUTION (UP/DOWN)..... 50 / 50
 LANE WIDTH (FT)..... 12
 USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)... 6
 PERCENT NO PASSING ZONES..... 20

B) CORRECTION FACTORS

 LEVEL TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	2	1.8	2.2	1	1	.84
B	2.2	2	2.5	1	1	.81
C	2.2	2	2.5	1	1	.81
D	2	1.6	1.6	1	1	.86
E	2	1.6	1.6	1	1	.86

C) LEVEL OF SERVICE RESULTS

 INPUT VOLUME(vph): 130
 ACTUAL FLOW RATE: 130

LOS	SERVICE FLOW RATE	V/C
A	283	.12
B	547	.24
C	889	.39
D	1491	.62
E	2405	1

LOS FOR GIVEN CONDITIONS: A

APPENDIX 10.12.7

1999 BACKGROUND INTERSECTION ANALYSIS

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 55

PEAK HOUR FACTOR..... 1

AREA POPULATION..... 3000

NAME OF THE EAST/WEST STREET..... CR 630

NAME OF THE NORTH/SOUTH STREET..... Fort Green Road

NAME OF THE ANALYST..... KBN

DATE OF THE ANALYSIS (mm/dd/yy)..... 03-11-1994

TIME PERIOD ANALYZED..... PM Peak Hour

OTHER INFORMATION.... Background 1999

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
	----	----	----	----
LEFT	8	13	36	8
THRU	150	139	40	10
RIGHT	35	34	83	1

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
	----	----	----	----
LANES	1	1	1	1

ADJUSTMENT FACTORS

Page-2

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS				
NB	6.50	6.50	0.00	6.50
SB	6.50	6.50	0.00	6.50
MAJOR LEFTS				
EB	5.50	5.50	0.00	5.50
WB	5.50	5.50	0.00	5.50
MINOR THROUGH				
NB	7.50	7.50	0.00	7.50
SB	7.50	7.50	0.00	7.50
MINOR LEFTS				
NB	8.00	8.00	0.00	8.00
SB	8.00	8.00	0.00	8.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... CR 630
NAME OF THE NORTH/SOUTH STREET.... Fort Green Road
DATE AND TIME OF THE ANALYSIS..... 03-11-1994 ; PM Peak Hour
OTHER INFORMATION.... Background 1999

CAPACITY AND LEVEL-OF-SERVICE

Page-3

MOVEMENT	FLOW- RATE v (pcph)	POTEN- TIAL CAPACITY c (pcph) p	ACTUAL MOVEMENT CAPACITY c (pcph) M		SHARED CAPACITY c (pcph) SH		RESERVE CAPACITY c = c - v R SH	LOS
MINOR STREET								
NB LEFT	40	436	423	>	423	>	383	> B
THROUGH	44	484	477	>	569	477	394	433 >B A
RIGHT	91	753	753	>	753	>	661	> A
MINOR STREET								
SB LEFT	9	364	313	>	313	>	304	> B
THROUGH	11	484	476	>	397	476	376	465 >B A
RIGHT	1	764	764	>	764	>	763	> A
MAJOR STREET								
EB LEFT	9	918	918		918		910	A
WB LEFT	14	906	906		906		891	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... CR 630
NAME OF THE NORTH/SOUTH STREET.... Fort Green Road
DATE AND TIME OF THE ANALYSIS..... 03-11-1994 ; PM Peak Hour
OTHER INFORMATION.... Background 1999

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 55
PEAK HOUR FACTOR..... 1
AREA POPULATION..... 3000
NAME OF THE EAST/WEST STREET..... SR 62
NAME OF THE NORTH/SOUTH STREET..... CR 663
NAME OF THE ANALYST..... KBN
DATE OF THE ANALYSIS (mm/dd/yy)..... 03-11-1994
TIME PERIOD ANALYZED..... PM Peak Hour
OTHER INFORMATION.... Background 1999

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION
MAJOR STREET DIRECTION: EAST/WEST
CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	20	0	--	61
THRU	145	95	--	0
RIGHT	0	36	--	10

NUMBER OF LANES

	EB	WB	NB	SB
LANES	1	1	--	1

ADJUSTMENT FACTORS

Page-2

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	-----	---	---	-
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	---	---	---
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS				
SB	6.50	6.50	0.00	6.50
MAJOR LEFTS				
EB	5.50	5.50	0.00	5.50
MINOR LEFTS				
SB	8.00	8.00	0.00	8.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... SR 62
NAME OF THE NORTH/SOUTH STREET.... CR 663
DATE AND TIME OF THE ANALYSIS..... 03-11-1994 ; PM Peak Hour
OTHER INFORMATION.... Background 1999

CAPACITY AND LEVEL-OF-SERVICE

Page-3

MOVEMENT	FLOW- RATE v (pcph)	POTEN- TIAL CAPACITY c (pcph) p	ACTUAL MOVEMENT CAPACITY c (pcph) M		SHARED CAPACITY c (pcph) SH		RESERVE CAPACITY c = c - v R SH		LOS
MINOR STREET									
SB LEFT	67	508	501	>	501	>	434	>	A
				>	529	>	451	>	A
RIGHT	11	807	807	>	807	>	796	>	A
MAJOR STREET									
EB LEFT	22	962	962		962		940		A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... SR 62
NAME OF THE NORTH/SOUTH STREET.... CR 663
DATE AND TIME OF THE ANALYSIS..... 03-11-1994 ; PM Peak Hour
OTHER INFORMATION.... Background 1999

APPENDIX 10.12.8

1999 OPERATION INTERSECTION ANALYSIS

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 55

PEAK HOUR FACTOR..... 1

AREA POPULATION..... 3000

NAME OF THE EAST/WEST STREET..... CR 630

NAME OF THE NORTH/SOUTH STREET..... Fort Green Road

NAME OF THE ANALYST..... KBN

DATE OF THE ANALYSIS (mm/dd/yy)..... 03-11-1994

TIME PERIOD ANALYZED..... PM Peak Hour

OTHER INFORMATION.... Operation

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
	----	----	----	----
LEFT	8	13	36	8
THRU	150	139	52	10
RIGHT	35	34	95	1

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
	----	----	----	----
LANES	1	1	1	1

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS				
NB	6.50	6.50	0.00	6.50
SB	6.50	6.50	0.00	6.50
MAJOR LEFTS				
EB	5.50	5.50	0.00	5.50
WB	5.50	5.50	0.00	5.50
MINOR THROUGHS				
NB	7.50	7.50	0.00	7.50
SB	7.50	7.50	0.00	7.50
MINOR LEFTS				
NB	8.00	8.00	0.00	8.00
SB	8.00	8.00	0.00	8.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... CR 630
 NAME OF THE NORTH/SOUTH STREET.... Fort Green Road
 DATE AND TIME OF THE ANALYSIS..... 03-11-1994 ; PM Peak Hour
 OTHER INFORMATION.... Operation

CAPACITY AND LEVEL-OF-SERVICE

Page-3

MOVEMENT	FLOW- RATE v (pcph)	POTEN- TIAL CAPACITY c (pcph) p	ACTUAL MOVEMENT CAPACITY c (pcph) M		SHARED CAPACITY c (pcph) SH		RESERVE CAPACITY c = c - v R SH		LOS
MINOR STREET									
NB LEFT	40	436	423	>	423	>	383	>	B
THROUGH	57	484	477	>	571	>	370	>	B A
RIGHT	105	753	753	>	753	>	648	>	A
MINOR STREET									
SB LEFT	9	350	290	>	290	>	281	>	C
THROUGH	11	484	476	>	380	>	360	>	B A
RIGHT	1	764	764	>	764	>	763	>	A
MAJOR STREET									
EB LEFT	9	918	918		918		910		A
WB LEFT	14	906	906		906		891		A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... CR 630
NAME OF THE NORTH/SOUTH STREET.... Fort Green Road
DATE AND TIME OF THE ANALYSIS..... 03-11-1994 ; PM Peak Hour
OTHER INFORMATION.... Operation

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 55

PEAK HOUR FACTOR..... 1

AREA POPULATION..... 3000

NAME OF THE EAST/WEST STREET..... SR 62

NAME OF THE NORTH/SOUTH STREET..... CR 663

NAME OF THE ANALYST..... KBN

DATE OF THE ANALYSIS (mm/dd/yy)..... 03-11-1994

TIME PERIOD ANALYZED..... PM Peak Hour

OTHER INFORMATION.... Operation

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
	----	----	----	----
LEFT	20	0	--	63
THRU	145	95	--	0
RIGHT	0	36	--	12

NUMBER OF LANES

	EB	WB	NB	SB
	----	----	----	----
LANES	1	1	--	1

ADJUSTMENT FACTORS

Page-2

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	-----	---	---	-
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	---	---	---
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS	SB	6.50	6.50	0.00	6.50
MAJOR LEFTS	EB	5.50	5.50	0.00	5.50
MINOR LEFTS	SB	8.00	8.00	0.00	8.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... SR 62
NAME OF THE NORTH/SOUTH STREET.... CR 663
DATE AND TIME OF THE ANALYSIS..... 03-11-1994 ; PM Peak Hour
OTHER INFORMATION.... Operation

CAPACITY AND LEVEL-OF-SERVICE

Page-3

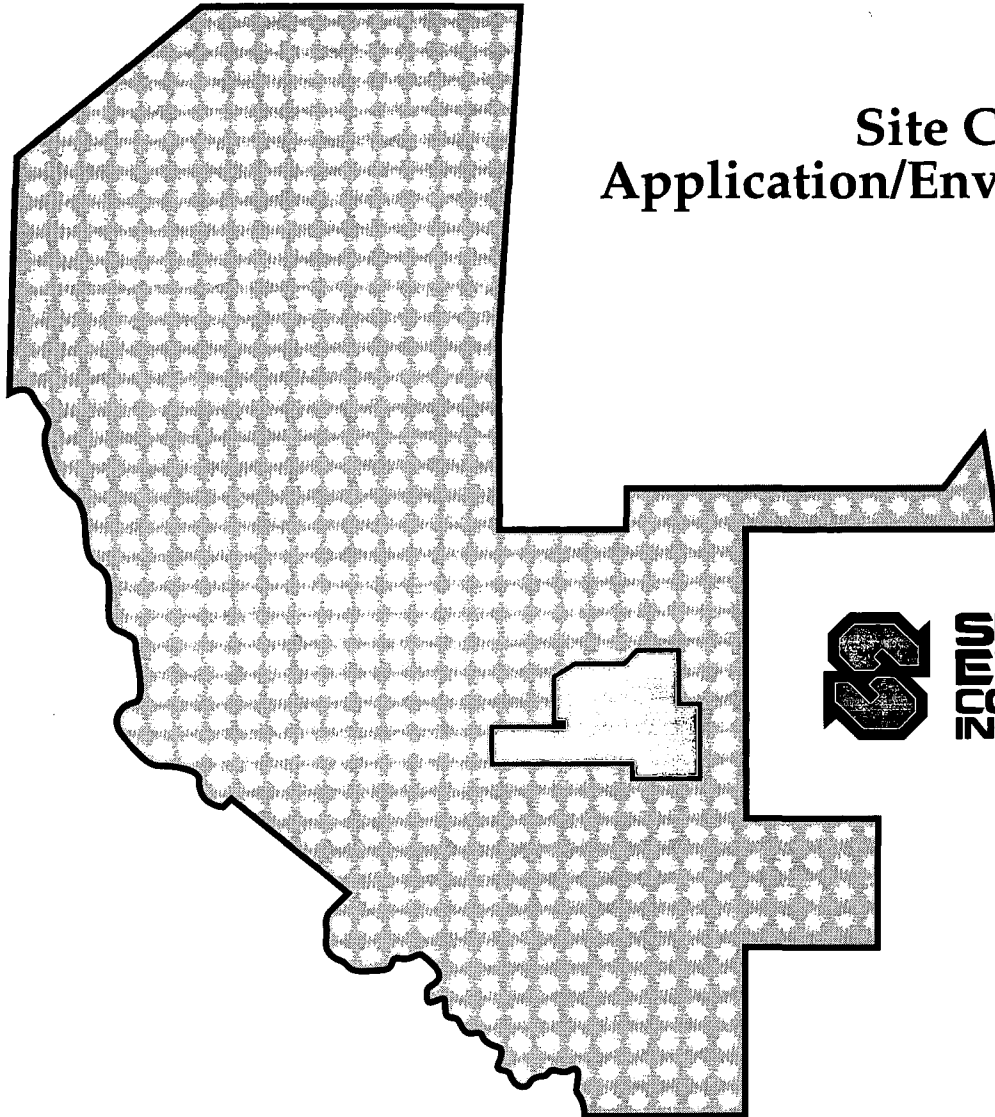
MOVEMENT	FLOW- RATE v (pcph)	POTEN- TIAL CAPACITY c (pcph) p	ACTUAL MOVEMENT CAPACITY c (pcph) M		SHARED CAPACITY c (pcph) SH		RESERVE CAPACITY c = c - v R SH		LOS
MINOR STREET									
SB LEFT	69	508	501	>	501	>	431	>	A
				>	533	>	451	>	A
RIGHT	13	807	807	>	807	>	794	>	A
MAJOR STREET									
EB LEFT	22	962	962		962		940		A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET..... SR 62
NAME OF THE NORTH/SOUTH STREET.... CR 663
DATE AND TIME OF THE ANALYSIS..... 03-11-1994 ; PM Peak Hour
OTHER INFORMATION.... Operation

HARDEE UNIT 3

Site Certification
Application/Environmental
Analysis



APPENDIX 10.13

**POLK COUNTY TRAFFIC CONCURRENCY
MINOR TRAFFIC REVIEW FORM**

TRAFFIC CONCURRENCY

MINOR TRAFFIC REVIEW

This procedure should be followed when applying for a Final or Conditional Concurrency Determination. These trips can then be assigned to the "Directly Accessed Segment" on the "Concurrency Determination Network." *(Note: The requirements for the completion of a Minor Traffic Review can be found in Appendix A "Polk County Traffic Impact Study Methodology and Procedures" (pp. 6-7) of the Polk County Concurrency Management Ordinance.)*

Project Name: Hardee Unit 3 Project Number: _____

1. Developments generating more than 50 and less than or equal to 750 average daily trips will be required to submit a Minor Traffic Review with any application for a Final or Conditional Concurrency Determination.
2. Submit of four copies of the completed Minor Traffic Review to Development Services with any application for a Concurrency Determination.
3. Complete the following information:
 - A. Provide a description and location of the project,

See Attachment A

Identify the Directly Accessed Segment from the proposed project onto the Concurrency Determination Network. This segment was identified in comments from the Preapplication Conference. *(NOTE: Road segments on the Concurrency Determination Network are contained in Exhibit 2. The Directly Accessed Segment is the first road on the Concurrency Determination Network which is accessed by a vehicle leaving the project site.)*

4093	Fort Green Road, Hardee County Line, CR 630
Segment #	Description (On Street, From Street, To Street)

B. Identify each land development activity (Column B) and number of units (Column C) from Exhibit 1. Table 1A - Small Project/Minor Traffic Review Data Table,

• land development activity (column B): 110 General Light Industrial

• number of units (column C): N/A

C. Estimate of the number of daily and peak hour trips generated (use Exhibit 1 - Table 1A) by multiplying the number of project units from above, e.g. dwelling units or 1,000 square feet, times the daily trip rate (column D) and peak hour trip rate (column E),

• number of project units (above) N/A

X daily trip rate (column D) N/A

= 109 daily trips

• number of project units (above) N/A

X peak hour trip rate (column E) N/A

= 24 peak hour trips

See Attachment B for average daily trips.

NOTE: Peak-hour trips were calculated using projected trip generation information regarding the specified proposed facility

D. Indicate the Generalized Peak Hour/Peak Direction Planning Capacity at Level of Service C (LOS "C" Capacity) of the Directly Accessed Segment (provided in comments from the Preapplication Conference) and percent of capacity consumed by the project traffic,

• LOS "C" Capacity (peak hour/peak direction) 540

• to calculate the percent of capacity consumed by the project traffic, divide the number of peak hour trips by the answer above

peak hour trips (from Step 3.C. above) 24

+ LOS "C" capacity (peak hour/peak direction) 540 (Derived from 1992 Polk County Roadway Inventory)

= 0.044 X 100

= 4.44 % percent consumed

E. Determine the number of net external peak hour trips that will impact each Directly Accessed Segment for both the peak and off-peak directions (e.g. after internal capture and/or adjacent street capture is considered).

1. Each road segment in Exhibit 2 consists of two (2) directional links, i.e. east and west, or north and south. The direction factor is the percentage (%) of the total traffic traveling

a given direction during the peak hour. Identify the direction factor which accompanies each directional link (Exhibit 2 - Column E). For example, on Segment 1000 during the peak hour, 54.1% of the vehicles are southbound (Link 1000S). The remaining 45.9% of the vehicles are northbound (Link 1000N). Link 1000S serves traffic in the peak direction, while Link 1000N serves traffic in the off-peak direction.

4093N 0.355
Link # Direction Factor

4093S 0.645
Link # Direction Factor

2. Steps to Determine Peak Hour Trips by Direction (see Exhibit 3 for an example):

a) Multiply the number of peak hour trips times the "Percent New Trips" factor (column F) (Under this step, the passerby capture trips are subtracted from the vehicle trip generation.)

• 24 peak hour trips (calculated under Step 3.C.)

X "Percent New Trips" factor (column F) N/A

= 24 peak hour trips ("new trips")

NOTE: Passerby capture trips for this facility are expected to be negligible.

b) Identify the greater of the two: the number of vehicle trips entering or exiting the site during the peak hour. For the land use category identified under Step 3.A., identify the percentage (%) of trips entering and exiting the site during the peak hour (column G). Multiply the higher percentage (%) times the number of peak hour trips calculated under Step 3.E.2.a. (Always round this number up to the next whole number.)

• (%) of trips entering the site: 25

• (%) of trips exiting the site: 75

• greater percentage 75% X

24 peak hour trips (Step 3.E.2) = 18 peak hour trips (round up)

NOTE: The project site is located directly on the Polk/Hardee County line; therefore, the peak-hour traffic indicated above depicts traffic affecting only the Polk County portion of Fort Green Road.

c.) Identify the peak hour trips the project will add to each directional link on the Directly Accessed Segment.

Multiply the number of peak hour trips obtained from Step 3.E.2.B. times the direction factors identified under Step 3.E. for each directional link on a segment. These are the peak hour trips for both the peak and off-peak direction. (Round these numbers to the nearest whole number. Peak and off-peak trips should equal the total trips.) These trips can be assigned to each link on the Directly Accessed Segment.

Link # 4093N :

0.355 Direction Factor (Step 3.E.1) X 18 peak hour trips (Step 3.e.2.b.)
= 6 peak hour trips (round to nearest whole number)

Link # 4093S :

0.645 Direction Factor (Step 3.E.1) X 18 peak hour trips (Step 3.e.2.b.)
= 12 peak hour trips (round to nearest whole number)

4. The impact of project traffic on the first Directly Accessed Segment on the Concurrency Determination Network, shall be evaluated relative to its adopted level of service. Additional impacted segments may be added by the Planning Division when it would be in the best interest of Polk County to do so in order to maintain the adopted level of service standards. Based upon this information, a determination shall be made by the Planning Division whether or not the road facilities are adequate to maintain adopted service levels upon build-out of the proposed development and a recommendation prepared for the Concurrency Review Committee. A Certificate of Concurrency may then be issued according to the procedures identified in the Concurrency Management Ordinance.
5. If the information submitted pursuant to Section 5.(b)4. of Polk County Ordinance 92-10 indicates the level of service will fall below the adopted standard, then the applicant may undertake a more detailed evaluation of future roadway operating conditions to demonstrate acceptable operating conditions pursuant to Sections 15 and 16 of the Ordinance, or, the applicant may propose roadway improvements to restore acceptable conditions.
6. The appeals process for a Minor Traffic Review shall be governed by the procedure set forth in the Concurrency Management Ordinance.

FILE - C:\WORK\CMS\FM_MINOR

ATTACHMENT A
PROJECT DESCRIPTION

PROJECT DESCRIPTION

SECI is proposing to own and operate a new 440-megawatt (MW) combined cycle power plant [the Hardee Power Station Unit 3 (Hardee Unit 3) Project]. This facility will be constructed under a turnkey construction contract with Westinghouse Electric Corporation and Black & Veatch Construction, Inc. The Hardee Unit 3 Project will be located on the existing Hardee Power Station (HPS) site and will represent an incremental increase in the ultimate power-generating capacity of the HPS site from 660 MW to 880 MW. The HPS site was selected as the preferred location for the Hardee Unit 3 Project because this site has been previously certified for a 660-MW combined cycle power plant (Certification Number PA 89-25). Furthermore, the HPS site has adequate area to accommodate the projected expansion from 660 MW to 880 MW. Locating the Hardee Unit 3 Project at the HPS site takes advantage of the existing infrastructure and onsite facilities, and minimizes potential environmental impacts that might otherwise be associated with the construction of a combined cycle power plant at a previously undeveloped site.

Operation of Hardee Unit 3 will require approximately 35 employees working three shifts daily. It is anticipated that most of the operating jobs will be filled by people already residing within commuting distance of the plant. Eighty-five percent of the operational workforce is expected to reside in areas north of the plant with the remaining 15 percent commuting from areas south of the plant site. For additional information, please see Sections 2.0, 4.0, and 5.0 of the Site Certification Application/Environmental Analysis (SCA/EA).

ATTACHMENT B
TRIP GENERATION TABLE

10

10-13-10

10-13-10

10-13-10

10-13-10

10-13-10

10-13-10

HARDEE UNIT 3
TRIP GENERATION

	Day Shift (7 a.m. to 3 p.m.)	Evening Shift (3 p.m. to 11 p.m.)	Night Shift (11 p.m. to 7 a.m.)	Total
Employees	21	7	7	35
Total Trip Ends ^a	49	17	17	83
Fuel Oil Trucks	12	1		
Total Trip Ends ^b	24	2		26
Miscellaneous Deliveries				
TOTAL	73	19	17	109
Total Peak Hour Trips ^c				24

^a Trip generation rate obtained from Kimley-Horn report for FPL.

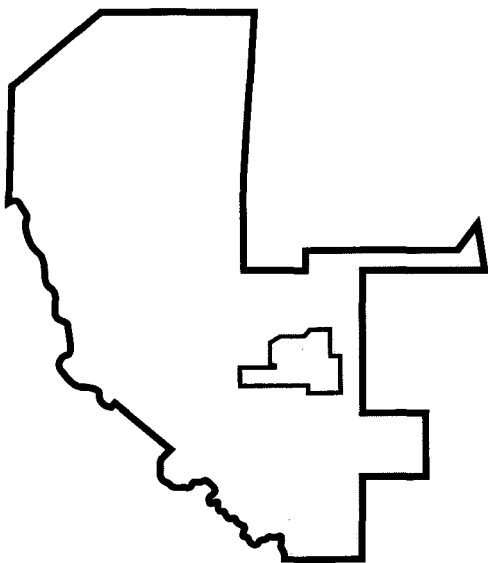
^b Oil truck deliveries assumes 2.0 trip ends per truck.

^c Based on peak p.m. period from 3:00 p.m. to 4:00 p.m.

21 operational employees leaving the site (18 traveling north on Fort Green Road).

7 operational employees entering the site (6 traveling south of Fort Green Road).

HARDEE UNIT 3



STORM WATER MANAGEMENT PLAN



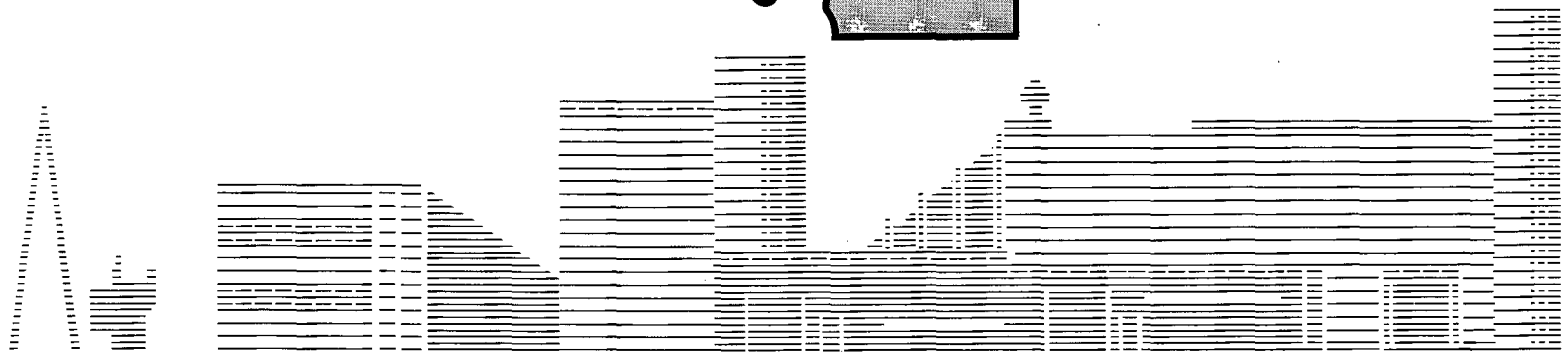
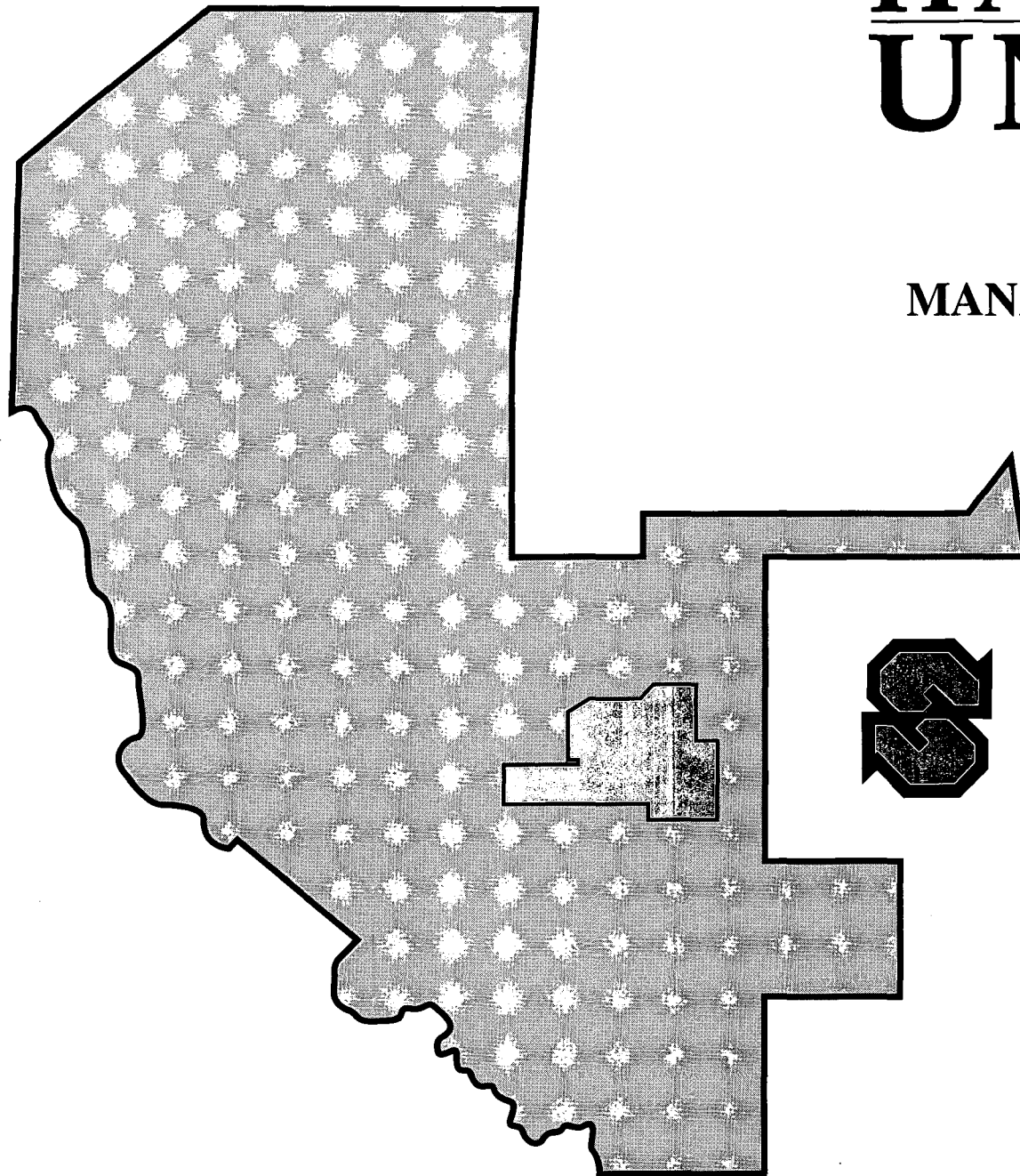
HARDEE UNIT 3

STORM WATER MANAGEMENT PLAN

Submitted by



**SEMINOLE
ELECTRIC
COOPERATIVE
INCORPORATED**



SEMINOLE ELECTRIC COOPERATIVE, INC.
HARDEE POWER STATION UNIT 3

STORM WATER MANAGEMENT PLAN

B&V FILE NO. 23930.32.0411

I hereby certify that this document was prepared by me
or under my direct supervision and that I am a duly
Registered Professional Engineer under the laws of the
State of Florida.

.....

Date Registration Number

ISSUE DATE AND REVISION NUMBER 030894-1

HARDEE POWER STATION UNIT 3

STORM WATER MANAGEMENT PLAN

CONTENTS

- 1.0 INTRODUCTION
 - 1.1 PURPOSE
 - 1.2 PROJECT DESCRIPTION
- 2.0 DESIGN CRITERIA
 - 2.1 GRADING
 - 2.2 ROADS
 - 2.3 DITCHES
 - 2.4 CULVERTS
 - 2.5 SITE RUNOFF DETENTION BASIN
- 3.0 STORM WATER MANAGEMENT
 - 3.1 NORMAL OPERATION
 - 3.2 CONSTRUCTION MEASURES

APPENDICES

- A DRAWING LIST
- B CALCULATIONS

1.0 INTRODUCTION

1.1 PURPOSE

This Storm water Management Plan provides a description of the measures proposed to control storm water runoff at the Hardee Power Station in Hardee and Polk Counties, Florida. Measures are proposed for both normal operation and construction periods.

1.2 PROJECT DESCRIPTION

Hardee Power Station Unit 3 will be a combined cycle electric generating facility with nominal capacity of 440 MW. The new facilities will be built on a 465 acre site in Hardee and Polk Counties about 9 miles northwest of Wauchula, west of County Road 663. The site is owned by Seminole Electric Cooperative, Inc. The site includes both undisturbed and mined areas of an active phosphate mine. The mined areas have been reclaimed by Agrico Chemical Company under the provisions of their phosphate mine reclamation plan. The entire site drains to an unnamed tributary of Payne Creek. Areas in the Payne Creek floodplain will not be disturbed.

The facility will use natural gas and distillate oil as fuels. An existing cooling reservoir will be used for heat rejection from the steam cycle.

2.0 DESIGN CRITERIA

Storm water control measures are designed to comply with all applicable federal, state, and local regulations. Storm water calculations were made using the U.S. Department of Agriculture (USDA) Soil Conservation Service (SCS) Methods or other approved methods. Peak discharges and runoff volumes were determined using methods approved by the Southwest Florida Water Management District.

2.1 GRADING

The general site grading will establish a working surface for construction and plant operating areas, provide positive drainage from buildings and structures, and provide adequate soil coverage for underground utilities.

Onsite drainage will be accomplished through gravity flow. The surface

drainage system will consist of mild overland slopes, ditches, and culverts. Buildings and structures will be located with the ground floor elevation a minimum of six inches above finish grade. The graded areas adjacent to buildings will be sloped away with a two percent slope. Other areas will have a minimum slope of 0.5 percent.

The ground floor elevation of all buildings will be above the estimated Payne Creek 100-year flood elevation of 109 (feet MSL). The elevation of the structures in the power block area will be 128.8 (feet MSL).

2.2 ROADS

A system of roads will provide access within the site. Permanent, paved roads will have a 20 foot wide asphalt paved surface with 3-foot wide aggregate surfaced shoulders. Aggregate surfaced roads will be 12-feet wide. The maximum profile grade for the roads will be 2 percent. Cross slope for both pavement and aggregate surfaces will be 2 percent.

All roads will be surfaced with crushed aggregate during the construction period.

2.3 DITCHES

Ditches will be trapezoidal in section, of sufficient width to facilitate cleaning, and mildly sloping so erosion of the ditch bottom due to high flow velocities is minimized. Side slopes on ditches will be 3 horizontal to 1 vertical. The preferred slope of the ditch bottom will be 200 horizontal to 1 vertical, with a minimum slope of 400 horizontal to 1 vertical.

Ditches are designed to carry the 25-year storm peak flow with velocities less than eroding velocities. Erosion protection will consist of grassed surfaces in all ditches. Enkamat, or an approved equal, erosion control fabric will be placed to limit erosion at culvert outlets.

2.4 CULVERTS

Drainage culverts will be provided at intersections of ditches and embankments. Culverts will be constructed of reinforced concrete or corrugated HDPE pipe.

The drainage culverts and associated ditches are designed to ensure passage of the 25-year storm peak runoff flow without producing a headwater elevation above the bottom of the roadway base course. The minimum cover for culverts will be 12 inches. All culverts will be designed to handle AASHTO HS20 and construction equipment loadings as applicable to the design. Culverts will have beveled end sections compatible with the ditch side slopes or concrete headwalls at both ends.

2.5 SITE RUNOFF DETENTION BASIN

The site runoff detention basin was designed as a wet detention pond in accordance with the requirements of the Southwest Florida Water Management District. The detention basin berm will have 4 to 1 side slopes inside the basin, 3 to 1 side slopes outside the basin, and a ten foot wide top. In accordance with SWFWMD Section 3.2.2.2, the detention pond will retain the volume of the first one inch runoff from the plant site and release it through a bleed down pipe. Less than one-half of the retained volume will be released in the first 60 hours after the storm. The total volume will be released in no less than 120 hours. When additional runoff occurs, the basin will function as a detention basin. The 25-year, 24-storm design storm discharge will be less than the pre-developed discharge rate. An emergency spillway will convey the peak discharge from a 100-year rainfall event.

3.0 STORM WATER MANAGEMENT

The project design drawings which accompany this report show the storm water management area. Storm water control will be managed as described below. Storm water during construction will also be managed to control erosion and sediment transport from the site.

3.1 NORMAL OPERATION

Runoff from the site area will be routed in a system of ditches to the storm water runoff detention basin located in the southwestern portion of the site. These ditches around the site area will intercept the runoff from overland flow and culverts in this area. Drawing 23930-CSTF-S3001 and 23930-CSTF-S3002 show the ditches and grading of the proposed site area.

Drawing 23930-CSTF-S3001 shows the storm water runoff detention basin. Runoff from the entire plant site area is treated and detained in this basin.

The storm water detention basin has been sized to treat and detain the runoff from a single 25-year, 24-hour rainfall event using a wet detention system in accordance with the requirements of the Southwest Florida Water Management District. The contributing drainage area of 40.8 acres is all the significantly disturbed area of the plant site area, with the exception of the fuel oil storage and unloading areas. Runoff from these areas will be treated and discharged to the cooling reservoir.

A gravity system of ditches and culverts will convey the runoff to the detention basin. A sedimentation area is provided where the runoff enters the basin. The runoff will flow through a littoral zone (plant area) for biological treatment and removal of pollutants before being discharged to Payne Creek.

The normal pool elevation in the basin will be 119.8 feet MSL. This elevation will be controlled by a small (4" diameter) bleed down pipe in the discharge structure. The bottom 12 inches of storage (up to elevation 120.8) will retain the volume of the first one inch of runoff from the 40.8 acre drainage area and release it through the bleed down pipe in approximately eight days, longer than the required 5 days.

When additional runoff occurs, the basin will function as a detention basin. Above elevation 120.8, water will begin to flow over the discharge structure weir and through three 36" diameter pipes, discharging to a tributary of Payne Creek. The 25-year, 24-hour design storm will produce a maximum water surface elevation of 122.45 (feet MSL) and a maximum discharge of 90 cfs. Based on predevelopment flows from the contributing drainage area, the maximum allowable discharge from the basin for this storm is approximately 111 cfs. An emergency spillway for the basin will be placed at elevation 123.0 (feet MSL), slightly above the design high water level. This 110-foot wide, grout filled synthetic fabric form surfaced, spillway will pass the peak 100-year storm flow of 290 cfs with one foot of freeboard to the top of berm. The top of berm will be at elevation 125.

3.2 CONSTRUCTION MEASURES

Temporary measures will be used during construction to control erosion and sediment transfer from the site. In general, silt fence will be used to filter sediment washed from grading areas where the ground slopes away from the site. Also, areas disturbed during grading operations will be seeded to establish a vegetative cover to reduce erosion on the site. The proposed overall control measures are presented in the document, "SEMINOLE ELECTRIC COOPERATIVE, INC. HARDEE POWER STATION UNIT 3, Erosion and Sedimentation Control Plan". These measures will be incorporated in the construction specifications, but are also shown on Drawing 23930-CSTF-S3021 to assist the permitting review.

The detention basin will be used as the construction runoff basin. The construction drainage area is approximately 43.5 acres and includes all of the permanent basin drainage area plus the area to be enclosed around by fuel oil storage tank secondary containment berm. This area is not included in the permanent drainage area because the runoff collected inside the bermed area will be discharged to the onsite oil/water separator after the design rainfall has ended.

In addition to storm water runoff, main plant area dewatering water will be routed to the basin through the site ditches. The flow rate from dewatering equipment will be insignificant (approximately 200 gpm or 0.4 cfs) when compared to design storm flows (approximately 87 cfs) and will not affect the operation of the basin.

Dewatering equipment will be provided and maintained during construction to remove and dispose of all surface and ground water entering excavations and other parts of the work. Groundwater dewatering will be used primarily for excavation, installation, and backfill of underground utilities. Dewatering effects will be shallow and will not impact existing facilities or wetlands. A silt screen, such as straw bales or silt fence, or other methods of sediment removal will be used to minimize the transport of suspended solids in the dewatering flow. Discharge from dewatering operations will be directed to the runoff detention basin where the filtration system will provide suspended solid sedimentation and removal. Each excavation will be kept dry during subgrade preparation and continually thereafter until the construction therein is completed to the extent that no damage from hydrostatic pressure, flotation, or flooding will result. The ground water level will be maintained a minimum of 12 inches below the bottom of each excavation.

APPENDIX A
DRAWING LIST

SECI 23930
03-08-94

DRAWING LIST

TABLE OF CONTENTS

SITE ARRANGEMENT

TOPOGRAPHIC SURVEY, SHEET 1

TOPOGRAPHIC SURVEY, SHEET 2

SITE - GRADING AND DRAINAGE KEY PLAN, GENERAL NOTES AND LEGEND

SITE - GRADING AND DRAINAGE, AREA 1

SITE - GRADING AND DRAINAGE, AREA 2

SITE - GRADING AND DRAINAGE, SECTIONS AND DETAILS, SHEET 1

SITE - GRADING AND DRAINAGE, FUEL UNLOADING AND STORAGE AREA DETAILS

SITE - EROSION AND SEDIMENTATION CONTROL PLAN

SITE - ROADS--ROADS, FENCING, AND SURFACING PLAN

SITE - ROADS--ROADS, FENCING, AND SURFACING PLAN

SITE - ROADS--SECTIONS AND DETAILS

APPENDIX B
CALCULATIONS

PART 1 - DITCHES & CULVERTS

PART 2 - STORM WATER DETENTION BASIN

PART 3 - DEWATERING

I hereby certify that these calculations were prepared
by me or under my direct supervision and that I am a
duly Registered Professional Engineer under the laws of
the State of Florida.

.....

Date Registration Number

PART 1

DITCHES & CULVERTS

SECI 23930
03-08-94

**SEMINOLE ELECTRIC
COOP, INC.**

**HARDEE STATION
UNIT 3**

PROJECT NO. 23930

SITework CALCULATIONS

DITCHES & CULVERTS

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE POWER STATION UNIT 3	DATE:	3/2/94
PROJECT NO.:	23930 52.5405. H11	CHECKED BY:	John Wary
TITLE:	DITCHES & CULVERTS	DATE:	3-2-94
		PAGE:	1 OF 64

OBJECTIVE: Determine the size of storm drainage culverts for the project.

ASSUMPTIONS:

- 1: The drainage areas are shown on page 34.
- 2: All culverts will be reinforced concrete pipe.
- 3: Design storm will be 25 year with 100 year storm considered.
- 4: The Rational Method will be used to determine peak flows.
- 5: Drainage ditches will be trapezoidal, grass lined.
- 6: All culverts will be sized using the nomographs provided. For all culverts, worst case controls. (Reference #1)
- 7: Allowable headwater depth is 6 inches below top of road surface.

REFERENCES:

- 1: Hydraulic Design of Highway Culverts, U.S. Department of Transportation. 1985.
- 2: Hydraulic Engineering, Roberson, Cassidy, and Chaundhry.
- 3: Grading and Drainage calculations for Teco Power Service.
- 4: Hydrology and Hydraulic Systems, Ram S. Gupta.
- 5: U.S. Soil Conservation Service, Technical Release 55 (TR 55).
- 6: Southwest Florida Water Management District, Permit Information Manual, Volume 1, March 1988.

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE POWER STATION UNIT 3	DATE:	3/2/94
PROJECT NO.:	23930	CHECKED BY:	JCD
TITLE:	CULVERTS	DATE:	3-1-94
		PAGE:	3 OF 64

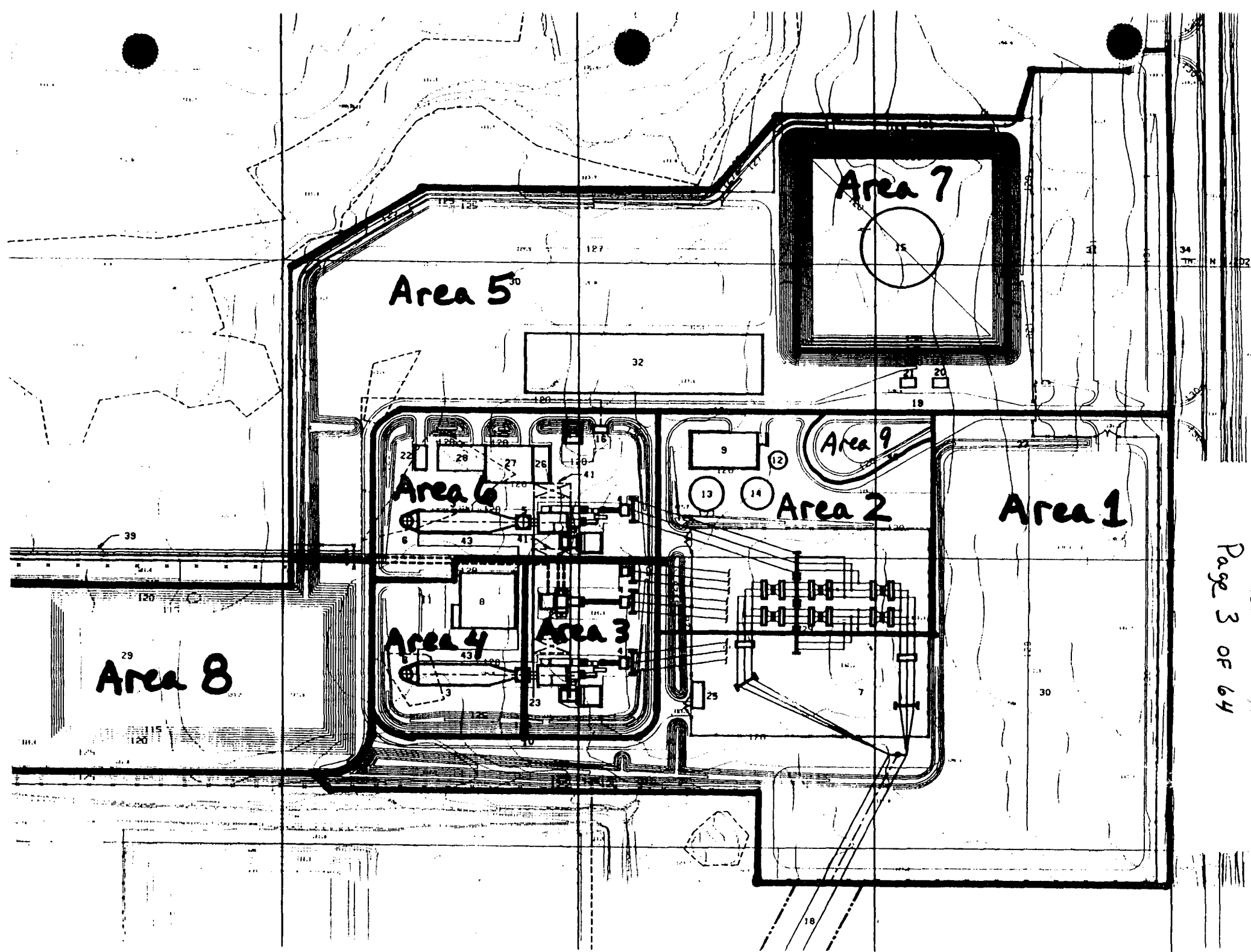
CULVERT DESIGN PROCEDURES

The proposed site is divided into 9 drainage areas which are shown on page 3. A tenth drainage area is part of the existing Teco Power Service site and not included in the proposed site area. This area is shown on page 5. The peak storm runoff for each drainage area is calculated using the Rational Method. The runoff coefficient for each drainage area is a weighted average and is calculated on pages 6 through 8. The time of concentration for each drainage area is calculated on pages 9 and 10. The rainfall intensity curves for the proposed site were taken from the Southwest Florida Water Management District, Permit Information Manual, Volume 1. Zone 8 curves were used and are shown on page 11. The drainage areas, runoff coefficients, and time of concentration values are found in table 1 on page 12.

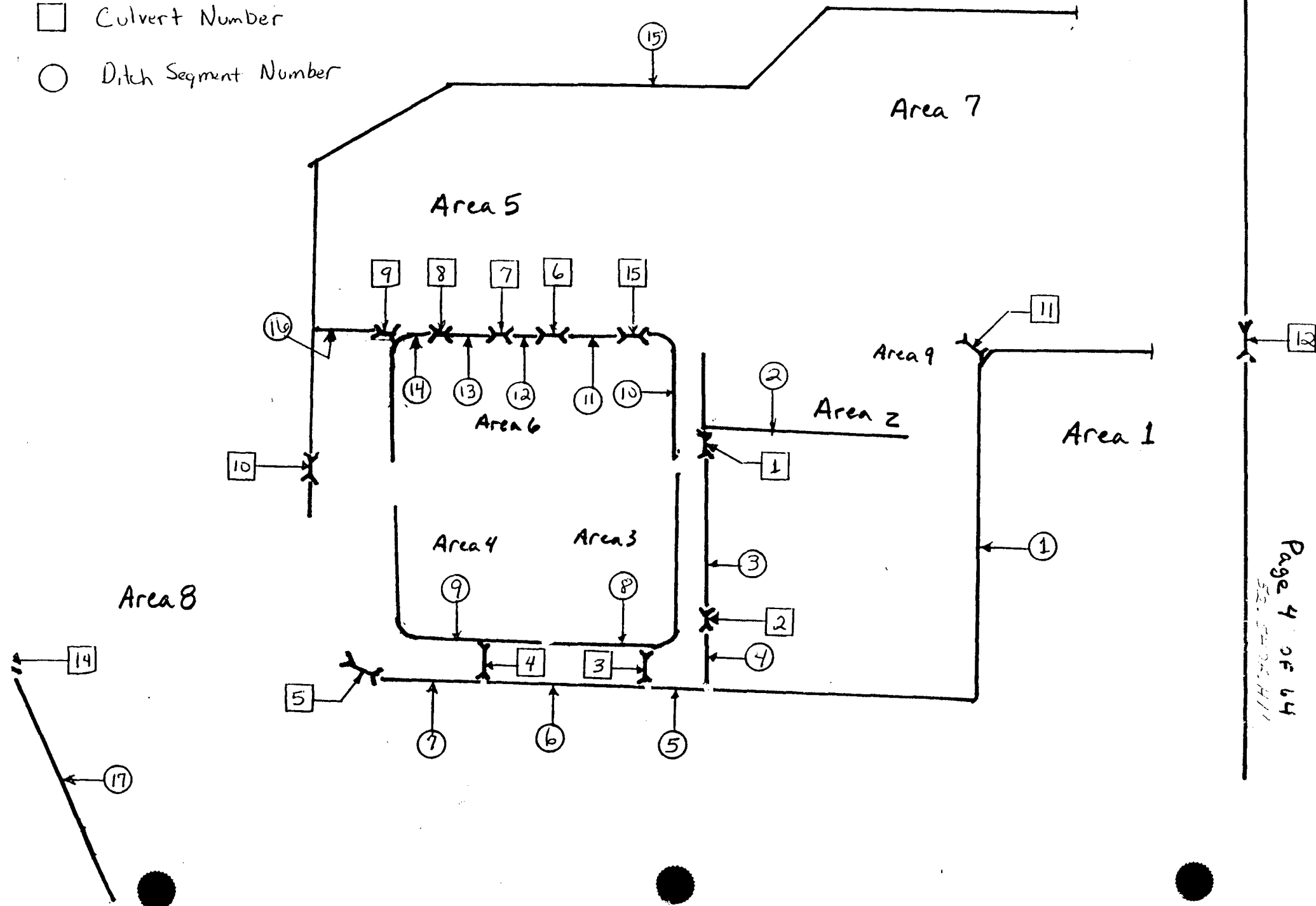
All culverts and ditch segments are shown on page 4. The ditches are flat bottom ditches with 3 to 1 side slopes. A summary of the ditches and flows are provided on page 28. The culverts were sized based on the peak flow from the 25 year storm that each culvert must handle. (Each culvert was also checked to handle the 100 year storm). For each culvert, inlet control and outlet control were considered. The condition which yielded the highest headwater depth was assumed to be the controlling condition. The allowable headwater depth for all culverts is 6 inches below the top of the road surface. The headwater depths were calculated using the nomographs included. When calculating the headwater depth for outlet control, the vertical distance in feet (ho) from the culvert invert at the outlet to the hydraulic gradeline is calculated as described in reference #1. The ho values are calculated on pages 63 and 64. A culvert summary is provided on page 62.

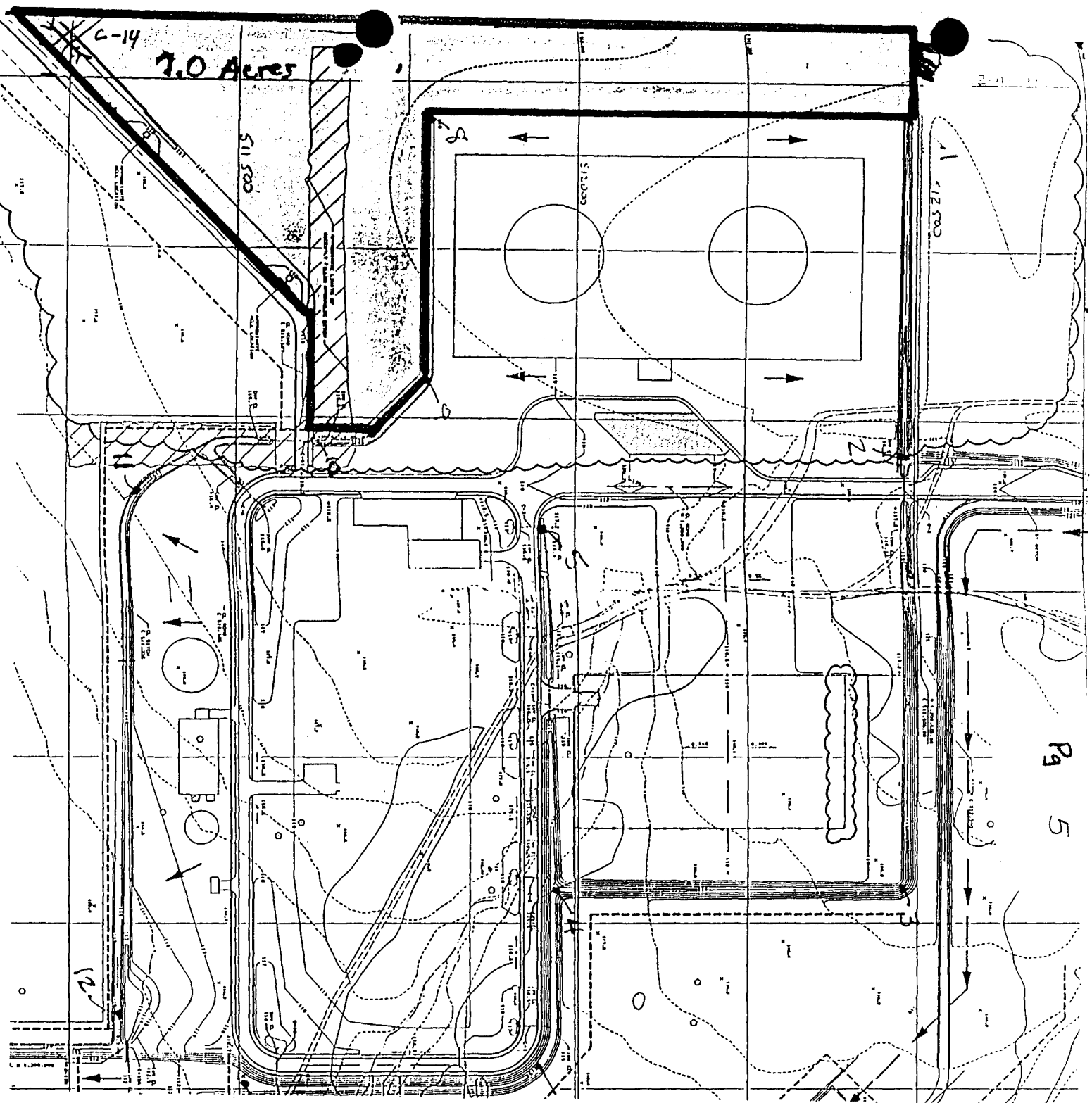
Image Quality

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



- Culvert Number
 Ditch Segment Number





Drainage Area # 10





Owner Seminole Computed By J.R. Wang
Plant Hardee Power Station Unit 3 Date 3-2 1994
Project No. 23930 File No. 52.5406.H11 Checked By JJD
Title Ditches and Culverts Date 3-3 1994
Page 6 of 64

Runoff Coefficient Values

The runoff Coefficient values used are recommended by the American Society of Civil Engineers and Water Pollution Control Federation and are as follows:

	<u>Range</u>	<u>Use</u> ✓
Buildings and Concrete	.70-.95	.90
Asphalt	.70-.95	.90
Aggregate	.25-.70	.70
Grass (Ref #7)	.30	.30

Weighted Average Runoff Coef Values

Area #1

Grass	11.2 ac
Aggregate	.5 ac
Total	11.7 ac

$$\bar{C} = [11.2(.30) + .5(.70)] / 11.7$$

$$= \underline{.32} \checkmark$$

Area #2

Asphalt	.5 ac
Buildings + Concrete	.5 ac
Aggregate	1.6 ac
Grass	1.3 ac
Total	3.9 ac

$$\bar{C} = [.5(.90) + .5(.90) + 1.6(.70) + 1.3(.30)] / 3.9$$

$$= \underline{.62} \checkmark$$

DO NOT WRITE IN THIS SPACE



Owner Seminole
Plant Harder Power Station Unit 3
Project No. 23930 File No. 52.5406.H11
Title Ditches and Culverts

Computed By J. R. Wang
Date 3-2 19 94
Checked By JJD
Date 3-3 19 94
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Area #3

grass	.2 ac
concrete + buildings	.2 ac
aggregate	1.1 ac
asphalt	.1 ac
total	<u>1.6 ac</u>

$$\bar{C} = [.2(.3) + .2(.9) + 1.1(.7) + .1(.9)] / 1.6$$

$$= .69 \checkmark$$

Area #4

grass	.6 ac
concrete + buildings	.5 ac
aggregate	.3 ac
asphalt	.2 ac
total	<u>1.6 ac</u>

$$\bar{C} = [.6(.30) + .5(.9) + .3(.7) + .2(.9)] / 1.6$$

$$= .64 \checkmark$$

Area #5

grass	8.8 ac
aggregate	3.2 ac
asphalt	.5 ac
total	<u>12.5 ac</u>

$$\bar{C} = [8.8(.3) + 3.2(.7) + .5(.9)] / 12.5$$

$$= .43 \checkmark$$

DO NOT WRITE IN THIS SPACE

PGN-172A



Owner Seminole
Plant Harder Power Station Unit 3
Project No. 23930 File No. 52,5426.H11
Title Ditches and Culverts

Computed By J.R. Wang
Date 3-2 1994
Checked By JJD
Date 3-3 1994
Page 8 of 64

Area # 6

grass 1.3 ac
concrete+buildings 1 ac
aggregate .5 ac
asphalt .4 ac
total 3.2 ac

$$C = [1.3(.3) + 1(.9) + .5(.7) + .4(.9)] / 3.2$$

$$= .63 \checkmark$$

Area # 7 is the Fuel Oil Storage Area and does not contribute storm runoff ~~to~~ the detention Pond.

Area # 8 Stormwater Retention Pond

Area # 9

grass .4 ac
asphalt .1 ac
total .5 ac

$$C = [.4(.3) + .1(.9)] / .5$$

$$= .42 \checkmark$$

DO NOT WRITE IN THIS SPACE



Owner Seminole
Plant Hardee Power Station Unit 3
Project No. 23930 File No. 52.5476.H11
Title Ditches and Culverts

Computed By JRW
Date 3-2 1994
Checked By JJD
Date 3-3 1994
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Time of Concentration, T_c

The time of concentration is the time it takes stormwater runoff to travel from the hydraulically most distant point of a watershed to a point of interest. For the purpose of these calculations, the first 300 feet of flow will be considered sheet flow. The remaining length of flow will be open channel flow.

- All slopes will be assumed to be 1%
- The 2yr, 24hr rainfall is 4.2 in
- Mannings n values for overland flow will be:

concrete, gravel, asphalt	0.011	(TR 55)
grass	0.15	(TR 55)

 (open channel "n" for grass is .03)

Area #1 total length of Flow is 1500 ft

$$\text{sheet flow, } T_{c1} = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} S^{0.4}} \quad \text{Ref (TR 55)}$$

n = Mannings n
 L = length of flow
 P_2 = 2yr, 24hr rainfall
 S = slope

$$T_{c1} = \frac{0.007 (.15 \times 300)^{0.8}}{(4.2)^{0.5} (.01)^{0.4}} = 27.2 \text{ min} \checkmark$$

$$\text{open channel flow, } T_{c2} = \frac{L}{3600 V} \checkmark \quad (\text{TR-55})$$

$$V = \frac{1.49 r^{2/3} S^{1/2}}{n}$$

$$= \frac{1.49 (.68)^{2/3} (.01)^{1/2}}{.03}$$

assume a ditch depth of 12" and bottom width = 4 ft
3 to 1 side slopes

DO NOT WRITE IN THIS SPACE



Owner Seawisak Computed By J. R. Wang
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$$V = 3.83 \text{ ft/sec} \checkmark$$

$$T_{b1} = \frac{1200}{3600(3.83)} = \underline{5.22 \text{ min}}$$

$$T_{b1} + T_{b2} = T_c = 27.2 \text{ min} + 5.2 \text{ min} = \underline{32.4 \text{ min}}$$

- T_c for Area 1 and Area 5 will be 15 min

(conservative)

Area #3 total length of flow is 300 ft

$$T_c = \frac{0.007 (.15 \times 300)^{0.8}}{(4.2)^{1.5} (1.01)^{.4}} = 27.2 \text{ min} \checkmark$$

T_c for

Areas 2, 3, 4, and 6 will be 8 min

(conservative)

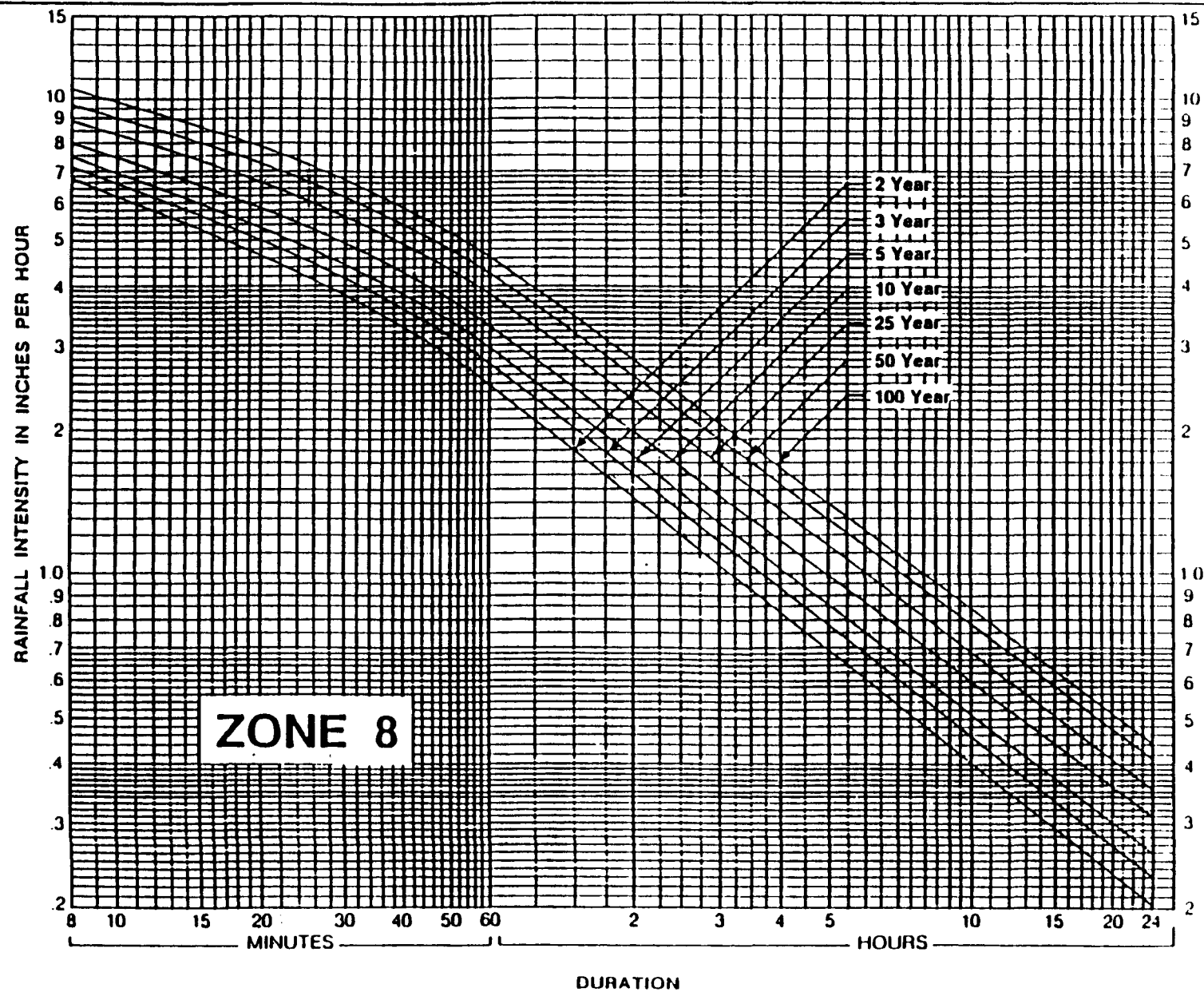
Area #9 total length of flow is 200 ft

$$T_c = \frac{0.007 (.15 \times 200)^{0.8}}{(4.2)^{1.5} (.01)^{.4}} = 19.6 \text{ min} \checkmark$$

T_c for Area #9 will be 8 min

(conservative)

DO NOT WRITE IN THIS SPACE



Rainfall Intensity-Duration-Frequency Curves for Zone 8

C-22

FIGURE C-13

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE POWER STATION UNIT 3	DATE:	03/07/94
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TABLE 1

DRAINAGE AREA NO.	AREA (AC)	RUNOFF ** COEF. (C)	TIME OF CONC. MINUTES
1	11.7	0.32	15
2	3.9	0.62	8
3	1.6	0.69	8
4	1.6	0.64	8
5	12.5	0.43	15
6	3.2	0.63	8
7 *	2.7	NA	NA
8	5.8	NA	NA
9	0.5	0.42	8
10 ***	7.0	0.30	15

- * DOES NOT CONTRIBUTE STORM RUNOFF TO THE DETENTION POND.
- ** ALL RUNOFF COEFFICIENT VALUES ARE WEIGHTED AVERAGES.
- *** AREA NOT INCLUDED IN PROPOSED SITE.

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE STATION UNIT 3	DATE:	03-Mar-94
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PEAK FLOW RATE USING THE RATIONAL METHOD
FLOW FROM AREA #9 INTO C-11

$Q = C * i * A$	
AREA, (acres)	0.50
RUNOFF COEFFICIENT, C =	0.42
TIME OF CONC., (min)	8

DESIGN STORM (years)	RAINFALL INTENSITY (in/hr)	PEAK FLOW RATE, Q (cfs)
25	8.8	1.85
100	10.5	2.21

OWNER:	SEMINOLE	NAME:	JOHN WAPY
PROJECT:	HARDEE STATION UNIT 3	DATE:	03-Mar-94
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PEAK FLOW RATE USING THE RATIONAL METHOD
FLOW FROM AREA #1 AT C-2

$Q = C * i * A$		DESIGN STORM (years)	RAINFALL INTENSITY (in/hr)	PEAK FLOW RATE, Q (cfs)
AREA, (acres)	10.40			
RUNOFF COEFFICIENT, C =	0.32	25	7.4	24.63
TIME OF CONC., (min)	15	100	8.6	28.62

DEPTH OF FLOW IN TRAPEZOIDAL DITCH SEGMENT 1 AT C-2

CHANNEL SLOPE, (ft/ft) =	0.0025	$V = 1.49 * (R^{(2/3)}) * (S^{(1/2)}) / n$
MANNING'S n =	0.03	$Q = 1.49 * A * (R^{(2/3)}) * (S^{(1/2)}) / n$
BOTTOM WIDTH, (ft) =	6	
DITCH SIDESLOPES =	3	
EST. FLOW DEPTH, (in.) =	13	
25 YR PEAK FLOW RATE	26.48	

DEPTH OF FLOW (in)	AREA OF FLOW (sq ft)	WETTED PERIMETER (ft)	HYDRAULIC RADIUS (ft)	PEAK FLOW (cfs)	FLOW VELOCITY (fps)	FROUDE NUMBER	TYPE OF FLOW
13	10.02	12.85	0.78	21.08	2.10	0.5096	SUBCRITICAL
14	11.08	13.38	0.83	24.28	2.19	0.4381	SUBCRITICAL
15	12.19	13.91	0.88	27.72	2.27	0.3799	SUBCRITICAL
16	13.33	14.43	0.92	31.41	2.36	0.3320	SUBCRITICAL
17	14.52	14.96	0.97	35.35	2.43	0.2921	SUBCRITICAL
18	15.75	15.49	1.02	39.55	2.51	0.2586	SUBCRITICAL
19	17.02	16.01	1.06	44.02	2.59	0.2302	SUBCRITICAL
20	18.33	16.54	1.11	48.76	2.66	0.2059	SUBCRITICAL
21	19.69	17.07	1.15	53.77	2.73	0.1851	SUBCRITICAL
22	21.08	17.60	1.20	59.07	2.80	0.1670	SUBCRITICAL
23	22.52	18.12	1.24	64.65	2.87	0.1513	SUBCRITICAL
24	24.00	18.65	1.29	70.52	2.94	0.1375	SUBCRITICAL
25	25.52	19.18	1.33	76.68	3.00	0.1254	SUBCRITICAL
26	27.08	19.70	1.37	83.15	3.07	0.1147	SUBCRITICAL
27	28.69	20.23	1.42	89.92	3.13	0.1052	SUBCRITICAL

OWNER:	SEMINOLE	NAME:	JOHN WARY
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PEAK FLOW RATE USING THE RATIONAL METHOD
FLOW FROM AREA #2 INTO C-1 AND C-2

Q = C * i * A		DESIGN STORM (years)	RAINFALL INTENSITY (in/hr)	PEAK FLOW RATE, Q (cfs)
AREA, (acres)	3.90			
RUNOFF COEFFICIENT, C =	0.62			
TIME OF CONC., (min)	8			
		25	8.8	21.28
		100	10.5	25.39

DEPTH OF FLOW IN TRAPEZOIDAL DITCH SEGMENTS 2, 3, AND 4

CHANNEL SLOPE, (ft/ft) =	0.005	$V = 1.49 * (R^{(2/3)}) * (S^{(1/2)}) / n$
MANNING'S n =	0.03	$Q = 1.49 * A * (R^{(2/3)}) * (S^{(1/2)}) / n$
BOTTOM WIDTH, (ft) =	4	
DITCH SIDESLOPES =	3	
EST. FLOW DEPTH, (in.) =	10	
25 YR PEAK FLOW RATE	21.28	

DEPTH OF FLOW (in)	AREA OF FLOW (sq ft)	WETTED PERIMETER (ft)	HYDRAULIC RADIUS (ft)	PEAK FLOW (cfs)	FLOW VELOCITY (fps)	FROUDE NUMBER	TYPE OF FLOW
10	5.42	9.27	0.58	13.30	2.45	0.9406	SUBCRITICAL
11	6.19	9.80	0.63	16.00	2.59	0.7704	SUBCRITICAL
12	7.00	10.32	0.68	18.97	2.71	0.6403	SUBCRITICAL
13	7.85	10.85	0.72	22.24	2.83	0.5387	SUBCRITICAL
14	8.75	11.38	0.77	25.79	2.95	0.4581	SUBCRITICAL
15	9.69	11.91	0.81	29.65	3.06	0.3933	SUBCRITICAL
16	10.67	12.43	0.86	33.82	3.17	0.3404	SUBCRITICAL
17	11.69	12.96	0.90	38.31	3.28	0.2968	SUBCRITICAL
18	12.75	13.49	0.95	43.13	3.38	0.2605	SUBCRITICAL
19	13.85	14.01	0.99	48.28	3.49	0.2300	SUBCRITICAL
20	15.00	14.54	1.03	53.78	3.59	0.2041	SUBCRITICAL
21	16.19	15.07	1.07	59.63	3.68	0.1821	SUBCRITICAL
22	17.42	15.60	1.12	65.84	3.78	0.1631	SUBCRITICAL
23	18.69	16.12	1.16	72.42	3.88	0.1468	SUBCRITICAL
24	20.00	16.65	1.20	79.37	3.97	0.1326	SUBCRITICAL

OWNER:	SEMINOLE	NAME:	JOHN WARY
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PEAK FLOW RATE USING THE RATIONAL METHOD
FLOW FROM AREA #1 AT C-3

$Q = C * i * A$		DESIGN STORM (years)	RAINFALL INTENSITY (in/hr)	PEAK FLOW RATE, Q (cfs)
AREA, (acres)	10.70	25	7.4	25.34
RUNOFF COEFFICIENT, C =	0.32	100	8.6	29.45
TIME OF CONC., (min)	15			

DEPTH OF FLOW IN TRAPEZOIDAL DITCH SEGMENT 5 AT C-3

CHANNEL SLOPE, (ft/ft) =	0.005	$V = 1.49 * (R^{(2/3)}) * (S^{(1/2)}) / n$
MANNING'S n =	0.03	$Q = 1.49 * A * (R^{(2/3)}) * (S^{(1/2)}) / n$
BOTTOM WIDTH, (ft) =	6	
DITCH SIDESLOPES =	3	
EST. FLOW DEPTH, (in.) =	10	
25 YR PEAK FLOW RATE	48.47 *	

DEPTH OF FLOW (in)	AREA OF FLOW (sq ft)	WETTED PERIMETER (ft)	HYDRAULIC RADIUS (ft)	PEAK FLOW (cfs)	FLOW VELOCITY (fps)	FROUDE NUMBER	TYPE OF FLOW
10	7.08	11.27	0.63	18.25	2.58	1.5696	SUPERCritical
11	8.02	11.80	0.68	21.78	2.72	1.3026	SUPERCritical
12	9.00	12.32	0.73	25.63	2.85	1.0959	SUPERCritical
13	10.02	12.85	0.78	29.81	2.98	0.9328	SUBCRITICAL
14	11.08	13.38	0.83	34.33	3.10	0.8019	SUBCRITICAL
15	12.19	13.91	0.88	39.20	3.22	0.6954	SUBCRITICAL
16	13.33	14.43	0.92	44.42	3.33	0.6078	SUBCRITICAL
17	14.52	14.96	0.97	49.99	3.44	0.5347	SUBCRITICAL
18	15.75	15.49	1.02	55.94	3.55	0.4734	SUBCRITICAL
19	17.02	16.01	1.06	62.26	3.66	0.4214	SUBCRITICAL
20	18.33	16.54	1.11	68.96	3.76	0.3769	SUBCRITICAL
21	19.69	17.07	1.15	76.05	3.86	0.3387	SUBCRITICAL
22	21.08	17.60	1.20	83.53	3.96	0.3057	SUBCRITICAL
23	22.52	18.12	1.24	91.42	4.06	0.2769	SUBCRITICAL
24	24.00	18.65	1.29	99.72	4.16	0.2517	SUBCRITICAL

* PEAK FLOW FROM AREA 1 AT C-3, AREA 2, AND AREA 9.

OWNER:	SEMINOLE	NAME:	JOHN WARY
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PEAK FLOW RATE USING THE RATIONAL METHOD
FLOW FROM AREA #1 AT C-4

$Q = C * i * A$		DESIGN STORM (years)	RAINFALL INTENSITY (in/hr)	PEAK FLOW RATE, Q (cfs)
AREA, (acres)	11.40	25	7.4	27.00
RUNOFF COEFFICIENT, C =	0.32	100	8.6	31.37
TIME OF CONC., (min)	15			

DEPTH OF FLOW IN TRAPEZOIDAL DITCH SEGMENT 6 AT C-4

CHANNEL SLOPE, (ft/ft) =	0.005	$V = 1.49 * (R^{(2/3)}) * (S^{(1/2)}) / n$
MANNING'S n =	0.03	$Q = 1.49 * A * (R^{(2/3)}) * (S^{(1/2)}) / n$
BOTTOM WIDTH, (ft) =	6	
DITCH SIDESLOPES =	3	
EST. FLOW DEPTH, (in.) =	10	
25 YR PEAK FLOW RATE	59.85 *	

DEPTH OF FLOW (in)	AREA OF FLOW (sq ft)	WETTED PERIMETER (ft)	HYDRAULIC RADIUS (ft)	PEAK FLOW (cfs)	FLOW VELOCITY (fps)	FROUDE NUMBER	TYPE OF FLOW
10	7.08	11.27	0.63	18.25	2.58	1.9381	SUPERCritical
11	8.02	11.80	0.68	21.78	2.72	1.6084	SUPERCritical
12	9.00	12.32	0.73	25.63	2.85	1.3532	SUPERCritical
13	10.02	12.85	0.78	29.81	2.98	1.1518	SUPERCritical
14	11.08	13.38	0.83	34.33	3.10	0.9902	SUBCRITICAL
15	12.19	13.91	0.88	39.20	3.22	0.8587	SUBCRITICAL
16	13.33	14.43	0.92	44.42	3.33	0.7504	SUBCRITICAL
17	14.52	14.96	0.97	49.99	3.44	0.6603	SUBCRITICAL
18	15.75	15.49	1.02	55.94	3.55	0.5845	SUBCRITICAL
19	17.02	16.01	1.06	62.26	3.66	0.5203	SUBCRITICAL
20	18.33	16.54	1.11	68.96	3.76	0.4654	SUBCRITICAL
21	19.69	17.07	1.15	76.05	3.86	0.4183	SUBCRITICAL
22	21.08	17.60	1.20	83.53	3.96	0.3774	SUBCRITICAL
23	22.52	18.12	1.24	91.42	4.06	0.3419	SUBCRITICAL
24	24.00	18.65	1.29	99.72	4.16	0.3107	SUBCRITICAL

* PEAK FLOW FROM AREA 1 AT C-4, AREA 2, AREA 3, AND AREA 9.

OWNER:	SEMINOLE	NAME:	JOHN WARY
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PEAK FLOW RATE USING THE RATIONAL METHOD
FLOW FROM AREA #1 AT C-5

$Q = C * i * A$		DESIGN STORM (years)	RAINFALL INTENSITY (in/hr)	PEAK FLOW RATE, Q (cfs)
AREA, (acres)	11.70	25	7.4	27.71
RUNOFF COEFFICIENT, C =	0.32	100	8.6	32.20
TIME OF CONC., (min)	15			

DEPTH OF FLOW IN TRAPEZOIDAL DITCH SEGMENT 7 AT C-5

CHANNEL SLOPE, (ft/ft) =	0.005	$V = 1.49 * (R^{2/3}) * (S^{1/2}) / n$
MANNING'S n =	0.03	$Q = 1.49 * A * (R^{2/3}) * (S^{1/2}) / n$
BOTTOM WIDTH, (ft) =	6	
DITCH SIDESLOPES =	3	
EST. FLOW DEPTH, (in.) =	15	
25 YR PEAK FLOW RATE	69.57 ~	

DEPTH OF FLOW (in)	AREA OF FLOW (sq ft)	WETTED PERIMETER (ft)	HYDRAULIC RADIUS (ft)	PEAK FLOW (cfs)	FLOW VELOCITY (fps)	FROUDE NUMBER	TYPE OF FLOW
15	12.19	13.91	0.88	39.20	3.22	0.9982	SUBCRITICAL
16	13.33	14.43	0.92	44.42	3.33	0.8723	SUBCRITICAL
17	14.52	14.96	0.97	49.99	3.44	0.7675	SUBCRITICAL
18	15.75	15.49	1.02	55.94	3.55	0.6795	SUBCRITICAL
19	17.02	16.01	1.06	62.26	3.66	0.6048	SUBCRITICAL
20	18.33	16.54	1.11	68.96	3.76	0.5410	SUBCRITICAL
21	19.69	17.07	1.15	76.05	3.86	0.4862	SUBCRITICAL
22	21.08	17.60	1.20	83.53	3.96	0.4387	SUBCRITICAL
23	22.52	18.12	1.24	91.42	4.06	0.3974	SUBCRITICAL
24	24.00	18.65	1.29	99.72	4.16	0.3612	SUBCRITICAL
25	25.52	19.18	1.33	108.44	4.25	0.3294	SUBCRITICAL
26	27.08	19.70	1.37	117.59	4.34	0.3013	SUBCRITICAL
27	28.69	20.23	1.42	127.17	4.43	0.2764	SUBCRITICAL
28	30.33	20.76	1.46	137.18	4.52	0.2542	SUBCRITICAL
29	32.02	21.28	1.50	147.65	4.61	0.2344	SUBCRITICAL

* PEAK FLOW FROM AREA 1 AT C-5, AREA 2, AREA 3, AREA 4, AND AREA 9.

OWNER:	SEMINOLE	NAME:	JOHN WARY
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PEAK FLOW RATE USING THE RATIONAL METHOD
FLOW FROM AREA #3 INTO C-3

$Q = C * i * A$	
AREA, (acres)	1.60
RUNOFF COEFFICIENT, C =	0.69
TIME OF CONC., (min)	8

DESIGN STORM (years)	RAINFALL INTENSITY (in/hr)	PEAK FLOW RATE, Q (cfs)
25	8.8	9.72
100	10.5	11.59

DEPTH OF FLOW IN TRAPEZOIDAL DITCH SEGMENT 8

CHANNEL SLOPE, (ft/ft) = 0.005
MANNING'S n = 0.03
BOTTOM WIDTH, (ft) = 4
DITCH SIDESLOPES = 3
EST. FLOW DEPTH, (in.) = 6
25 YR PEAK FLOW RATE 9.72

$$V = 1.49 * (R^{(2/3)}) * (S^{(1/2)}) / n$$

$$Q = 1.49 * A * (R^{(2/3)}) * (S^{(1/2)}) / n$$

DEPTH OF FLOW (in)	AREA OF FLOW (sq ft)	WETTED PERIMETER (ft)	HYDRAULIC RADIUS (ft)	PEAK FLOW (cfs)	FLOW VELOCITY (fps)	FROUDE NUMBER	TYPE OF FLOW
6	2.75	7.16	0.38	5.10	1.86	1.1872	SUPERCritical
7	3.35	7.69	0.44	6.78	2.02	0.8813	SUBCRITICAL
8	4.00	8.22	0.49	8.69	2.17	0.6768	SUBCRITICAL
9	4.69	8.74	0.54	10.86	2.32	0.5335	SUBCRITICAL
10	5.42	9.27	0.58	13.30	2.45	0.4295	SUBCRITICAL
11	6.19	9.80	0.63	16.00	2.59	0.3518	SUBCRITICAL
12	7.00	10.32	0.68	18.97	2.71	0.2923	SUBCRITICAL
13	7.85	10.85	0.72	22.24	2.83	0.2460	SUBCRITICAL
14	8.75	11.38	0.77	25.79	2.95	0.2092	SUBCRITICAL
15	9.69	11.91	0.81	29.65	3.06	0.1796	SUBCRITICAL
16	10.67	12.43	0.86	33.82	3.17	0.1554	SUBCRITICAL
17	11.69	12.96	0.90	38.31	3.28	0.1355	SUBCRITICAL
18	12.75	13.49	0.95	43.13	3.38	0.1189	SUBCRITICAL
19	13.85	14.01	0.99	48.28	3.49	0.1050	SUBCRITICAL
20	15.00	14.54	1.03	53.78	3.59	0.0932	SUBCRITICAL

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE STATION UNIT 3	DATE:	03-Mar-94
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PEAK FLOW RATE USING THE RATIONAL METHOD
FLOW FROM AREA #4 INTO C-4

$Q = C * i * A$		DESIGN STORM (years)	RAINFALL INTENSITY (in/hr)	PEAK FLOW RATE, Q (cfs)
AREA, (acres)	1.60	25	8.8	9.01
RUNOFF COEFFICIENT, C =	0.64	100	10.5	10.75
TIME OF CONC., (min)	8			

DEPTH OF FLOW IN TRAPEZOIDAL DITCH SEGMENT 9 AT C-4

CHANNEL SLOPE, (ft/ft) =	0.005	$V = 1.49 * (R^{(2/3)}) * (S^{(1/2)}) / n$
MANNING'S n =	0.03	$Q = 1.49 * A * (R^{(2/3)}) * (S^{(1/2)}) / n$
BOTTOM WIDTH, (ft) =	4	
DITCH SIDESLOPES =	3	
EST. FLOW DEPTH, (in.) =	6	
25 YR PEAK FLOW RATE	9.01	

DEPTH OF FLOW (in)	AREA OF FLOW (sq ft)	WETTED PERIMETER (ft)	HYDRAULIC RADIUS (ft)	PEAK FLOW (cfs)	FLOW VELOCITY (fps)	FROUDE NUMBER	TYPE OF FLOW
6	2.75	7.16	0.38	5.10	1.86	1.1012	SUPERCritical
7	3.35	7.69	0.44	6.78	2.02	0.8175	SUBCRITICAL
8	4.00	8.22	0.49	8.69	2.17	0.6277	SUBCRITICAL
9	4.69	8.74	0.54	10.86	2.32	0.4948	SUBCRITICAL
10	5.42	9.27	0.58	13.30	2.45	0.3983	SUBCRITICAL
11	6.19	9.80	0.63	16.00	2.59	0.3263	SUBCRITICAL
12	7.00	10.32	0.68	18.97	2.71	0.2711	SUBCRITICAL
13	7.85	10.85	0.72	22.24	2.83	0.2281	SUBCRITICAL
14	8.75	11.38	0.77	25.79	2.95	0.1940	SUBCRITICAL
15	9.69	11.91	0.81	29.65	3.06	0.1665	SUBCRITICAL
16	10.67	12.43	0.86	33.82	3.17	0.1441	SUBCRITICAL
17	11.69	12.96	0.90	38.31	3.28	0.1257	SUBCRITICAL
18	12.75	13.49	0.95	43.13	3.38	0.1103	SUBCRITICAL
19	13.85	14.01	0.99	48.28	3.49	0.0974	SUBCRITICAL
20	15.00	14.54	1.03	53.78	3.59	0.0864	SUBCRITICAL

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE STATION UNIT 3	DATE:	03-Mar-94
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PEAK FLOW RATE USING THE RATIONAL METHOD
FLOW FROM AREA #6 INTO C-15

Q = C * i * A	
AREA, (acres)	0.70
RUNOFF COEFFICIENT, C =	0.63
TIME OF CONC., (min)	8

DESIGN STORM (years)	RAINFALL INTENSITY (in/hr)	PEAK FLOW RATE, Q (cfs)
25	8.8	3.88
100	10.5	4.63

DEPTH OF FLOW IN TRAPEZOIDAL DITCH SEGMENT 10

CHANNEL SLOPE, (ft/ft) = 0.005
MANNING'S n = 0.03
BOTTOM WIDTH, (ft) = 4
DITCH SIDESLOPES = 3
EST. FLOW DEPTH, (in.) = 4
25 YR PEAK FLOW RATE 3.88

$$V = 1.49 * (R^{(2/3)}) * (S^{(1/2)}) / n$$

$$Q = 1.49 * A * R^{(2/3)} * (S^{(1/2)}) / n$$

DEPTH OF FLOW (in)	AREA OF FLOW (sq ft)	WETTED PERIMETER (ft)	HYDRAULIC RADIUS (ft)	PEAK FLOW (cfs)	FLOW VELOCITY (fps)	FROUDE NUMBER	TYPE OF FLOW
4	1.67	6.11	0.27	2.46	1.48	1.0051	SUPERCritical
5	2.19	6.64	0.33	3.67	1.68	0.6685	SUBCRITICAL
6	2.75	7.16	0.38	5.10	1.86	0.4742	SUBCRITICAL
7	3.35	7.69	0.44	6.78	2.02	0.3521	SUBCRITICAL
8	4.00	8.22	0.49	8.69	2.17	0.2703	SUBCRITICAL
9	4.69	8.74	0.54	10.86	2.32	0.2131	SUBCRITICAL
10	5.42	9.27	0.58	13.30	2.45	0.1716	SUBCRITICAL
11	6.19	9.80	0.63	16.00	2.59	0.1405	SUBCRITICAL
12	7.00	10.32	0.68	18.97	2.71	0.1168	SUBCRITICAL
13	7.85	10.85	0.72	22.24	2.83	0.0983	SUBCRITICAL
14	8.75	11.38	0.77	25.79	2.95	0.0836	SUBCRITICAL
15	9.69	11.91	0.81	29.65	3.06	0.0717	SUBCRITICAL
16	10.67	12.43	0.86	33.82	3.17	0.0621	SUBCRITICAL
17	11.69	12.96	0.90	38.31	3.28	0.0541	SUBCRITICAL
18	12.75	13.49	0.95	43.13	3.38	0.0475	SUBCRITICAL

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE STATION UNIT 3	DATE:	03-Mar-94
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PEAK FLOW RATE USING THE RATIONAL METHOD
FLOW FROM AREA #6 INTO C-6

$Q = C * i * A$		DESIGN STORM (years)	RAINFALL INTENSITY (in/hr)	PEAK FLOW RATE, Q (cfs)
AREA, (acres)	1.40	25	8.8	7.76
RUNOFF COEFFICIENT, C =	0.63	100	10.5	9.26
TIME OF CONC., (min)	8			

DEPTH OF FLOW IN TRAPEZOIDAL DITCH SEGMENT 11

CHANNEL SLOPE, (ft/ft) =	0.005	$V = 1.49 * (R^{(2/3)}) * (S^{(1/2)}) / n$
MANNING'S n =	0.03	$Q = 1.49 * A * (R^{(2/3)}) * (S^{(1/2)}) / n$
BOTTOM WIDTH, (ft) =	4	
DITCH SIDESLOPES =	3	
EST. FLOW DEPTH, (in.) =	6	
25 YR PEAK FLOW RATE	7.76	

DEPTH OF FLOW (in)	AREA OF FLOW (sq ft)	WETTED PERIMETER (ft)	HYDRAULIC RADIUS (ft)	PEAK FLOW (cfs)	FLOW VELOCITY (fps)	FROUDE NUMBER	TYPE OF FLOW
6	2.75	7.16	0.38	5.10	1.86	0.9485	SUBCRITICAL
7	3.35	7.69	0.44	6.78	2.02	0.7041	SUBCRITICAL
8	4.00	8.22	0.49	8.69	2.17	0.5407	SUBCRITICAL
9	4.69	8.74	0.54	10.86	2.32	0.4262	SUBCRITICAL
10	5.42	9.27	0.58	13.30	2.45	0.3431	SUBCRITICAL
11	6.19	9.80	0.63	16.00	2.59	0.2810	SUBCRITICAL
12	7.00	10.32	0.68	18.97	2.71	0.2335	SUBCRITICAL
13	7.85	10.85	0.72	22.24	2.83	0.1965	SUBCRITICAL
14	8.75	11.38	0.77	25.79	2.95	0.1671	SUBCRITICAL
15	9.69	11.91	0.81	29.65	3.06	0.1435	SUBCRITICAL
16	10.67	12.43	0.86	33.82	3.17	0.1242	SUBCRITICAL
17	11.69	12.96	0.90	38.31	3.28	0.1083	SUBCRITICAL
18	12.75	13.49	0.95	43.13	3.38	0.0950	SUBCRITICAL
19	13.85	14.01	0.99	48.28	3.49	0.0839	SUBCRITICAL
20	15.00	14.54	1.03	53.78	3.59	0.0745	SUBCRITICAL

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE STATION UNIT 3	DATE:	03-Mar-94
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PEAK FLOW RATE USING THE RATIONAL METHOD
FLOW FROM AREA #6 INTO C-7

$Q = C * i * A$	
AREA, (acres)	1.80
RUNOFF COEFFICIENT, C =	0.63
TIME OF CONC., (min)	8

DESIGN STORM (years)	RAINFALL INTENSITY (in/hr)	PEAK FLOW RATE, Q (cfs)
25	8.8	9.98
100	10.5	11.91

DEPTH OF FLOW IN TRAPEZOIDAL DITCH SEGMENT 12

CHANNEL SLOPE, (ft/ft) = 0.005
MANNING'S n = 0.03
BOTTOM WIDTH, (ft) = 4
DITCH SIDESLOPES = 3
EST. FLOW DEPTH, (in.) = 6
25 YR PEAK FLOW RATE 9.98

$$V = 1.49 * (R^{(2/3)}) * (S^{(1/2)}) / n$$

$$Q = 1.49 * A * (R^{(2/3)}) * (S^{(1/2)}) / n$$

DEPTH OF FLOW (in)	AREA OF FLOW (sq ft)	WETTED PERIMETER (ft)	HYDRAULIC RADIUS (ft)	PEAK FLOW (cfs)	FLOW VELOCITY (fps)	FROUDE NUMBER	TYPE OF FLOW
6	2.75	7.16	0.38	5.10	1.86	1.2195	SUPERCritical
7	3.35	7.69	0.44	6.78	2.02	0.9053	SUBCRITICAL
8	4.00	8.22	0.49	8.69	2.17	0.6951	SUBCRITICAL
9	4.69	8.74	0.54	10.86	2.32	0.5480	SUBCRITICAL
10	5.42	9.27	0.58	13.30	2.45	0.4411	SUBCRITICAL
11	6.19	9.80	0.63	16.00	2.59	0.3613	SUBCRITICAL
12	7.00	10.32	0.68	18.97	2.71	0.3003	SUBCRITICAL
13	7.85	10.85	0.72	22.24	2.83	0.2526	SUBCRITICAL
14	8.75	11.38	0.77	25.79	2.95	0.2149	SUBCRITICAL
15	9.69	11.91	0.81	29.65	3.06	0.1844	SUBCRITICAL
16	10.67	12.43	0.86	33.82	3.17	0.1596	SUBCRITICAL
17	11.69	12.96	0.90	38.31	3.28	0.1392	SUBCRITICAL
18	12.75	13.49	0.95	43.13	3.38	0.1222	SUBCRITICAL
19	13.85	14.01	0.99	48.28	3.49	0.1078	SUBCRITICAL
20	15.00	14.54	1.03	53.78	3.59	0.0957	SUBCRITICAL

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE STATION UNIT 3	DATE:	03-Mar-94
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PEAK FLOW RATE USING THE RATIONAL METHOD
FLOW FROM AREA #6 INTO C-8

$Q = C * i * A$		DESIGN STORM (years)	RAINFALL INTENSITY (in/hr)	PEAK FLOW RATE, Q (cfs)
AREA, (acres)	2.00	25	8.8	11.09
RUNOFF COEFFICIENT, C =	0.63	100	10.5	13.23
TIME OF CONC., (min)	8			

DEPTH OF FLOW IN TRAPEZOIDAL DITCH SEGMENT 13

CHANNEL SLOPE, (ft/ft) =	0.005	$V = 1.49 * (R^{(2/3)}) * (S^{(1/2)}) / n$
MANNING'S n =	0.03	$Q = 1.49 * A * (R^{(2/3)}) * (S^{(1/2)}) / n$
BOTTOM WIDTH, (ft) =	4	
DITCH SIDESLOPES =	3	
EST. FLOW DEPTH, (in.) =	6	
25 YR PEAK FLOW RATE	11.09	

DEPTH OF FLOW (in)	AREA OF FLOW (sq ft)	WETTED PERIMETER (ft)	HYDRAULIC RADIUS (ft)	PEAK FLOW (cfs)	FLOW VELOCITY (fps)	FROUDE NUMBER	TYPE OF FLOW
6	2.75	7.16	0.38	5.10	1.86	1.3550	SUPERCritical
7	3.35	7.69	0.44	6.78	2.02	1.0059	SUPERCritical
8	4.00	8.22	0.49	8.69	2.17	0.7724	SUBCRITICAL
9	4.69	8.74	0.54	10.86	2.32	0.6089	SUBCRITICAL
10	5.42	9.27	0.58	13.30	2.45	0.4901	SUBCRITICAL
11	6.19	9.80	0.63	16.00	2.59	0.4015	SUBCRITICAL
12	7.00	10.32	0.68	18.97	2.71	0.3336	SUBCRITICAL
13	7.85	10.85	0.72	22.24	2.83	0.2807	SUBCRITICAL
14	8.75	11.38	0.77	25.79	2.95	0.2387	SUBCRITICAL
15	9.69	11.91	0.81	29.65	3.06	0.2049	SUBCRITICAL
16	10.67	12.43	0.86	33.82	3.17	0.1774	SUBCRITICAL
17	11.69	12.96	0.90	38.31	3.28	0.1546	SUBCRITICAL
18	12.75	13.49	0.95	43.13	3.38	0.1357	SUBCRITICAL
19	13.85	14.01	0.99	48.28	3.49	0.1198	SUBCRITICAL
20	15.00	14.54	1.03	53.78	3.59	0.1064	SUBCRITICAL

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE STATION UNIT 3	DATE:	07-Mar-94
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PEAK FLOW RATE USING THE RATIONAL METHOD
FLOW FROM AREA #5 AT C-10

$Q = C * i * A$	
AREA, (acres)	12.50
RUNOFF COEFFICIENT, C =	0.43
TIME OF CONC., (min)	15

DESIGN STORM (years)	RAINFALL INTENSITY (in/hr)	PEAK FLOW RATE, Q (cfs)
25	7.4	39.78
100	8.6	46.23

DEPTH OF FLOW IN TRAPEZOIDAL DITCH SEGMENT 15 AT C-10

CHANNEL SLOPE, (ft/ft) = 0.005
MANNING'S n = 0.03
BOTTOM WIDTH, (ft) = 6
DITCH SIDESLOPES = 3
EST. FLOW DEPTH, (in.) = 12
25 YR PEAK FLOW RATE 58.00 *

$$V = 1.49 * (R^{(2/3)}) * (S^{(1/2)}) / n$$

$$Q = 1.49 * A * (R^{(2/3)}) * (S^{(1/2)}) / n$$

DEPTH OF FLOW (in)	AREA OF FLOW (sq ft)	WETTED PERIMETER (ft)	HYDRAULIC RADIUS (ft)	PEAK FLOW (cfs)	FLOW VELOCITY (fps)	FROUDE NUMBER	TYPE OF FLOW
12	9.00	12.32	0.73	25.63	2.85	1.3114	SUPERCritical
13	10.02	12.85	0.78	29.81	2.98	1.1162	SUPERCritical
14	11.08	13.38	0.83	34.33	3.10	0.9596	SUBCRITICAL
15	12.19	13.91	0.88	39.20	3.22	0.8322	SUBCRITICAL
16	13.33	14.43	0.92	44.42	3.33	0.7272	SUBCRITICAL
17	14.52	14.96	0.97	49.99	3.44	0.6399	SUBCRITICAL
18	15.75	15.49	1.02	55.94	3.55	0.5665	SUBCRITICAL
19	17.02	16.01	1.06	62.26	3.66	0.5042	SUBCRITICAL
20	18.33	16.54	1.11	68.96	3.76	0.4511	SUBCRITICAL
21	19.69	17.07	1.15	76.05	3.86	0.4053	SUBCRITICAL
22	21.08	17.60	1.20	83.53	3.96	0.3657	SUBCRITICAL
23	22.52	18.12	1.24	91.42	4.06	0.3313	SUBCRITICAL
24	24.00	18.65	1.29	99.72	4.16	0.3011	SUBCRITICAL
25	25.52	19.18	1.33	108.44	4.25	0.2746	SUBCRITICAL
26	27.08	19.70	1.37	117.59	4.34	0.2512	SUBCRITICAL

* PEAK FLOW FROM AREA 5 AND AREA 6.

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE STATION UNIT 3	DATE:	07-Mar-94
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PEAK FLOW RATE USING THE RATIONAL METHOD
FLOW FROM AREA #6 INTO C-9

$Q = C * i * A$	
AREA, (acres)	3.20
RUNOFF COEFFICIENT, C =	0.63
TIME OF CONC., (min)	8

DESIGN STORM (years)	RAINFALL INTENSITY (in/hr)	PEAK FLOW RATE, Q (cfs)
25	8.8	17.74
100	10.5	21.17

DEPTH OF FLOW IN TRAPEZOIDAL DITCH SEGMENTS 14 AND 16.

CHANNEL SLOPE, (ft/ft) = 0.005
MANNING'S n = 0.03
BOTTOM WIDTH, (ft) = 4
DITCH SIDESLOPES = 3
EST. FLOW DEPTH, (in.) = 8
25 YR PEAK FLOW RATE 17.74

$$V = 1.49 * (R^{(2/3)}) * (S^{(1/2)}) / n$$

$$Q = 1.49 * A * (R^{(2/3)}) * (S^{(1/2)}) / n$$

DEPTH OF FLOW (in)	AREA OF FLOW (sq ft)	WETTED PERIMETER (ft)	HYDRAULIC RADIUS (ft)	PEAK FLOW (cfs)	FLOW VELOCITY (fps)	FROUDE NUMBER	TYPE OF FLOW
8	4.00	8.22	0.49	8.69	2.17	1.2358	SUPERCritical
9	4.69	8.74	0.54	10.86	2.32	0.9742	SUBCRITICAL
10	5.42	9.27	0.58	13.30	2.45	0.7842	SUBCRITICAL
11	6.19	9.80	0.63	16.00	2.59	0.6424	SUBCRITICAL
12	7.00	10.32	0.68	18.97	2.71	0.5338	SUBCRITICAL
13	7.85	10.85	0.72	22.24	2.83	0.4492	SUBCRITICAL
14	8.75	11.38	0.77	25.79	2.95	0.3820	SUBCRITICAL
15	9.69	11.91	0.81	29.65	3.06	0.3279	SUBCRITICAL
16	10.67	12.43	0.86	33.82	3.17	0.2838	SUBCRITICAL
17	11.69	12.96	0.90	38.31	3.28	0.2474	SUBCRITICAL
18	12.75	13.49	0.95	43.13	3.38	0.2172	SUBCRITICAL
19	13.85	14.01	0.99	48.28	3.49	0.1917	SUBCRITICAL
20	15.00	14.54	1.03	53.78	3.59	0.1702	SUBCRITICAL
21	16.19	15.07	1.07	59.63	3.68	0.1518	SUBCRITICAL
22	17.42	15.60	1.12	65.84	3.78	0.1360	SUBCRITICAL

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE STATION UNIT 3	DATE:	03-Mar-94
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PEAK FLOW RATE USING THE RATIONAL METHOD
FLOW FROM AREA #10 INTO C-14

$Q = C * i * A$		DESIGN STORM (years)	RAINFALL INTENSITY (in/hr)	PEAK FLOW RATE, Q (cfs)
AREA, (acres)	7.00	25	7.4	15.54
RUNOFF COEFFICIENT, C =	0.30	100	8.6	18.06
TIME OF CONC., (min)	15			

DEPTH OF FLOW IN TRAPEZOIDAL DITCH SEGMENT 17

CHANNEL SLOPE, (ft/ft) =	0.0025	$V = 1.49 * (R^{(2/3)}) * (S^{(1/2)}) / n$
MANNING'S n =	0.03	$Q = 1.49 * A * (R^{(2/3)}) * (S^{(1/2)}) / n$
BOTTOM WIDTH, (ft) =	6	
DITCH SIDESLOPES =	3	
EST. FLOW DEPTH, (in.) =	10	
25 YR PEAK FLOW RATE	15.54	

DEPTH OF FLOW (in)	AREA OF FLOW (sq ft)	WETTED PERIMETER (ft)	HYDRAULIC RADIUS (ft)	PEAK FLOW (cfs)	FLOW VELOCITY (fps)	FROUDE NUMBER	TYPE OF FLOW
10	7.08	11.27	0.63	12.91	1.82	0.5032	SUBCRITICAL
11	8.02	11.80	0.68	15.40	1.92	0.4176	SUBCRITICAL
12	9.00	12.32	0.73	18.12	2.01	0.3514	SUBCRITICAL
13	10.02	12.85	0.78	21.08	2.10	0.2991	SUBCRITICAL
14	11.08	13.38	0.83	24.28	2.19	0.2571	SUBCRITICAL
15	12.19	13.91	0.88	27.72	2.27	0.2230	SUBCRITICAL
16	13.33	14.43	0.92	31.41	2.36	0.1949	SUBCRITICAL
17	14.52	14.96	0.97	35.35	2.43	0.1714	SUBCRITICAL
18	15.75	15.49	1.02	39.55	2.51	0.1518	SUBCRITICAL
19	17.02	16.01	1.06	44.02	2.59	0.1351	SUBCRITICAL
20	18.33	16.54	1.11	48.76	2.66	0.1209	SUBCRITICAL
21	19.69	17.07	1.15	53.77	2.73	0.1086	SUBCRITICAL
22	21.08	17.60	1.20	59.07	2.80	0.0980	SUBCRITICAL
23	22.52	18.12	1.24	64.65	2.87	0.0888	SUBCRITICAL
24	24.00	18.65	1.29	70.52	2.94	0.0807	SUBCRITICAL

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE STATION UNIT 3	DATE:	07-Mar-94
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DITCH SUMMARY

DITCH SEGMENT	BOTTOM WIDTH (FT)	PEAK FLOW (CFS)	DEPTH OF FLOW (IN)
1 *	6	27	15
2	4	22	13
3	4	22	13
4	4	22	13
5	6	49	17
6	6	60	28 **
7	6	70	21
8	4	10	9
9	4	9	9
10	4	4	6
11	4	8	8
12	4	10	9
13	4	11	10
14	4	18	12
15	6	58	19
16	4	18	12
17	6	16	12

* VALUES CALCULATED WHERE DITCH 1 MEETS DITCH 4.

** DEPTH OF FLOW DETERMINED WITH WATER SURFACE PROFILE.

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE POWER STATION UNIT 3	DATE:	3/2/94
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TITLE:	CULVERTS	DATE:	
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CULVERT NUMBER 1

Culvert number 1 (C-1) must handle the storm runoff from drainage area number 2, ditch segment 2. For the 25 year storm, the peak flow from area 2 is 22 cfs. The top of pavement at C-1 is at elevation 128.1. The inlet invert for C-1 is at elevation 124.2 and the outlet invert is at elevation 124.0. The maximum headwater depth using a 30" rcp culvert would be approximately 30 inches above the inlet invert, assuming inlet control. (See the nomographs on the following pages.) Therefore, the maximum headwater depth for C-1 is at elevation 126.7.

USE 1-30" RCP FOR C-1

CULVERT NUMBER 2

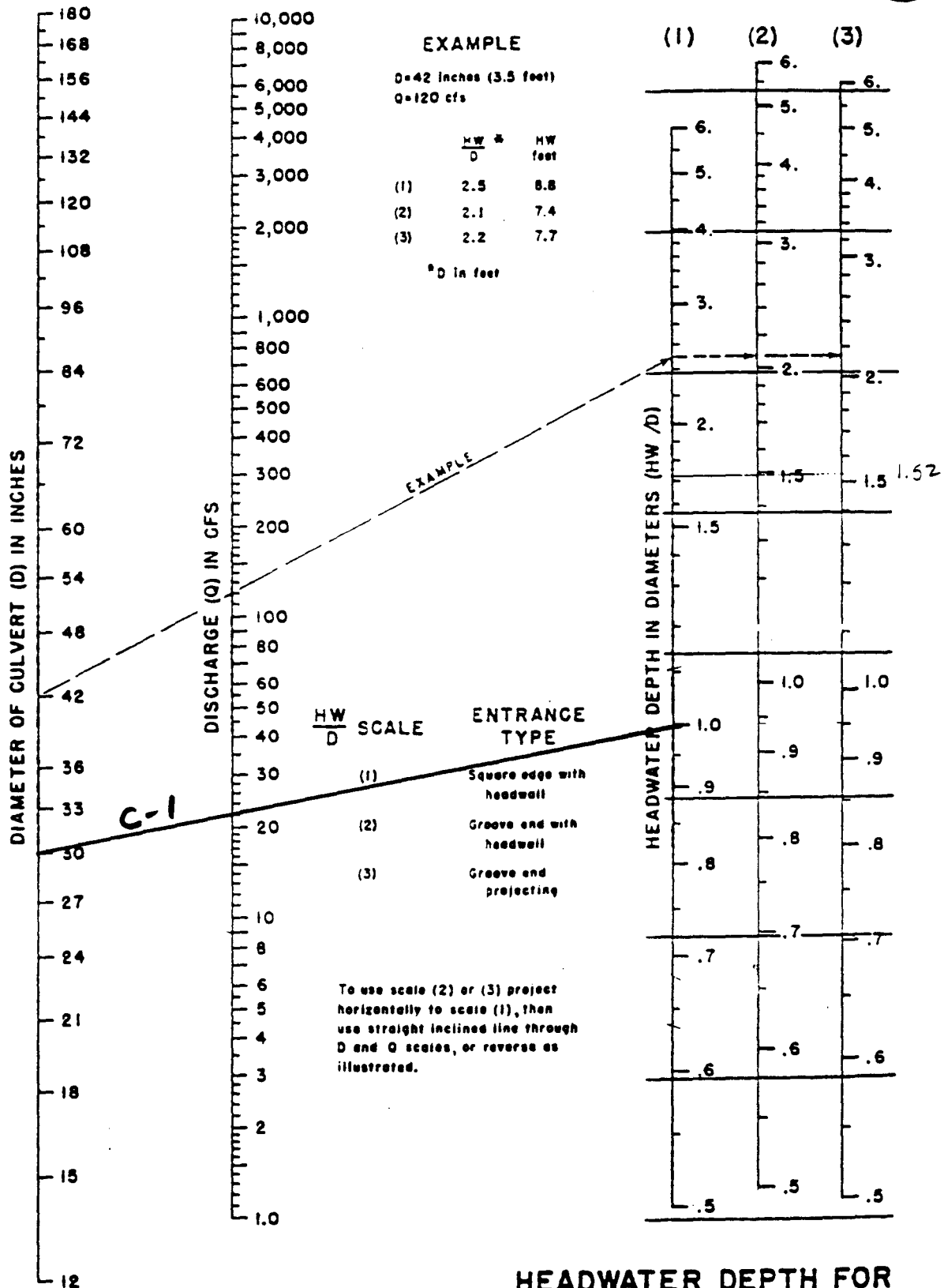
Culvert number 2 (C-2) must handle the storm runoff from drainage area number 2, ditch segment 3. For the 25 year storm, the peak flow from area 2 is 22 cfs. The top of pavement at C-2 is at elevation 128.1. The inlet invert for C-2 is at elevation 123.0 and the outlet invert is at elevation 122.8. The maximum headwater depth using a 30" rcp culvert would be approximately 30 inches above the inlet invert, assuming inlet control. (See the nomographs on the following pages.) Therefore, the maximum headwater depth for C-2 is at elevation 125.5.

USE 1-30" RCP FOR C-2

C-1

52. B405. H11

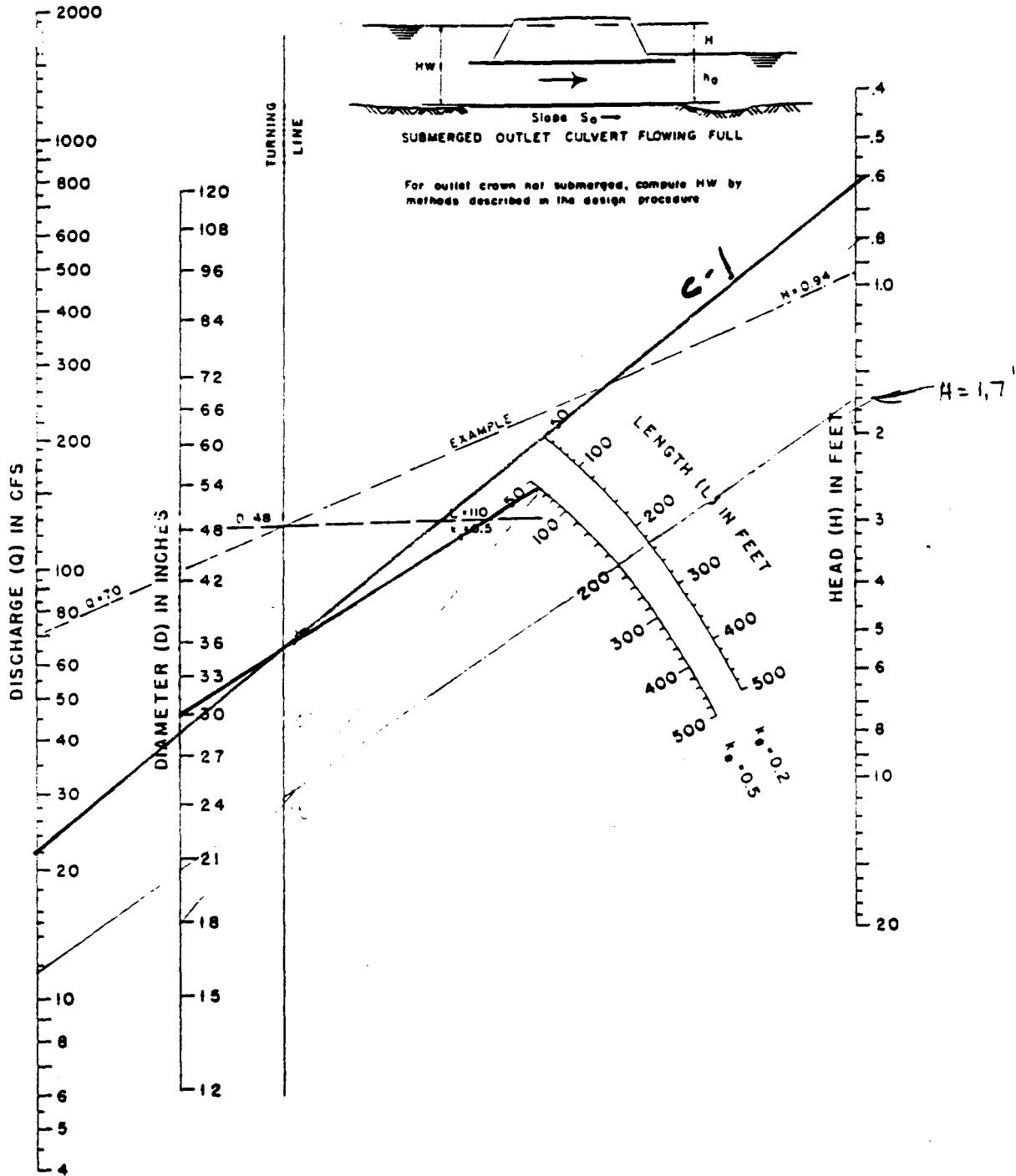
CHART 1



C-1

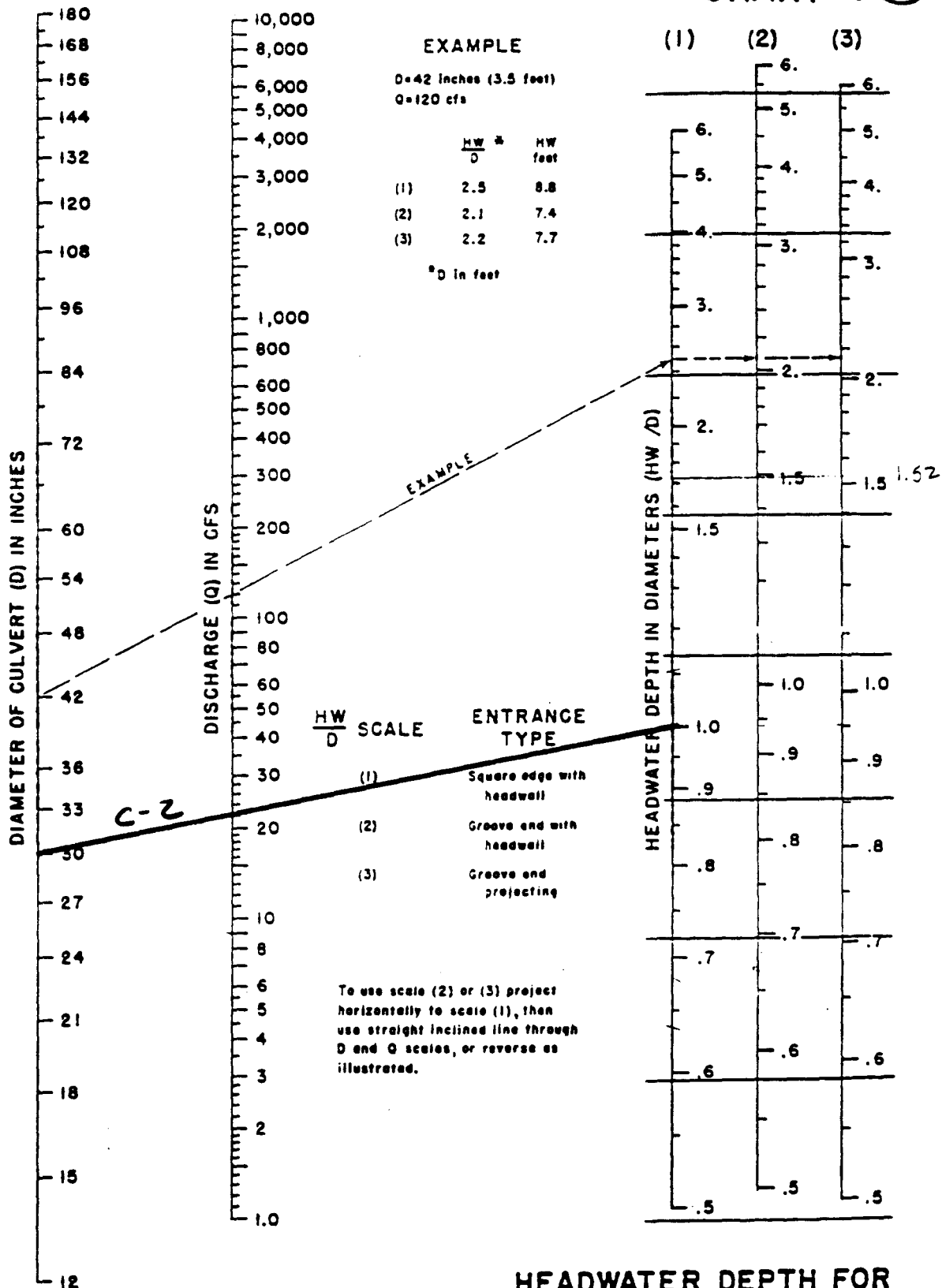
52.5406.H11

CHART 5



HEAD FOR
CONCRETE PIPE CULVERTS
FLOWING FULL
 $n = 0.012$

C-2

52.0706.171
CHART 1

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

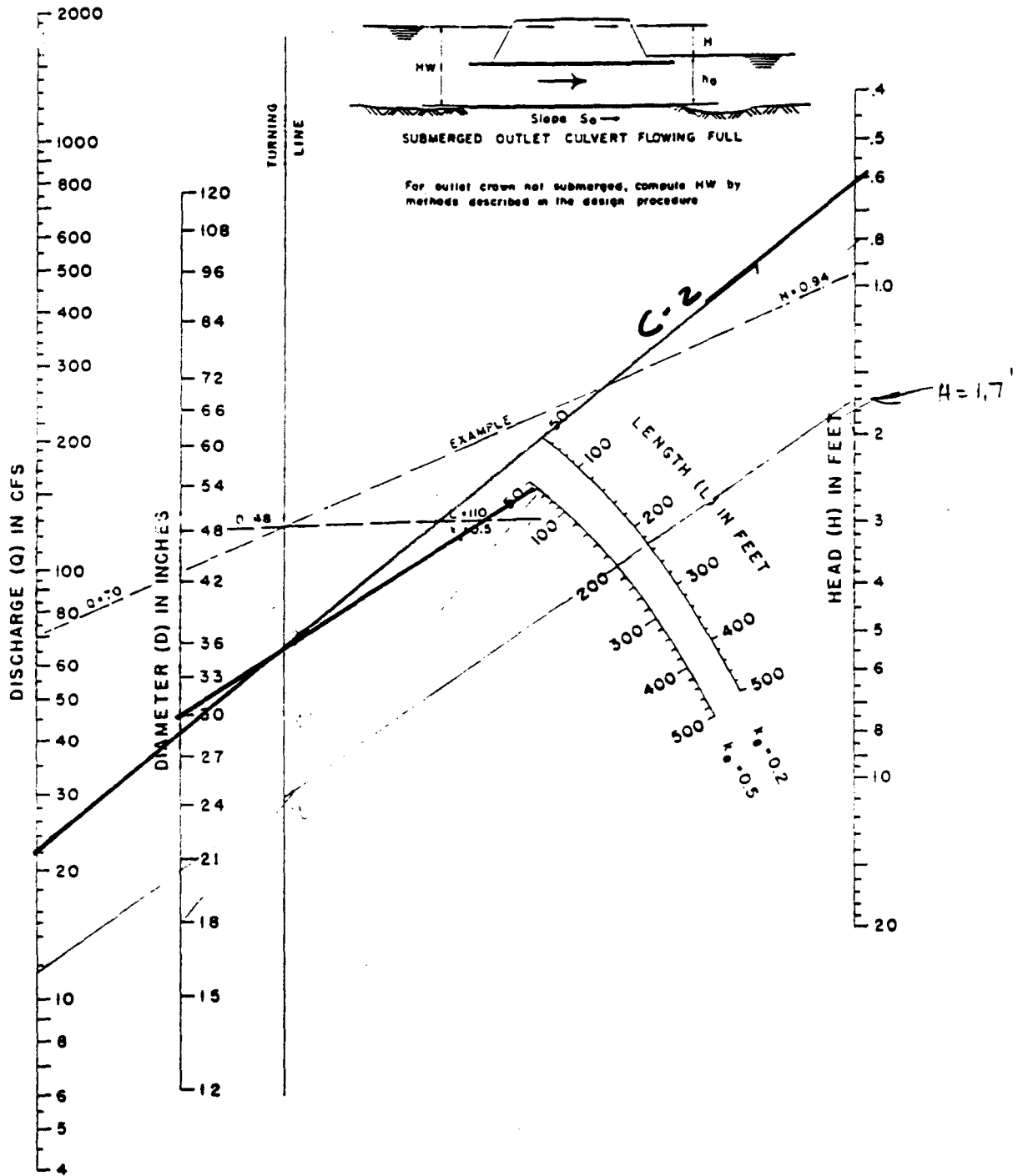
HEADWATER SCALES 2B3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

C-2

52.5406.44

CHART 5



HEAD FOR
CONCRETE PIPE CULVERTS
FLOWING FULL
 $n = 0.012$

OWNER:	SEMINOLE	NAME:	JOHN WARY
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CULVERT NUMBER 3

Culvert number 3 (C-3) must handle the storm runoff from drainage area number 3, ditch segment 8. For the 25 year storm, the peak flow from area 3 is 10 cfs. The top of pavement at C-3 is at elevation 128.1. The inlet invert for C-3 is at elevation 122.5 and the outlet invert is at elevation 122.3. The maximum headwater depth using a 24" rcp culvert would be approximately 21 inches above the inlet invert, assuming outlet control. (See the nomographs on the following pages.) Therefore, the maximum headwater depth for C-3 is at elevation 124.3.

USE 1-24" RCP FOR C-3

CULVERT NUMBER 4

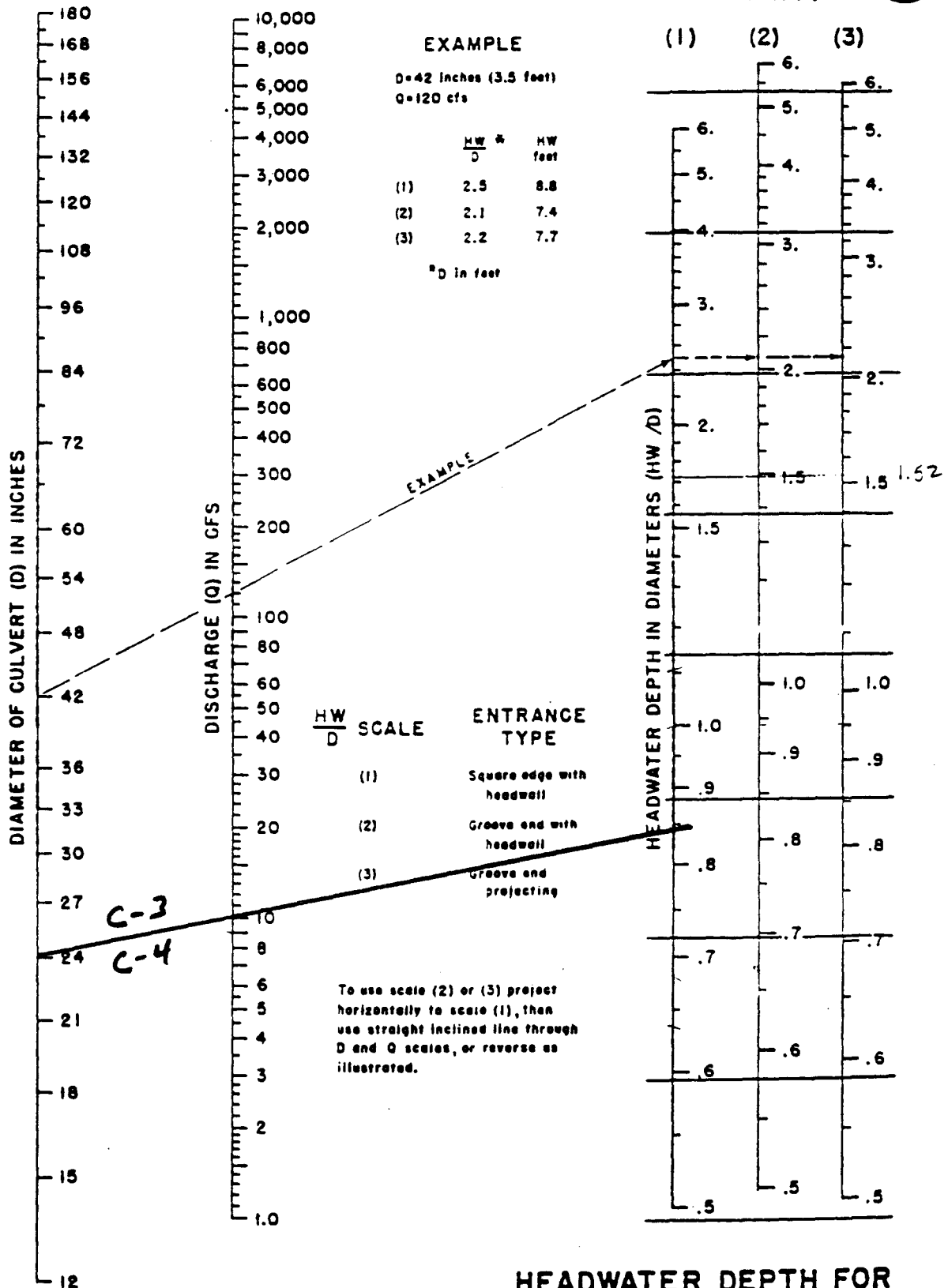
Culvert number 4 (C-4) must handle the storm runoff from drainage area number 4, ditch segment 9. For the 25 year storm, the peak flow from area 4 is 9 cfs. The top of pavement at C-4 is at elevation 128.1. The inlet invert for C-4 is at elevation 122.3 and the outlet invert is at elevation 122.0. The maximum headwater depth using a 24" rcp culvert would be approximately 21 inches above the inlet invert, assuming outlet control. (See the nomographs on the following pages.) Therefore, the maximum headwater depth for C-4 is at elevation 124.0.

USE 1-24" RCP FOR C-4

C-3 + C-4

52.5406. H/1

CHART 1



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

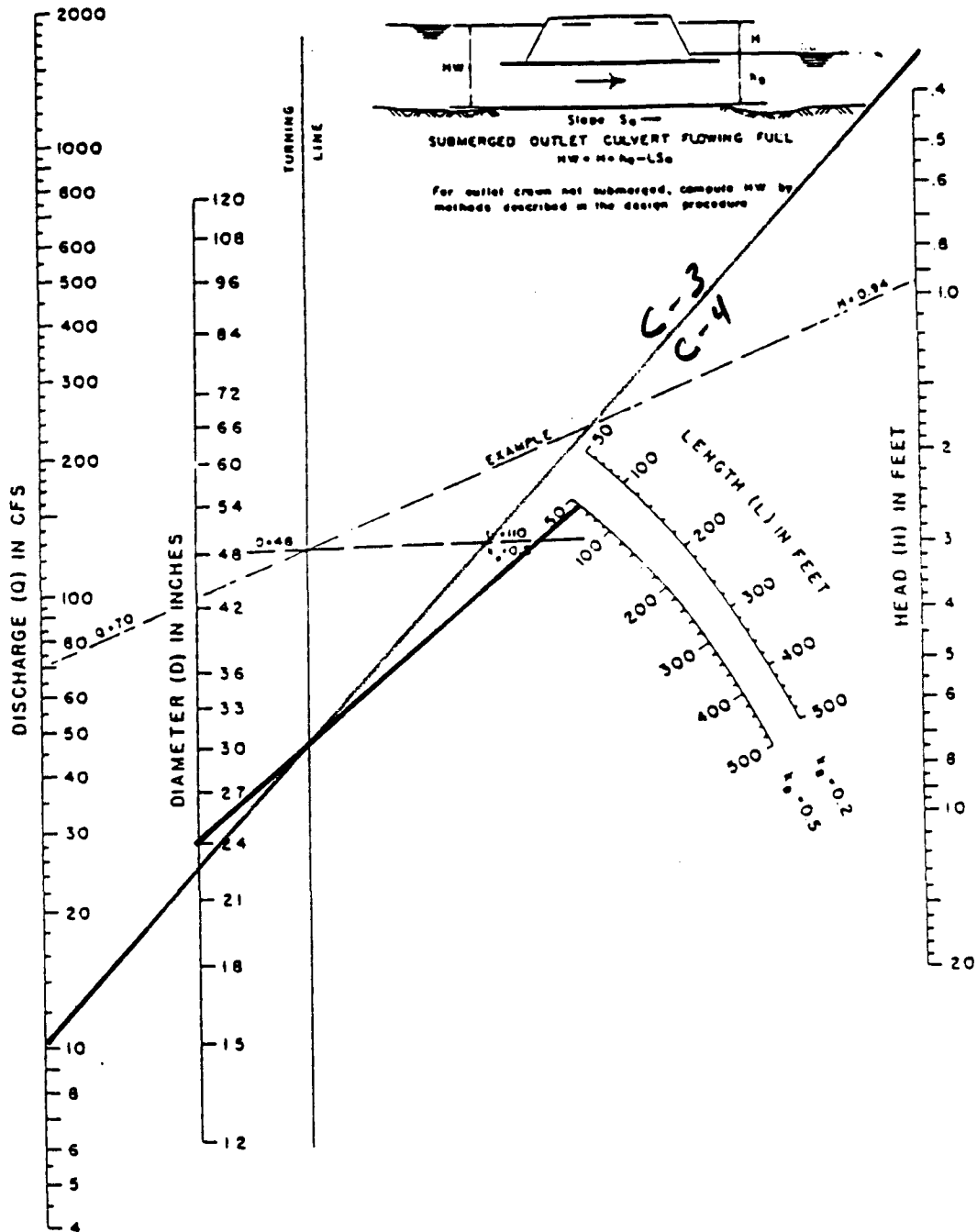
HEADWATER SCALES 283
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C-3 + C-4

Page 16 of 17
52.5406.H/1

CHART 9



HEAD FOR
CONCRETE PIPE CULVERTS
FLOWING FULL
 $n = 0.012$

BUREAU OF PUBLIC ROADS JAN. 1963

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE POWER STATION UNIT 3	DATE:	3/2/94
PROJECT NO.:	23930 52.5406.H//	CHECKED BY:	<i>[Signature]</i>
TITLE:	CULVERTS	DATE:	3-2-94
		PAGE:	57 OF 64

CULVERT NUMBER 5 ✓

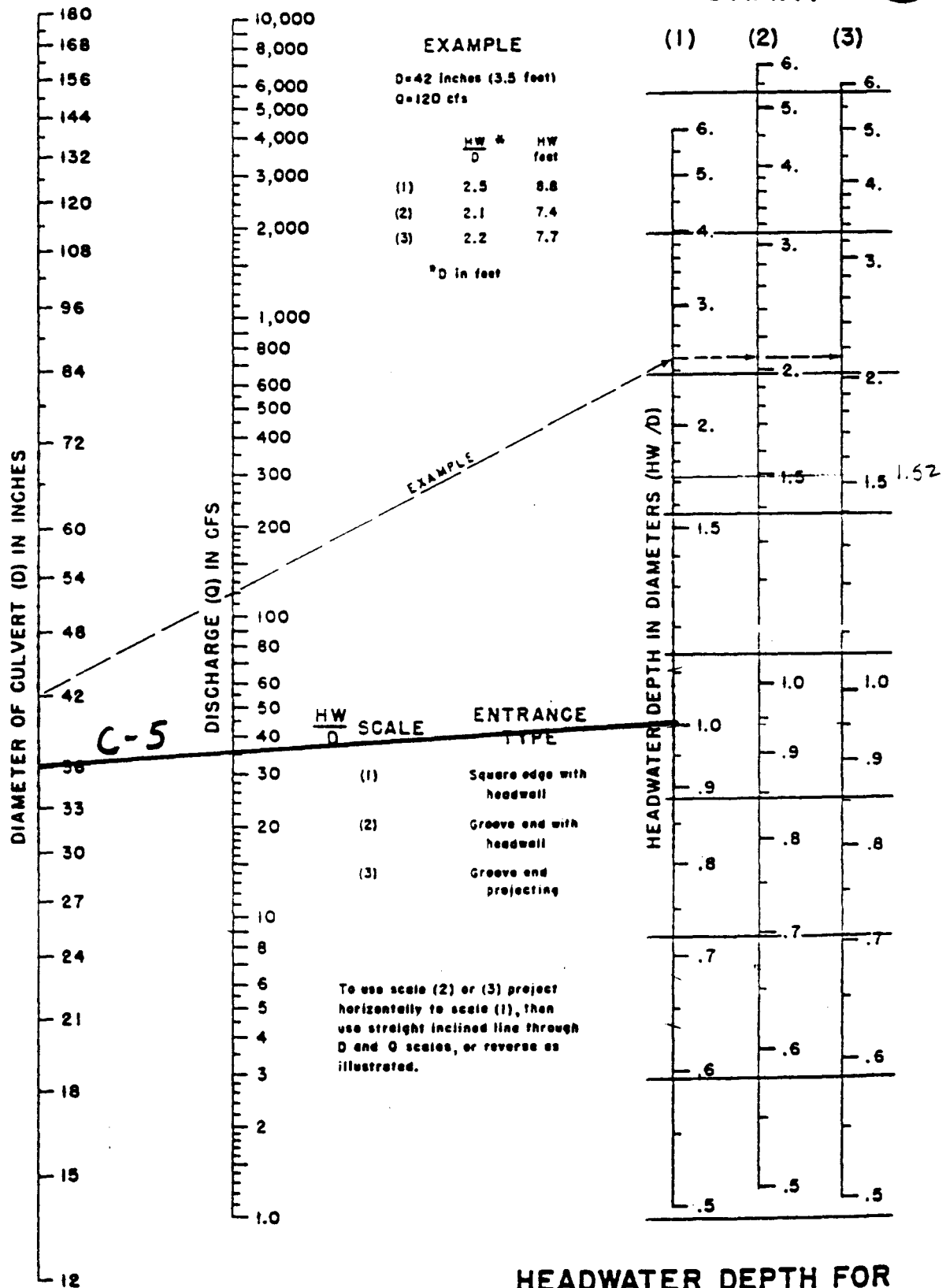
Culvert number 5 (C-5) must handle the storm runoff from drainage areas 1,2,3,4, and 9, ditch segment 7. For the 25 year storm, the peak flow from these areas is 70 cfs. The top of aggregate surface at C-5 is at elevation 127.5. The inlet invert for C-5 is at elevation 120.3 and the outlet invert is at elevation 120.0. The tailwater depth for C-5 is at elevation 122.5 which is the maximum water surface elevation of the detention pond during a 25 year storm. The maximum headwater depth for C-5 using 2-36" rcp culverts would be approximately 40 inches above the inlet invert, for outlet control. (See the nomographs on the following pages.) Therefore, the maximum headwater depth for C-5 is at elevation 123.7.

USE 2-36" RCP FOR C-5

While sizing C-4, the tailwater depth for C-4 was calculated to be 19 inches (downstream end of ditch segment 6) which is elevation 122.4. The maximum headwater depth for C-5 will be 40 inches which is elevation 123.7. The Direct Step Method was used to perform a water surface profile on ditch segment 7. Given that the maximum headwater elevation at C-5 is 123.7, it was determined that the tailwater elevation at C-4 is 123.7. The outlet invert elevation of C-4 is at 122.0, for a tailwater depth of 20.4 inches. Therefore, culvert C-4 will be located 150 feet upstream from C-5 and the outlet invert of C-4 will remain at elevation 122.0. The water surface profile is found on page 40.

C-5

CHART 1



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

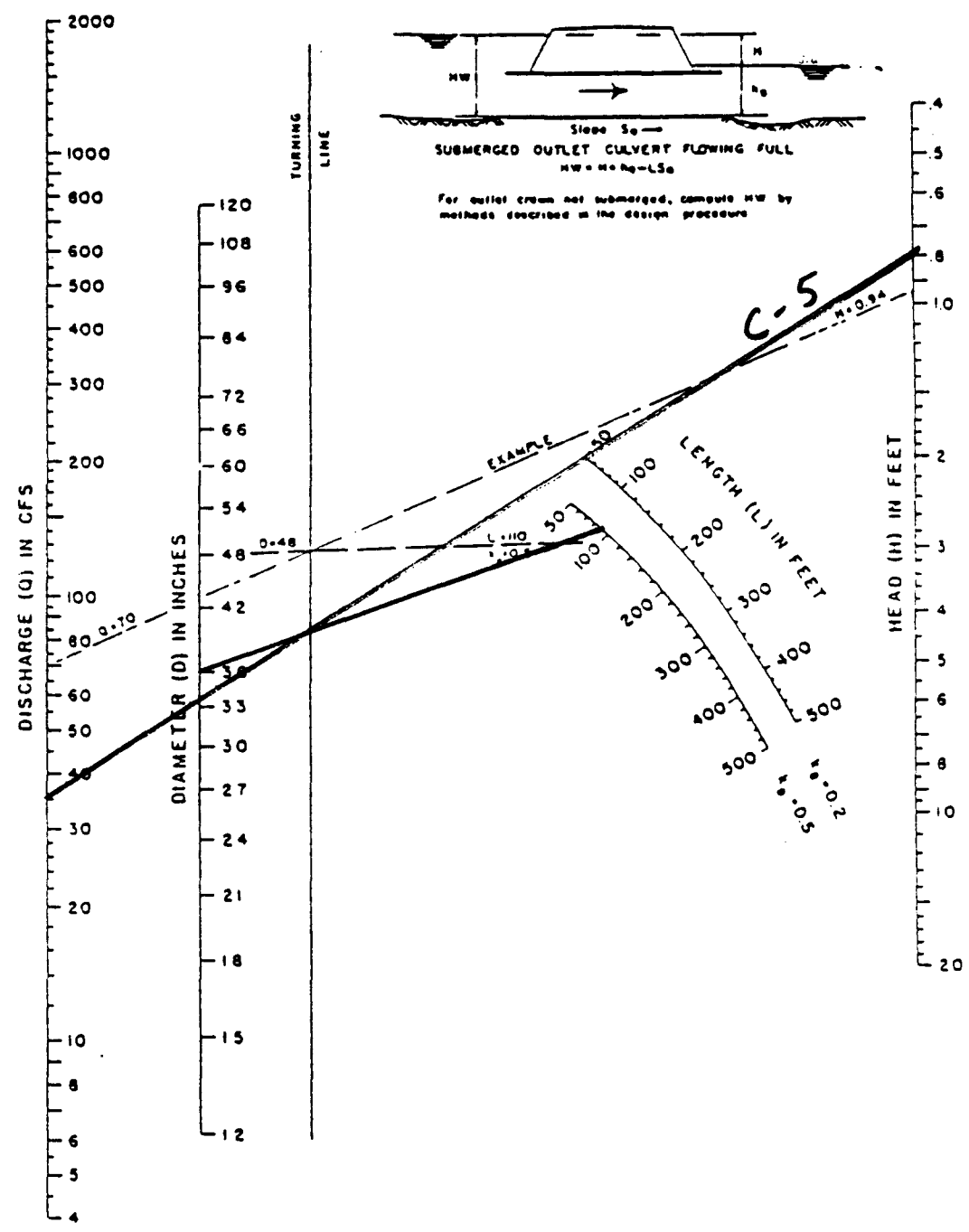
HEADWATER SCALES 283
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52.5405, H/1

C-5

CHART 9



HEAD FOR
CONCRETE PIPE CULVERTS
FLOWING FULL
 $n = 0.012$

BUREAU OF PUBLIC ROADS JAN. 1963

OWNER: SEMINOLE
 PROJECT: HARDEE STATION UNIT 3
 PROJECT NO.: 23930 *#52.5406.111*
 TITLE: CULVERTS
 WATER SURFACE PROFILE

NAME: J.R. WARY
 DATE: 03/07/94
 CHECKED BY: *[Signature]*
 DATE: *[Signature]*
 PAGE: 40 OF 64

DISCHARGE (CFS)	70	UNIFORM WATER DEPTH (Y _o , FT) **	1.68
MANNINGS N	0.03	DISCHARGE FOR Y _o	70.07
SIDE SLOPE, M (FT/FT)	3	CRITICAL WATER DEPTH (Y _c , FT) ***	1.29
BOTTOM WIDTH, B (FT)	6	FROUDE NUMBER FOR Y _c	1.0065
INITIAL STATION, X (FT)	300	TYPE OF CHANNEL	MILD
INITIAL BOTTOM EL, Z (FT)	120.3	FROUDE NUMBER	0.6193
BOTTOM SLOPE (FT/FT)	0.005	TYPE OF FLOW	SUBCRITICAL
INITIAL WATER DEPTH, Y (FT) *	3.33	** ADJUST UNIFORM DEPTH UNTIL DISCHARGES MATCH	
DEPTH STEP (FT)	-0.1	*** ADJUST CRITICAL DEPTH UNTIL FROUDE NO. EQUALS 1.0	

* IF FLOW IS SUBCRITICAL, BEGIN PROFILE DOWNSTREAM - SUPERCRITICAL, UPSTREAM

Y	AREA	VEL	ENERGY	Pw	Rh	V AVE	Rh AVE	Sf	DX	X	Z	Z+Y	FORCE
FT	FT^2	FT/S	FT	FT	FT		FT	FT/FT	FT	FT	FT	FT	FT^3
3.33	53.25	1.31	3.36	27.06	1.97	1.31	1.97	0.0003	0.0	300.0	120.30	123.63	73.051
3.23	50.68	1.38	3.26	26.43	1.92	1.35	1.94	0.0003	-20.7	279.3	120.40	123.63	68
3.13	48.17	1.45	3.16	25.80	1.87	1.42	1.89	0.0003	-20.8	258.5	120.51	123.64	63.214
3.03	45.72	1.53	3.07	25.16	1.82	1.49	1.84	0.0004	-21.0	237.5	120.61	123.64	58.689
2.93	43.33	1.62	2.97	24.53	1.77	1.57	1.79	0.0005	-21.1	216.4	120.72	123.65	54.42
2.83	41.01	1.71	2.88	23.90	1.72	1.66	1.74	0.0005	-21.3	195.1	120.82	123.65	50.403
2.73	38.74	1.81	2.78	23.27	1.67	1.76	1.69	0.0006	-21.6	173.5	120.93	123.66	46.633
2.63	36.53	1.92	2.69	22.63	1.61	1.86	1.64	0.0007	-21.9	151.6	121.04	123.67	43.108
2.53	34.38	2.04	2.59	22.00	1.56	1.98	1.59	0.0009	-22.3	129.2	121.15	123.68	39.823
2.43	32.29	2.17	2.50	21.37	1.51	2.10	1.54	0.0010	-22.9	106.3	121.27	123.70	36.776

FORMULAS:

CHANNEL CROSS SECTION AREA, $A = Y(B + MY)$
 LOW VELOCITY, $V = Q/A$
 SPECIFIC ENERGY, $E = Y + V^2/2G$
 WETTED PERIMETER, $Pw = B + 2Y(1 + M^2)^{.5}$
 HYDRAULIC RADIUS, $Rh = A/Pw$

$V AVE = (V1 + V2)/2$ $n = \text{MANNINGS COEFFICIENT}$
 $Rh AVE = (Rh1 + Rh2)/2$ $C = \text{CHEZY COEFFICIENT}$
 $FRICITION SLOPE, Sf = ((V AVE)n/C(Rh AVE)^{(2/3)})^2$
 CHANGE IN STATION, $DX = (E2 - E1)/(So - Sf)$
 $X2 = X1 + DX$

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE POWER STATION UNIT 3	DATE:	3/2/94
PROJECT NO.:	23930 52.5408.H11	CHECKED BY:	JS
TITLE:	CULVERTS	DATE:	3-2-94
		PAGE:	71

CULVERT NUMBER 6

Culvert number 6 (C-6) must handle the storm runoff from a 1.4 acre portion of drainage area number 6, ditch segment 11. For the 25 year storm, the peak flow from this portion of area 6 is 8 cfs. The top of pavement at C-6 is at elevation 128.1. The inlet invert for C-6 is at elevation 124.2 and the outlet invert is at elevation 124.0. (The tailwater depth for C-6 is assumed to be 35 inches, which is the maximum headwater depth for C-7). The maximum headwater depth for C-6 using a 24" rcp culvert would be approximately 36 inches above the inlet invert, assuming outlet control. (See the nomographs on the following pages.) Therefore, the maximum headwater depth for C-6 is at elevation 127.2.

USE 1-24" RCP FOR C-6

CULVERT NUMBER 7

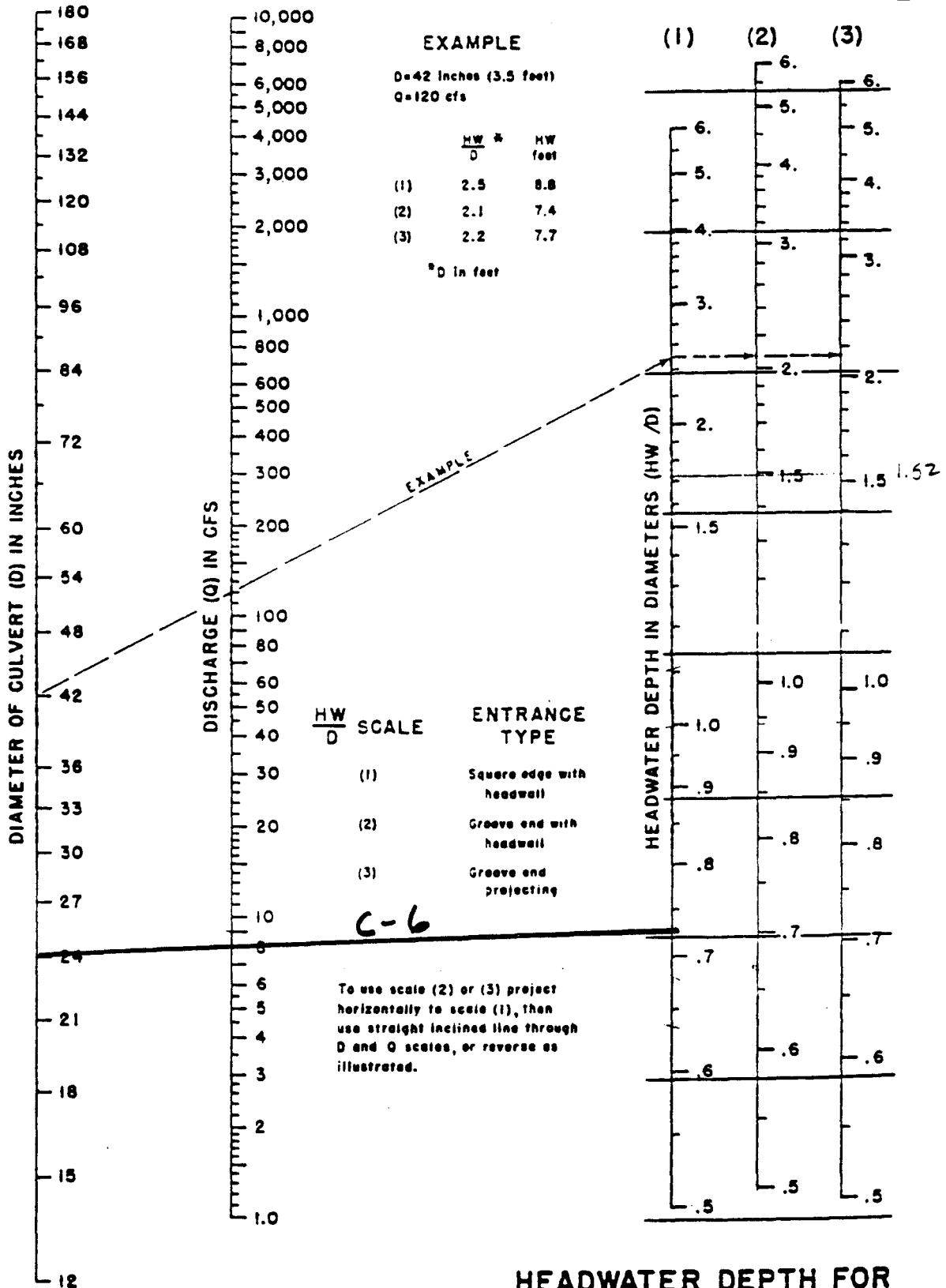
Culvert number 7 (C-7) must handle the storm runoff from a 1.8 acre portion of drainage area number 6, ditch segment 12. For the 25 year storm, the peak flow from this portion of area 6 is 10 cfs. The top of pavement at C-7 is at elevation 128.1. The inlet invert for C-7 is at elevation 123.9 and the outlet invert is at elevation 123.7. (The tailwater depth for C-7 is assumed to be 31 inches, which is the maximum headwater depth for C-8). The maximum headwater depth for C-7 using a 24" rcp culvert would be approximately 35 inches assuming outlet control. (See the nomographs on the following pages.) Therefore, the maximum headwater depth for C-7 is at elevation 126.8.

USE 1-24" RCP FOR C-7

C-6

52.5406.H11

CHART 1



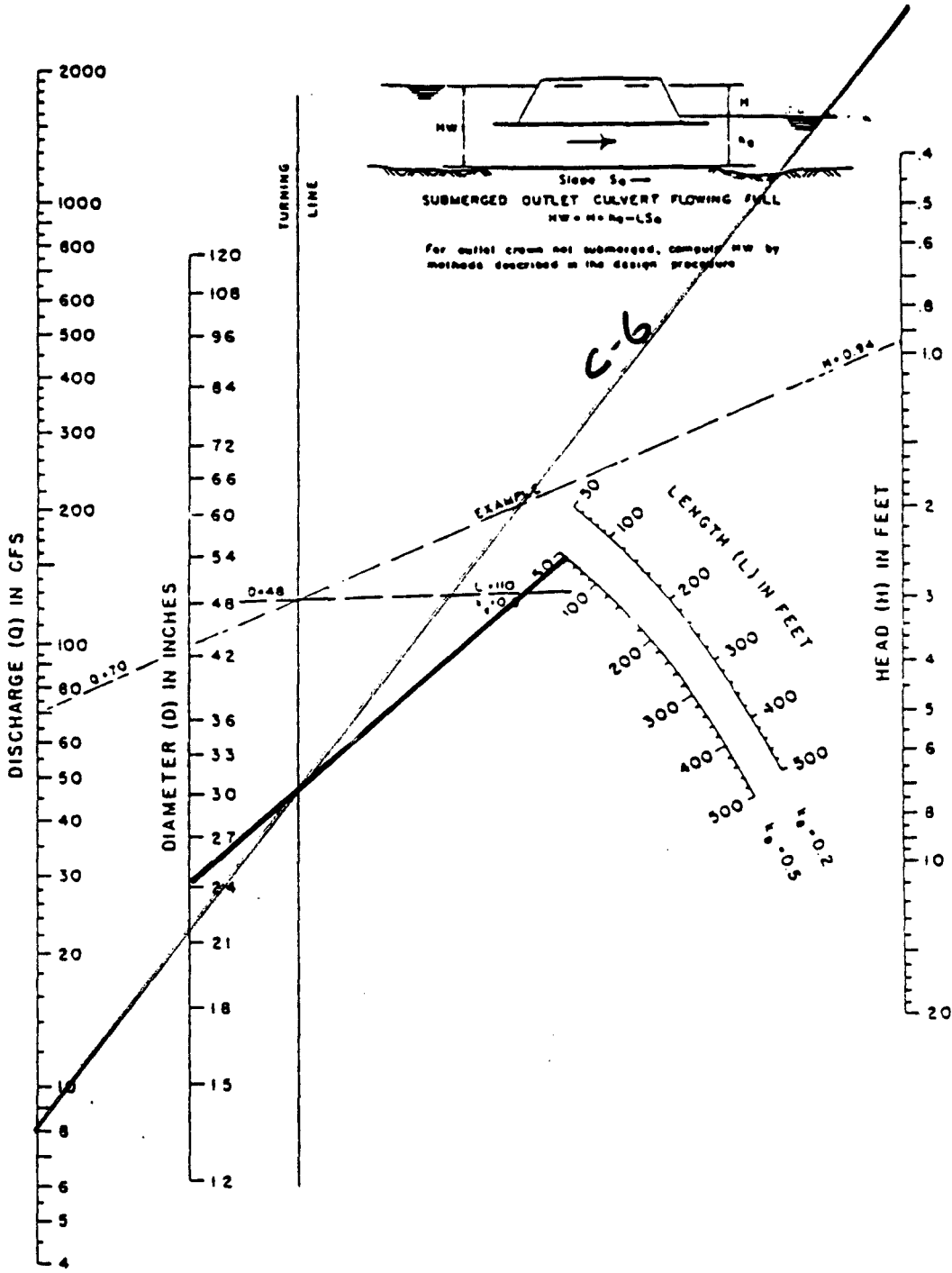
HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 283
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

C-6

CHART 9



HEAD FOR
CONCRETE PIPE CULVERTS
FLOWING FULL
 $n = 0.012$

C-7

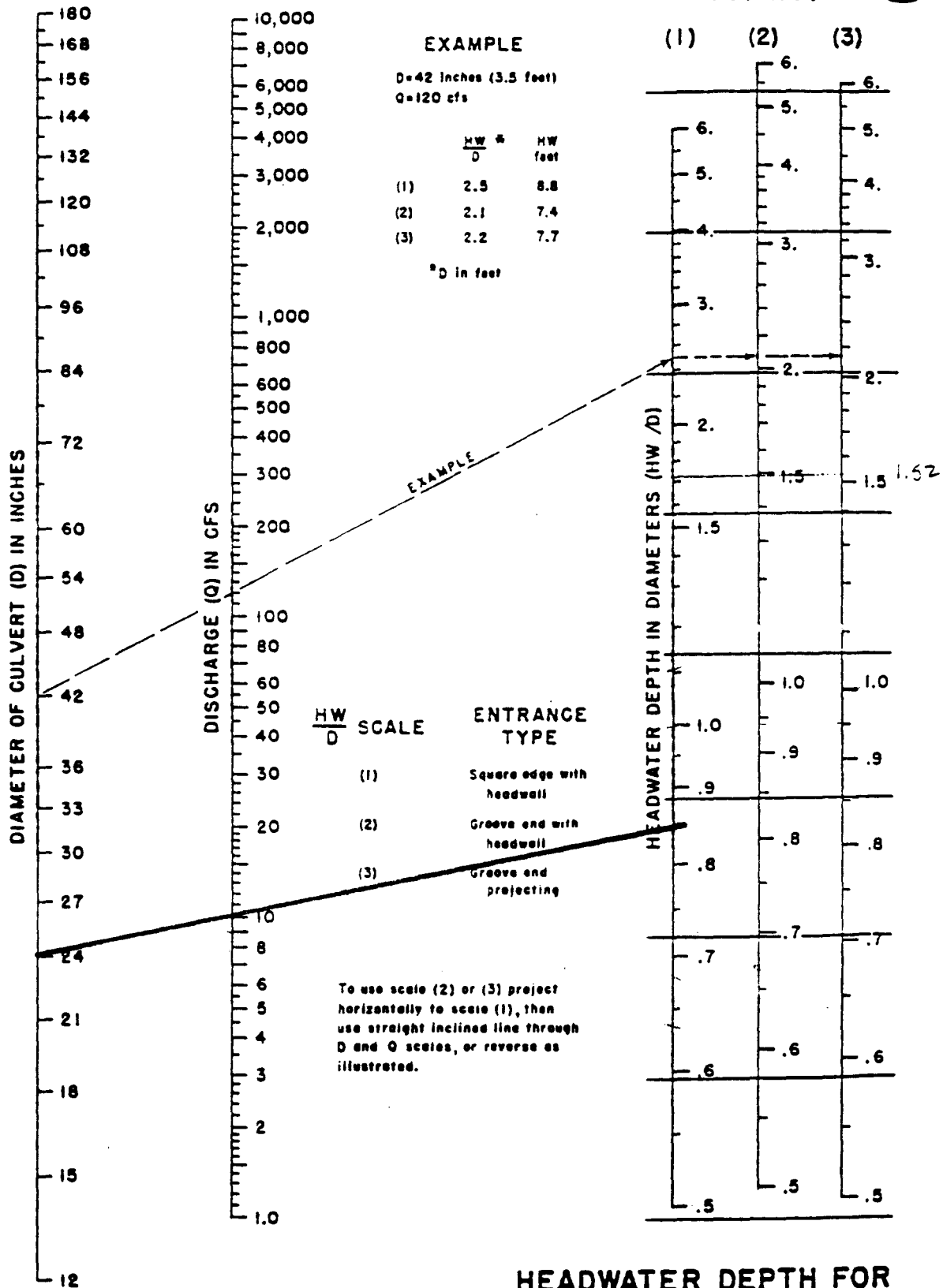
CHART 1

EXAMPLE

D=42 inches (3.5 feet)
Q=120 cfs

	$\frac{HW}{D}$	HW feet
(1)	2.5	8.8
(2)	2.1	7.4
(3)	2.2	7.7

^aD in feet



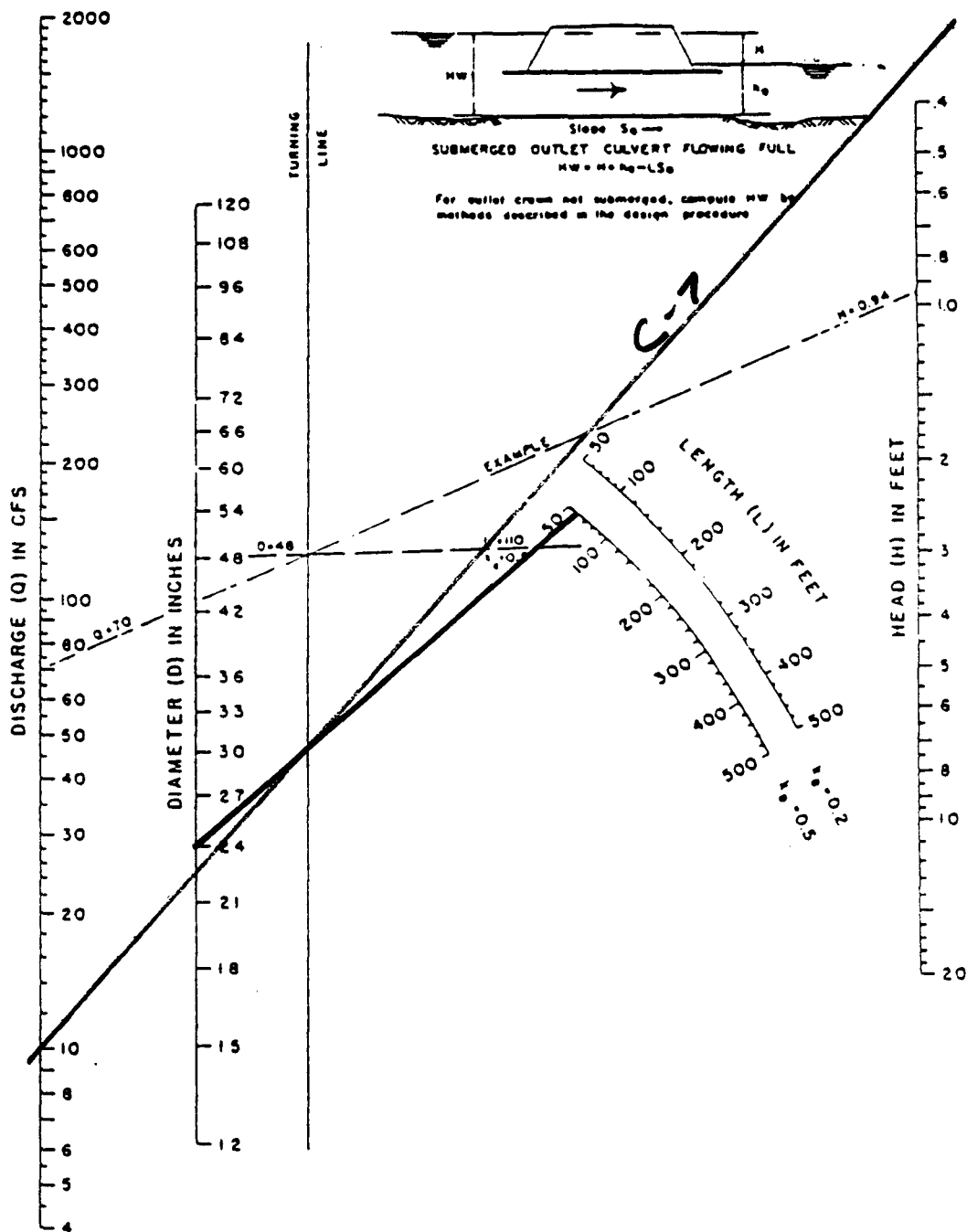
HEADWATER DEPTH FOR
CONCRETE PIPE CULVERTS
WITH INLET CONTROL

HEADWATER SCALES 283
REVISED MAY 1964

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C-7

CHART 9



HEAD FOR
CONCRETE PIPE CULVERTS
FLOWING FULL
 $n = 0.012$

BUREAU OF PUBLIC ROADS JAN. 1963

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE POWER STATION UNIT 3	DATE:	3/2/94
PROJECT NO.:	23930 <i>52.5408. H11</i>	CHECKED BY:	<i>[Signature]</i>
TITLE:	CULVERTS	DATE:	<i>3-2-94</i>
		PAGE:	<i>10-6-94</i>

CULVERT NUMBER 8

Culvert number 8 (C-8) must handle the storm runoff from a 2 acre portion of drainage area number 6 (ditch segment 13). For the 25 year storm, the peak flow from this portion of area 6 is 11 cfs. The top of pavement at C-8 is at elevation 128.1. The inlet invert for C-8 is at elevation 123.5 and the outlet invert is at elevation 123.3. (The tailwater depth for C-8 is assumed to be 27 inches, which is the maximum headwater depth for C-9). The maximum headwater depth using a 24" rcp culvert for C-8 would be approximately 31 inches assuming outlet control. (See the nomographs on the following pages.) Therefore, the maximum headwater depth for C-8 is at elevation 125.9.

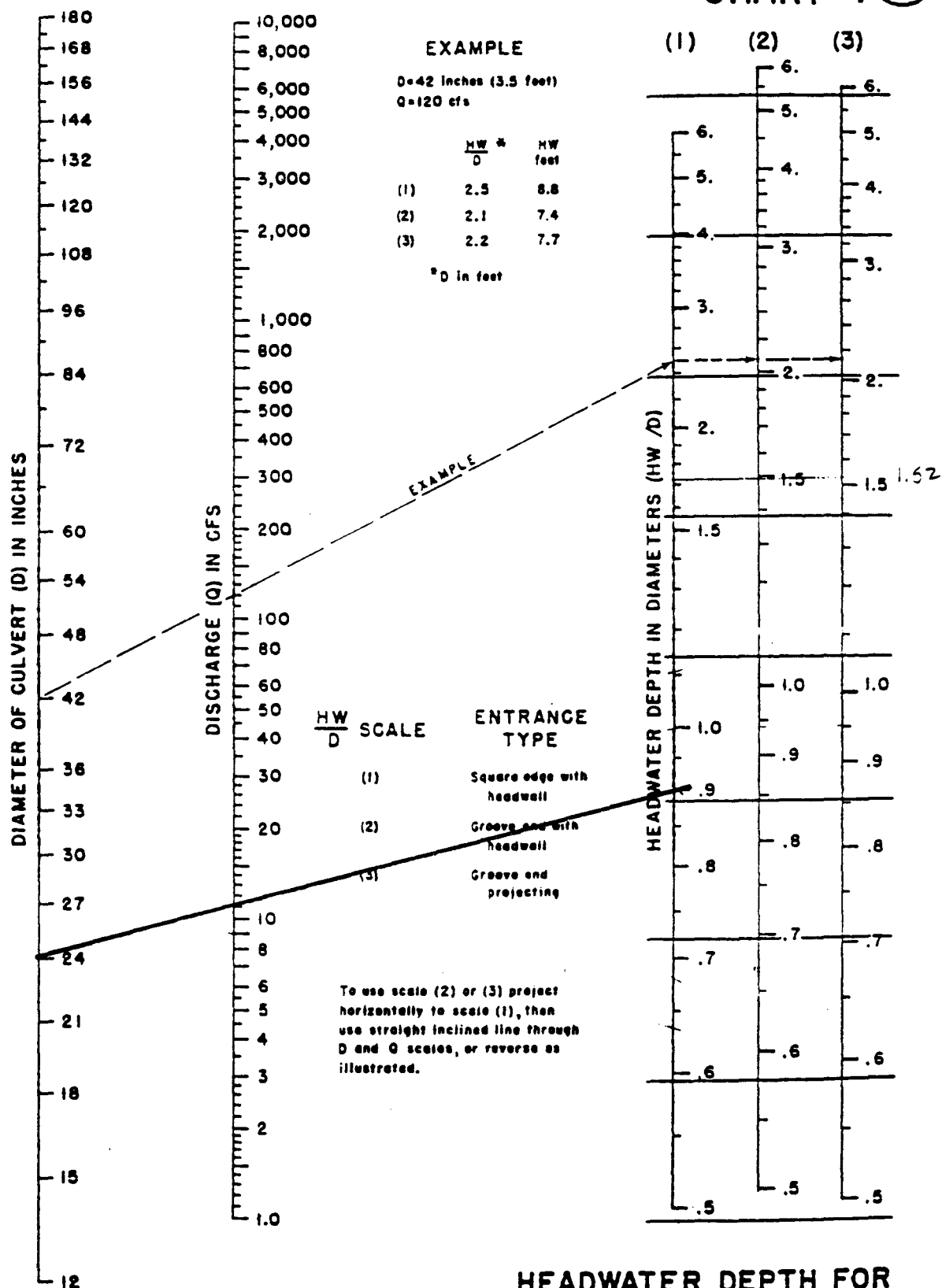
USE 1-24" RCP FOR C-8

CULVERT NUMBER 9

Culvert number 9 (C-9) must handle the storm runoff from drainage area number 6 (ditch segment 14). For the 25 year storm, the peak flow from area 6 is 18 cfs. The top of pavement at C-9 is at elevation 128.1. The inlet invert for C-9 is at elevation 123.2 and the outlet invert is at elevation 122.9. The maximum headwater depth using a 30" rcp culvert would be approximately 27 inches assuming inlet control. (See the nomographs on the following pages.) Therefore, the maximum headwater depth for C-9 is at elevation 125.5.

USE 1-30" RCP FOR C-9

C-8

52.5406.411
CHART 1

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

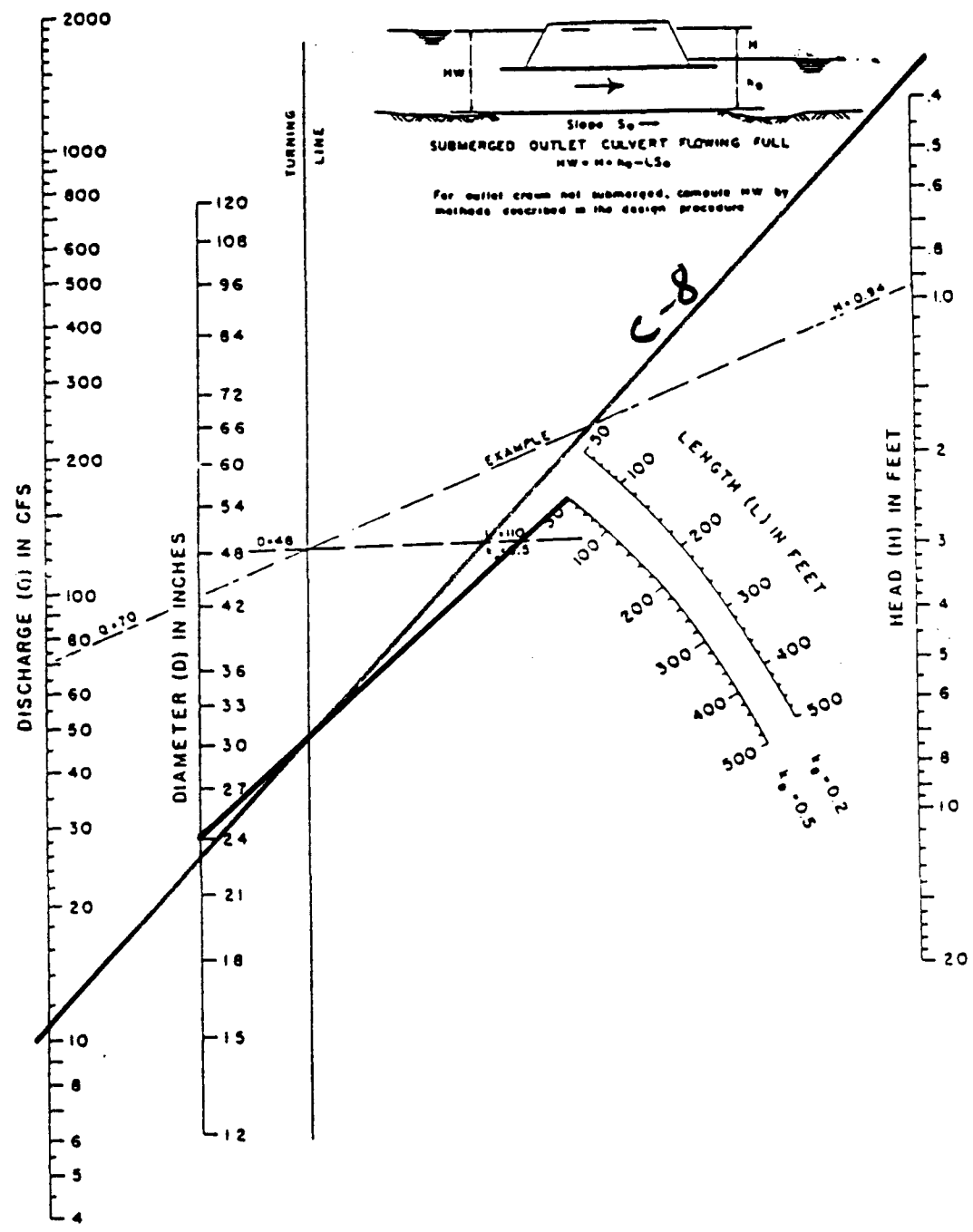
HEADWATER SCALES 283
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52.5408.H.11

C-8

CHART 9



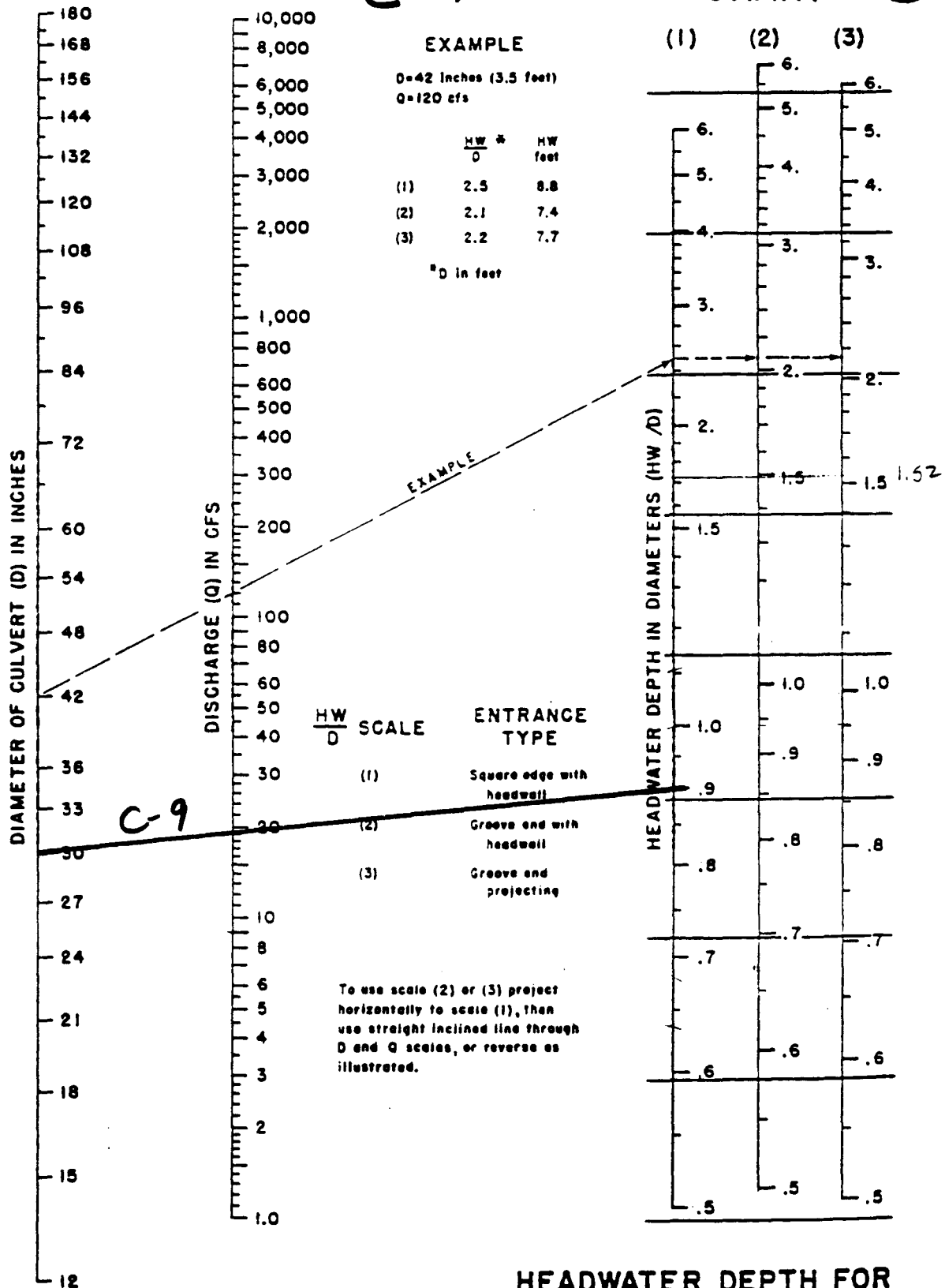
HEAD FOR
CONCRETE PIPE CULVERTS
FLOWING FULL
 $n = 0.012$

BUREAU OF PUBLIC ROADS JAN. 1963

C-9

52.5408.H11

CHART 1



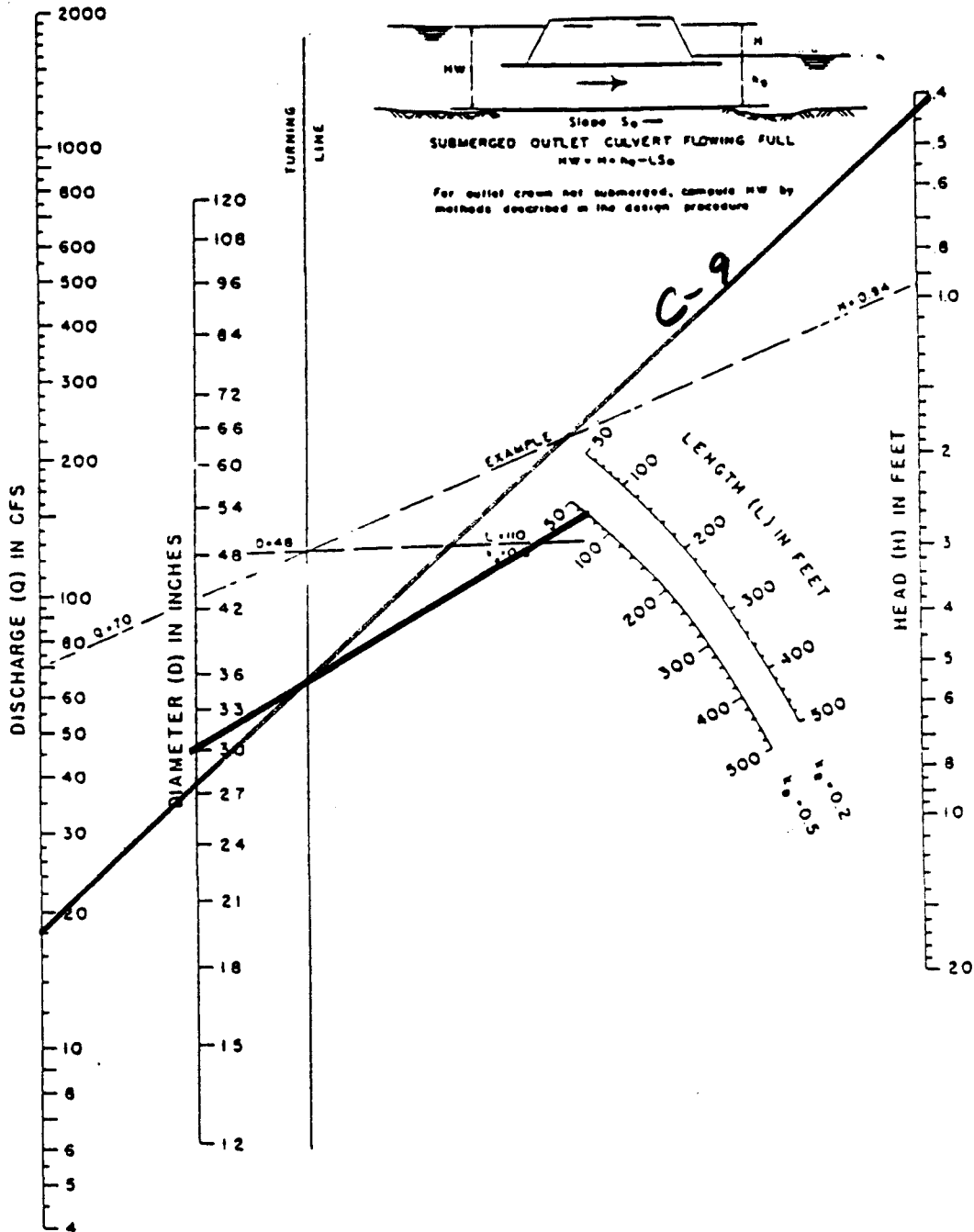
HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 283
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BUREAU OF PUBLIC ROADS JAN. 1963

C-9

CHART 9



HEAD FOR
 CONCRETE PIPE CULVERTS
 FLOWING FULL
 $n = 0.012$

BUREAU OF PUBLIC ROADS JAN. 1963

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE POWER STATION UNIT 3	DATE:	3/2/94
PROJECT NO.:	23930 <i>52.5405.411</i>	CHECKED BY:	<i>[Signature]</i>
TITLE:	CULVERTS	DATE:	<i>3/2/94</i>
		PAGE:	<i>51 176V</i>

CULVERT NUMBER 10 ✓

Culvert number 10 (C-10) must handle the storm runoff from drainage areas 5 and 6 (ditch segment 15). For the 25 year storm, the peak flow into C-10 will be 58 cfs. The top of aggregate surface at C-9 is at elevation 125.0. The inlet invert for C-10 is at elevation 120.7 and the outlet invert is at elevation 120.5. The maximum headwater depth using 2-36" rcp culverts for C-10 would be approximately 33 inches assuming inlet control. (See the nomographs on the following pages.) Therefore, the maximum headwater depth for C-10 is at elevation 123.4.

USE 2-36" RCP FOR C-10

CULVERT NUMBER 11 ✓

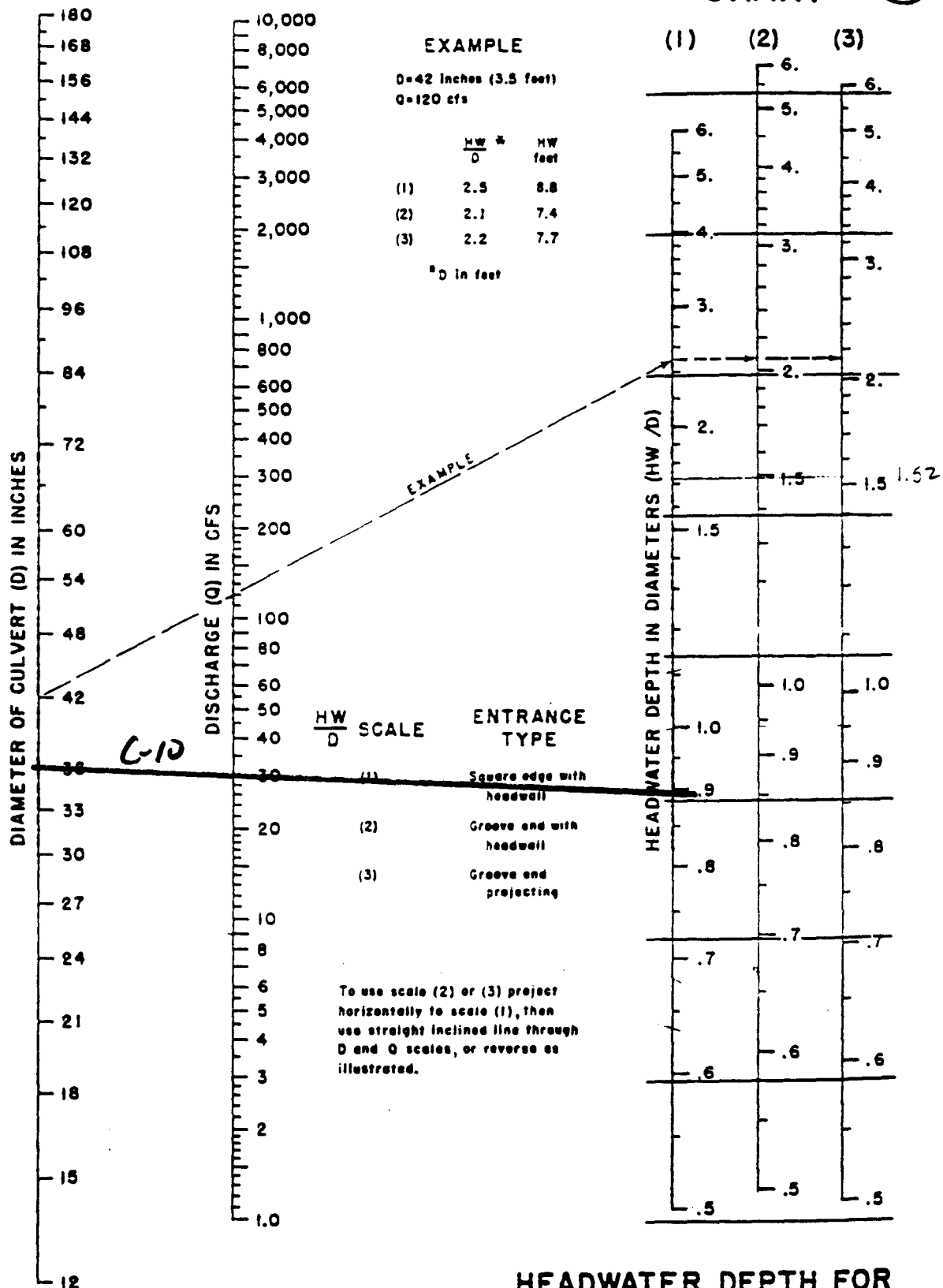
Culvert number 11 (C-11) must handle the storm runoff from drainage area number 9 (ditch segment 11). For the 25 year storm, the peak flow from area 9 is 2 cfs. The top of pavement at C-9 is at elevation 128.1. The inlet invert for C-11 is at elevation 125.8 and the outlet invert is at elevation 125.5. The maximum headwater depth using a 12" rcp culvert for C-11 would be approximately 11 inches assuming inlet control. (See the nomographs on the following pages.) Therefore, the maximum headwater depth for C-11 is at elevation 126.7.

USE 1-12" RCP FOR C-11

C-10

53.5406.411

CHART 1



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

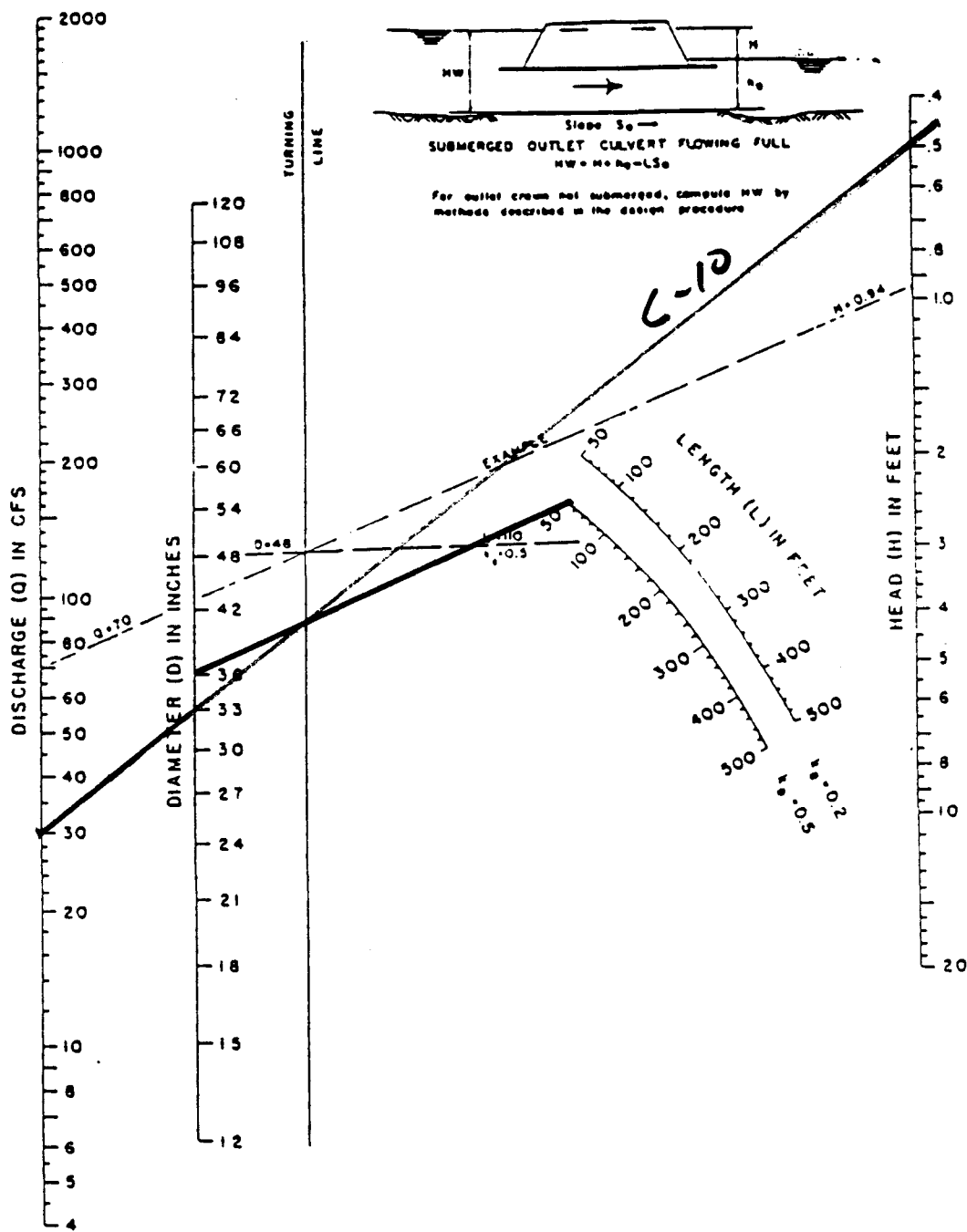
HEADWATER SCALES 283
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C-10

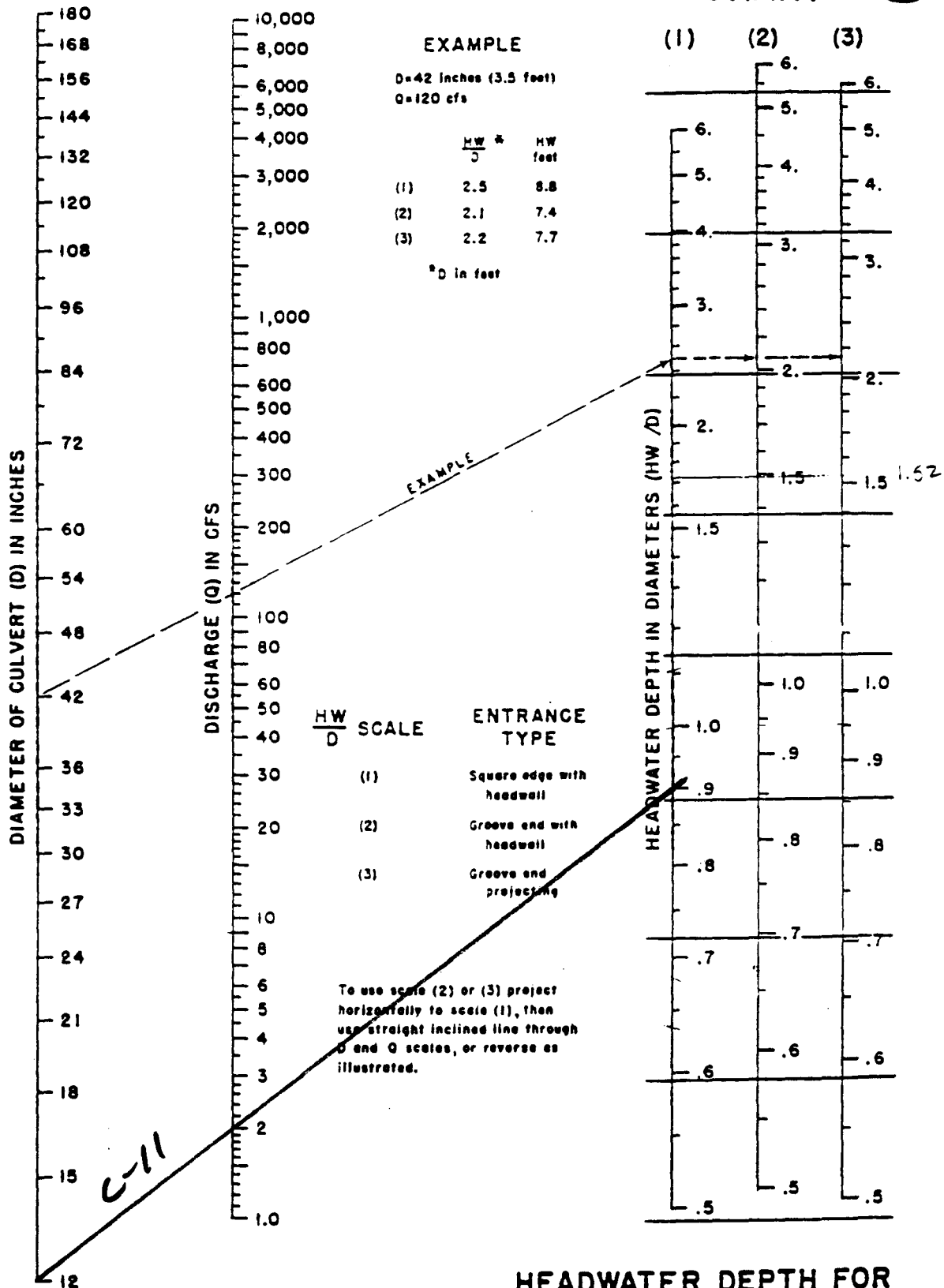
CHART 9



HEAD FOR
CONCRETE PIPE CULVERTS
FLOWING FULL
 $n = 0.012$

BUREAU OF PUBLIC ROADS JAN. 1963

C-11

52.5406.111
CHART 1

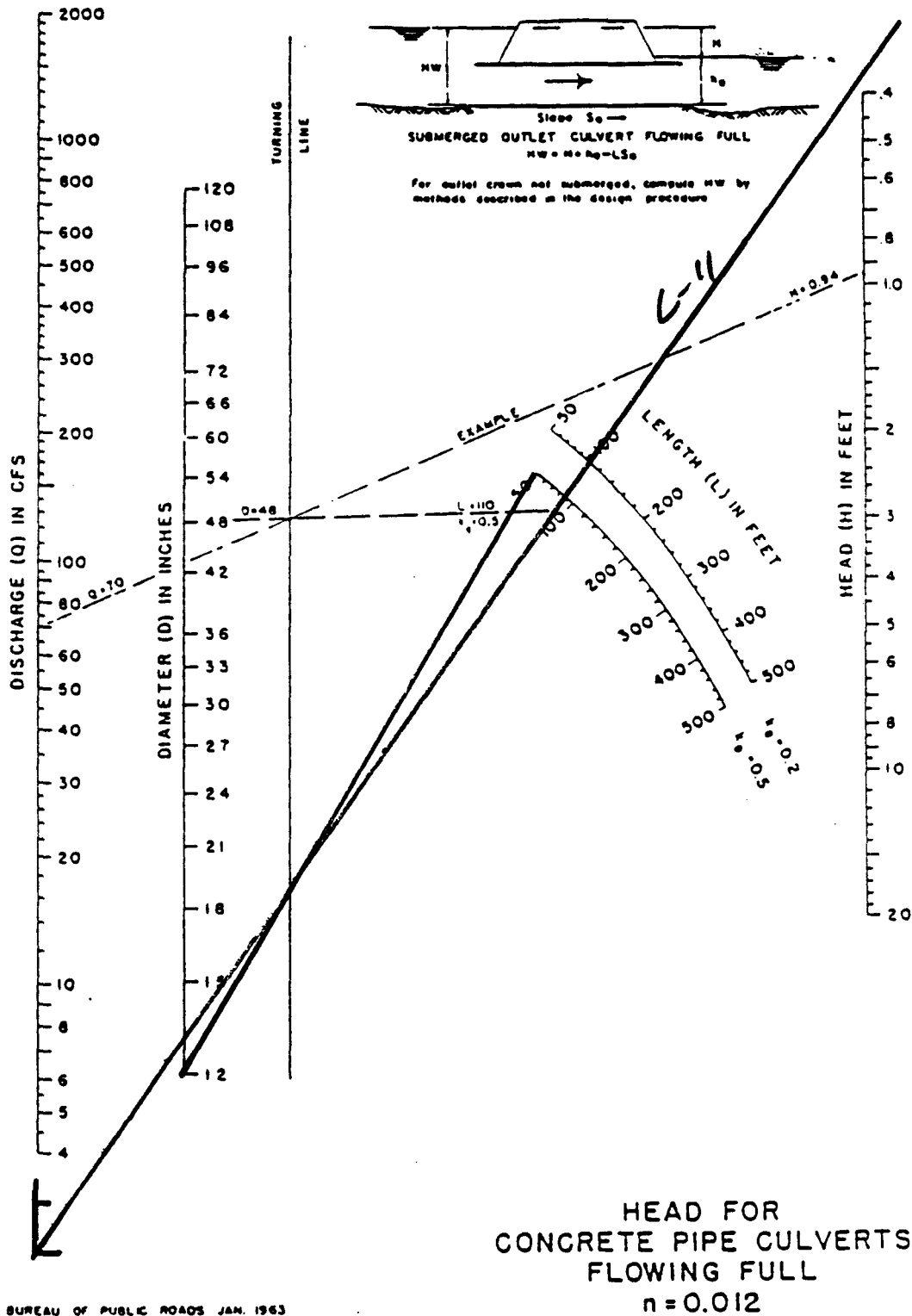
HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 283
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BUREAU OF PUBLIC ROADS JAN. 1963

CHART 9

C-11



BUREAU OF PUBLIC ROADS JAN. 1963

HEAD FOR
CONCRETE PIPE CULVERTS
FLOWING FULL
 $n = 0.012$

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE POWER STATION UNIT 3	DATE:	3/2/94
PROJECT NO.:	23930 <i>52.5408. H11</i>	CHECKED BY:	<i>[Signature]</i>
TITLE:	CULVERTS	DATE:	<i>3-2-94</i>
		PAGE:	<i>16-17-94</i>

CULVERTS NUMBER 12 AND 13

The information required to determine the flows that C-12 and C-13 must pass is not available. The access road to the existing Teco Power Service, which connects to county road 663, has a 15" diameter culvert. (Reference #3). It is assumed that natural drainage of unit 3 is to the north and west and away from C-12 and C-13. Therefore, a 15" rcp culvert will be adequate for culverts C-12 and C-13. The invert elevations for C-12 and C-13 were determined based on a minimum of 1 foot of cover and are listed in the culvert summary on page 62.

USE 1-15" RCP FOR C-12 AND C-13

CULVERT NUMBER 14 ✓

Culvert number 14 (C-14) must handle the storm runoff from drainage area 10 (ditch segment 17). Area 10 consists of part of the existing Heco Site and is not shown on the proposed site drawing. Area 10 is shown on page 5. For the 25 year storm, the peak flow from area 10 is 16 cfs. The top of aggregate surface at C-14 is at elevation 120.0. The inlet invert for C-14 is at elevation 116.7 and the outlet invert is at elevation 116.5. The maximum headwater depth using 2-24" rcp culverts for C-14 would be approximately 20 inches assuming outlet control. (See the nomographs on the following pages.) Therefore, the maximum headwater depth for C-11 is at elevation 118.4.

USE 2-24" RCP FOR C-14

CHART 1

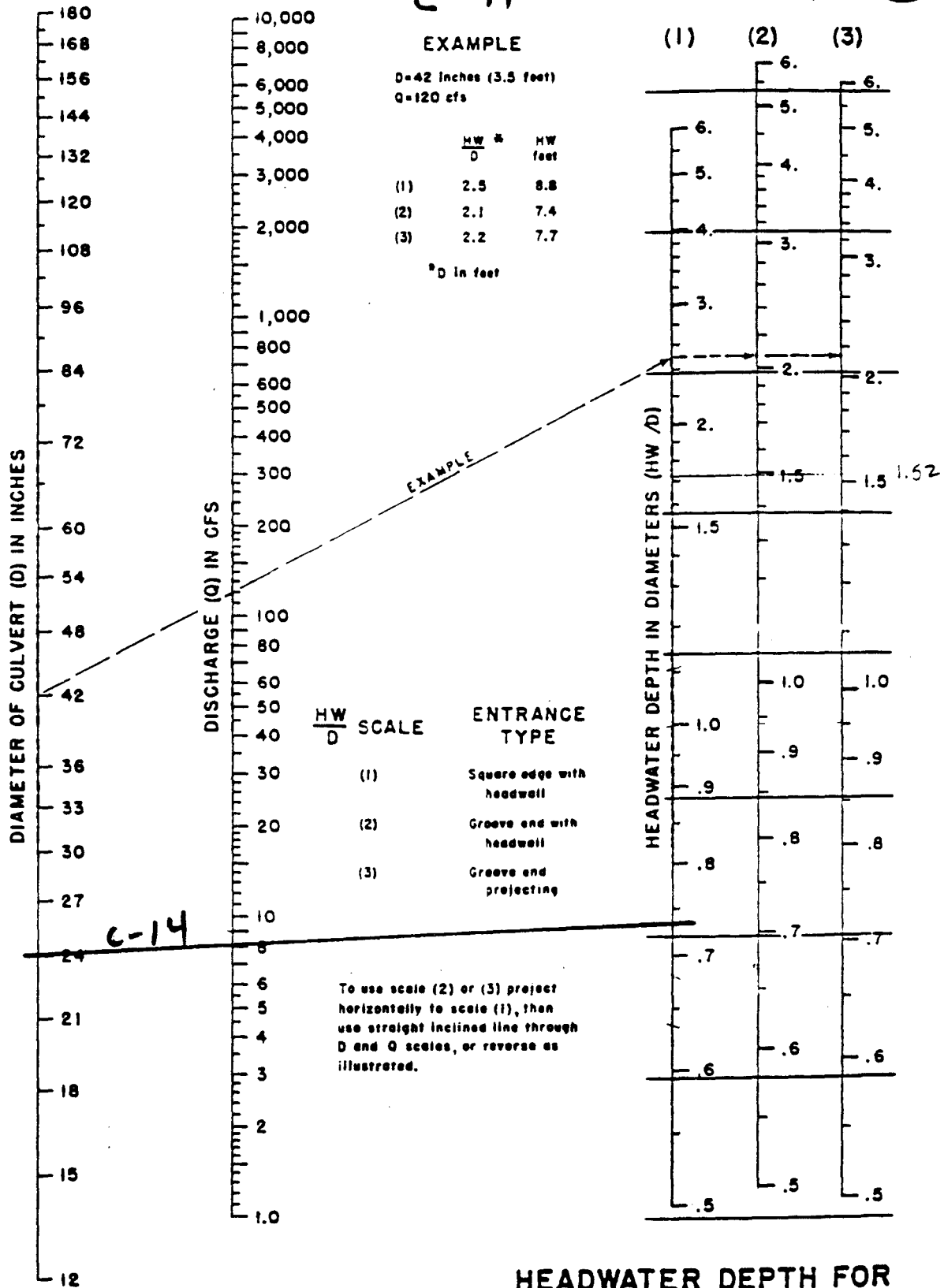
C-14

EXAMPLE

D=42 inches (3.5 feet)
Q=120 cfs

	$\frac{HW}{D}$	HW feet
(1)	2.5	8.8
(2)	2.1	7.4
(3)	2.2	7.7

*D in feet

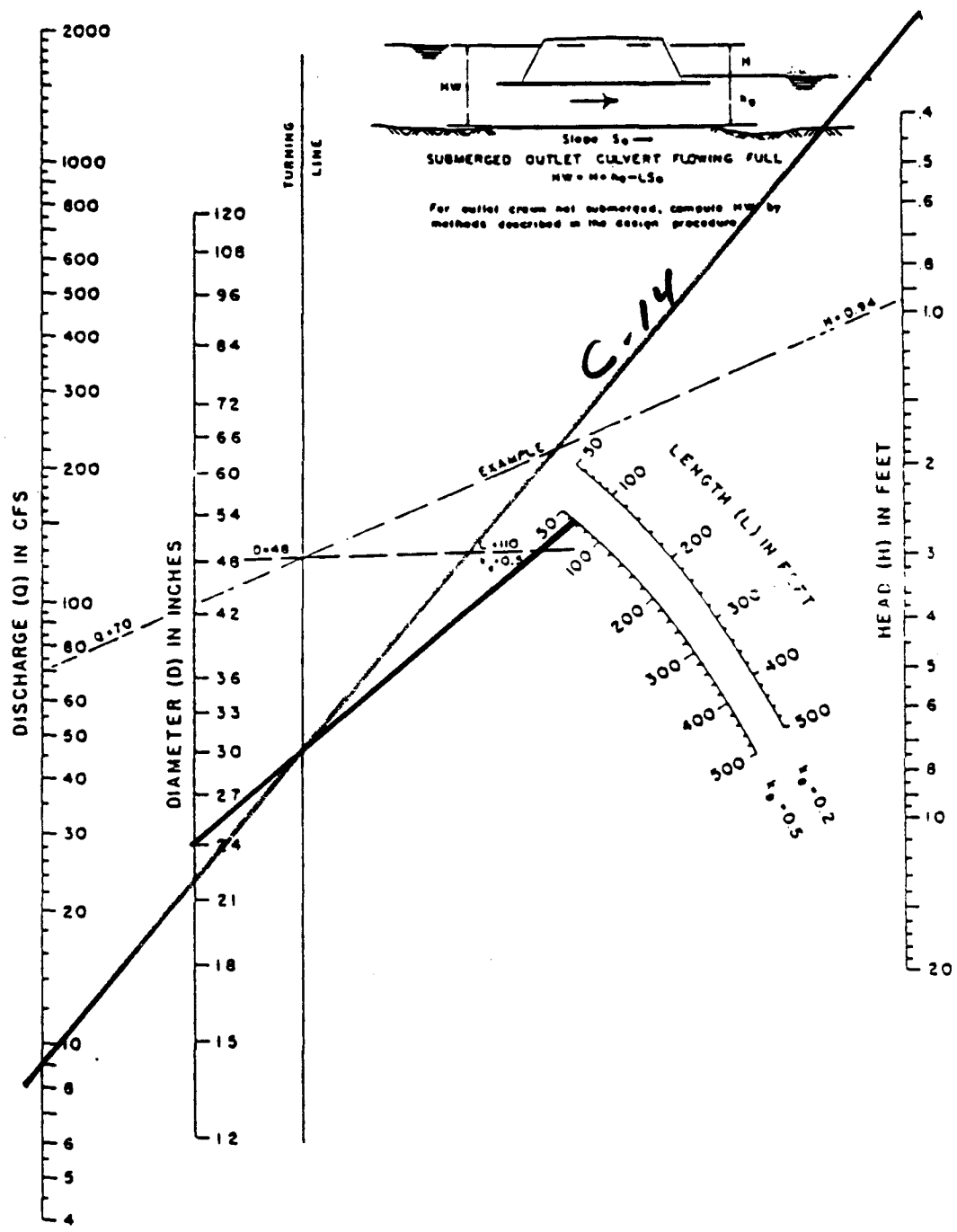


HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 283
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CHART 9



HEAD FOR
CONCRETE PIPE CULVERTS
FLOWING FULL
 $n = 0.012$

BUREAU OF PUBLIC ROADS JAN. 1963

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE POWER STATION UNIT 3	DATE:	3/2/94
PROJECT NO.:	23930 52.5406. H11	CHECKED BY:	_____
TITLE:	CULVERTS	DATE:	3-3-94
		PAGE:	1-5-94

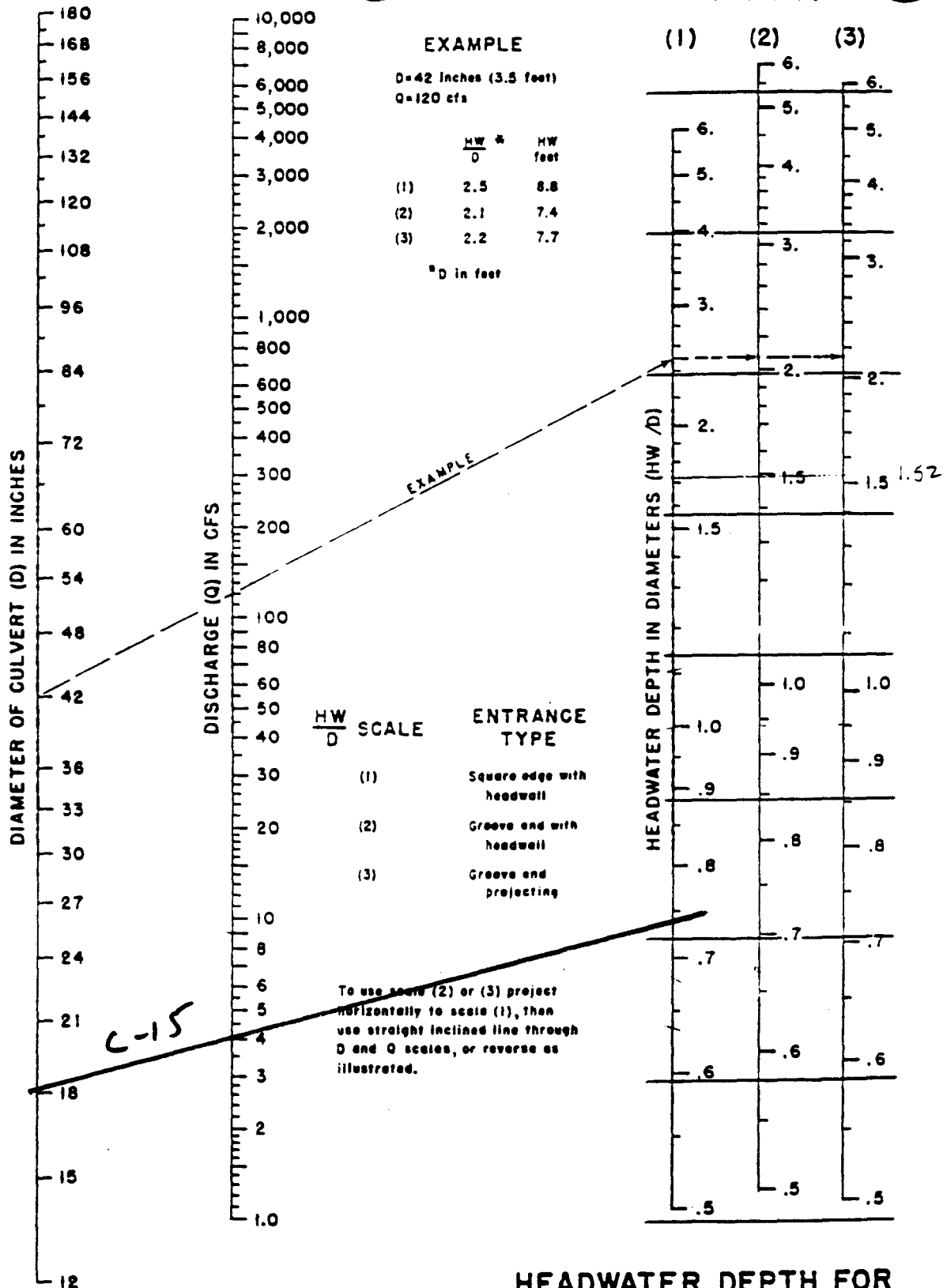
CULVERT NUMBER 15

Culvert number 15 (C-15) must handle the storm runoff from a 0.7 acre portion of drainage area number 6. For the 25 year storm, the peak flow from this portion of area 6 is 4 cfs. The top of aggregate surface at C-14 is at elevation 128.1. The inlet invert for C-15 is at elevation 124.7 and the outlet invert is at elevation 124.5. (The tailwater depth for C-15 is assumed to be 30 inches, which is the maximum headwater depth for C-6 minus the slope in ditch 15). The maximum headwater depth using an 18" rcp culvert for C-15 would be approximately 30 inches assuming outlet control. (See the nomographs on the following pages.) Therefore, the maximum headwater depth for C-10 is at elevation 127.2.

USE 1-18" RCP FOR C-15

C-15

52.5406.H/11
CHART 1



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

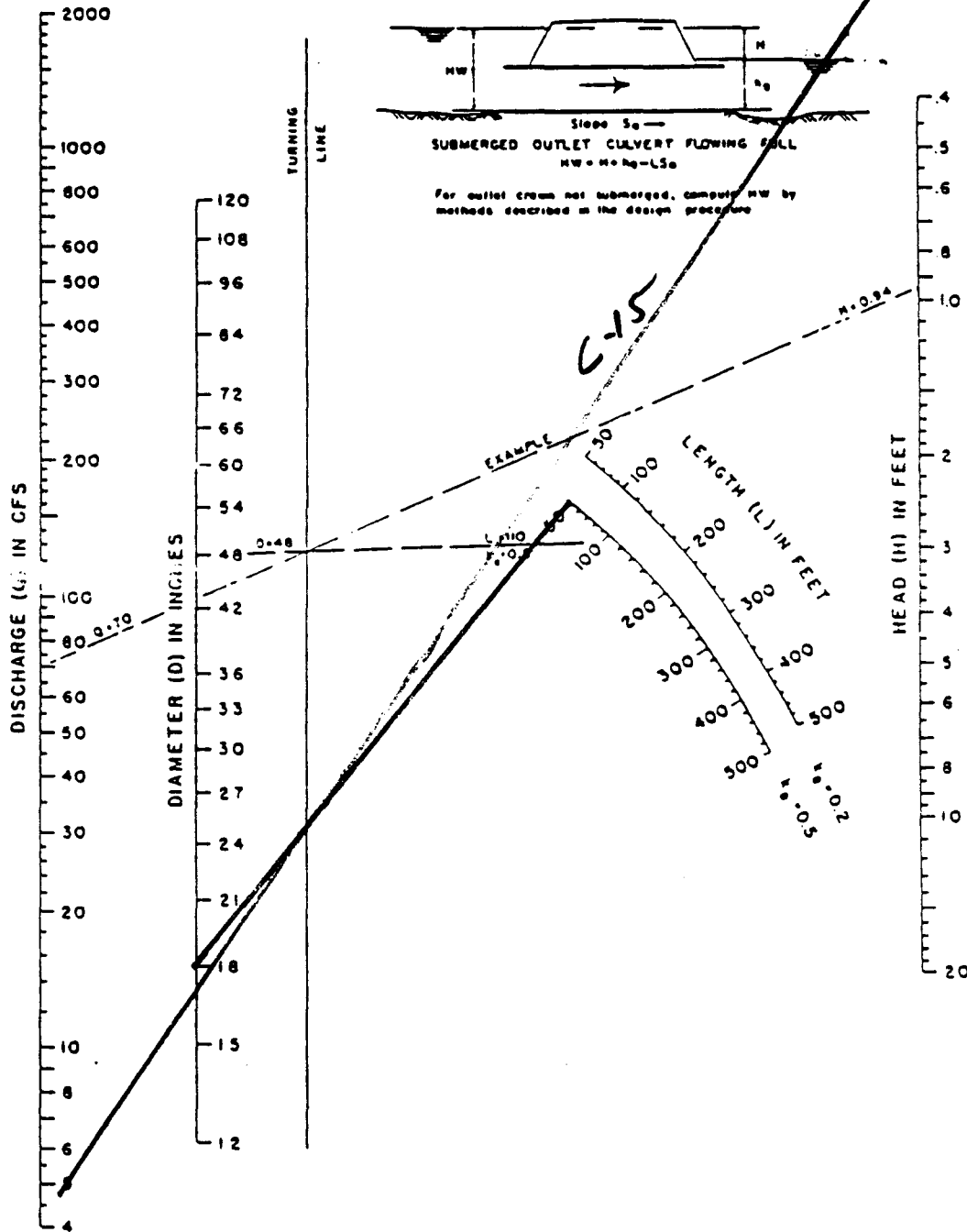
HEADWATER SCALES 283
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1.25 OF C-11
52.5406, H1

C-15

CHART 9



HEAD FOR
CONCRETE PIPE CULVERTS
FLOWING FULL
 $n = 0.012$

BUREAU OF PUBLIC ROADS JAN. 1963

OWNER:	SEMINOLE	NAME:	JOHN WARY
PROJECT:	HARDEE POWER STATION UNIT 3	DATE:	3/2/94
PROJECT NO.:	23930 52.5406.H11	CHECKED BY:	_____
TITLE:	CULVERTS	DATE:	3-2-94
		PAGE:	1

CULVERT SUMMARY

CULVERT	PEAK FLOW (CFS)	HEADWATER DEPTH (IN)	CULVERT SIZE (DIA)	INLET INVERT	OUTLET INVERT	LENGTH (FT)*
C-1	22	30	1-30"	124.2	124.0	60
C-2	22	30	1-30"	123.0	122.8	63
C-3	10	21	1-24"	122.5	122.3	57
C-4	9	21	1-24"	122.3	122.0	75
C-5	70	40	2-36"	120.3	120.0	84
C-6	8	36	1-24"	124.2	124.0	58
C-7	10	35	1-24"	123.9	123.7	63
C-8	11	31	1-24"	123.5	123.3	46
C-9	18	27	1-30"	123.2	122.9	72
C-10	58	33	2-36"	120.7	120.5	40
C-11	2	11	1-12"	125.8	125.5	43
C-12	NA	NA	1-15"	129.4	129.2	59
C-13	NA	NA	1-15"	129.8	129.6	73
C-14	16	20	2-24"	116.7	116.5	38
C-15	4	30	1-18"	124.7	124.5	45

* Does not include headwalls



h_o values for using outlet control nomographs

C-1 Tailwater, $TW = 24"$ (C-2 HW - slope of ditch 3)
 $d_c = 1.6'$ $h_o = \frac{d_c + D}{2} = \frac{1.6 + 2.5}{2} = 2.05'$ use 25"
(d_c = critical depth)

HW for outlet control = 29.8" . HW max is 30" , inlet control

C-2 $TW = 15"$ $h_o = 25"$ (from above)

HW for outlet control = 29.8" . HW max is 30" , inlet control

C-3 $TW = 17"$ $d_c = 1.2'$ $h_o = \frac{1.2 + 2}{2} = 1.6' = 19.2"$

HW for outlet control = 21"

HW max is 21" , outlet control

C-4 $TW = 19"$ $h_o = 19.2"$ (same as C-3)

HW for outlet control = 20"

HW max is 20" , outlet control

C-5 $TW = 2.5'$ $d_c = 2.7'$
 $h_o = \frac{2.7 + 3}{2} = 2.85'$

HW for outlet control = $2.85' + .8' - .3' = 3.35'$
($h_o + H - L_s = HW$)

HW max is 40" , outlet control

C-6 $TW > D$, $h_o = TW$

C-7 $TW > D$, $h_o = TW$

C-8 $TW > D$, $h_o = TW$

DO NOT WRITE IN THIS SPACE



Owner Seminole
Plant Hardee Power Station Unit 3
Project No. 23930 File No. 52.5406.H11
Title Ditches and Culverts

Computed By J. W. Long
Date 3-2 19 94
Checked By JTD
Date 3-7 19 94
Page 64 of 64

C-9 TW = 12" $d_c = 1.5'$
 $h_o = \frac{1.5 + 2.5}{2} = 2.0'$

HW for outlet control = 25.8"
HW max is 27" for inlet control

C-10 TW = 19" $d_c = 1.8'$
 $h_o = \frac{1.8 + 3}{2} = 2.4'$ $2.4 + 1.5 - .2 = 2.7'$

HW for outlet control is 32.4"
HW max is 33", inlet control

C-11 TW = ? $d_c = 0.5'$
 $h_o = \frac{.5 + 1}{2} = .75'$

HW for outlet control = .75 + .35 - .3 = 1.0"
HW max is 11", inlet control

C-14 TW = ? $d_c = 1.2'$
 $h_o = \frac{1.2 + 2}{2} = 1.6'$

HW for outlet control = 20.4"
HW max is 20.4", outlet control

C-15 TW > D, $h_o = TW$

DO NOT WRITE IN THIS SPACE

PART 2

SITE RUNOFF DETENTION BASIN

SECI 23930
03-08-94

**SEMINOLE ELECTRIC
COOP, INC.**

**HARDEE STATION
UNIT 3**

PROJECT NO. 23930

SITework CALCULATIONS

**STORM WATER
DETENTION BASIN**

Owner:	Seminole Electric Coop. Inc.	Computed By:	Joe P. Bauer
Plant:	Hardee Power Station Unit 3	Date:	2-24-94
Project #:	23930.050 52.5406.H12	Checked By:	J. B. Baker
Title:	Storm Water Detention Basin	Date:	3-7-94
		Page:	1 of 65

OBJECTIVE: Determine the Pre-development and the Post-development peak flow rates discharging from the proposed project site area using a computer program developed by the Army Corps. of Engineers called HEC-1. If the Post-development peak flow rate exceeds the Pre-development rate, then a detention basin is necessary. The detention basin will be designed to serve two functions:

- Quality Control
- Quantity Control

Quality control requires the detention basin to collect the first one inch of runoff from the site area and discharge it over a period of time of not less than 120 hours (5 days). In addition, the first half of this amount shall not be discharged in less than 60 hours (2.5 days).

Quality control requires the detention basin to detain and release the runoff at a rate equal to or less than the Pre-development rate to prevent flooding downstream. At the same time, the Post-development discharge volume should be as close as possible to the Pre-development rate so downstream is not being deprived of water.

Further design standards are stated in Southwest Florida Water Management District's Management and Storage of Surface Waters Permit Information Manual, Volume 1.

NOTES:

1. It is understood that the soil type for the proposed site is clayey mine reclamation soil and the Hydrological Soil Type is "D". The Curve Numbers will be determined using the information provided in the Soil Survey of Hardee County Florida and TR-55.
2. The proposed site area will not receive any runoff from off-site.

REFERENCES:

1. Management and Storage of Surface Waters Permit Information Manual, Volume 1, Southwest Florida Water Management District.
2. Soil Survey of Hardee County Florida, United States Department of Agriculture and the Soil Conservation Service (SCS), 1984.
3. Technical Release 55 (TR-55) Urban Hydrology for Small Watersheds, 2nd Edition, Soil Conservation Service (SCS), 1986.
4. HEC-1 Flood Hydrograph Package, U.S. Army Corps. of Engineers Hydrologic Engineering Center, 1988.

**SEMINOLE ELECTRIC COOPERATIVE, INC.
HARDEE POWER STATION
HARDEE UNIT 3
SEASONAL HIGH WATER DETERMINATION**

KBN and SWFWMD visited the HPS site on February 7, 1994, to perform seasonal high water (SHW) determinations for the on-site soils and wetland areas. Wetland SHW limits were marked and hand augers were conducted in soils at various location to mark the proposed upland SHW levels. The seasonal high water marks were surveyed and are shown on a Chastain Skillman, Inc. survey Drawing DSS 5326.01, dated February 11, 1994.

The SHW levels are:

	<u>Ground</u>	<u>SHW</u>
Creek:		
#1	117.20	117.20
#2	117.13	117.13
Pond:		
# 1	119.79	119.79
# 2	120.20	120.37
# 3	121.19	121.19
Site:		
#4	125.36	124.36
#5	125.13	124.43

In general, the SHW is at the ground surface in the pond area and 9-12" below grade in the plant area.

Detention Pond Normal Pool

The pond normal pool level will be set at 119.8, equal to the ground and SHW elevation at the low (west) end of the proposed detention pond. This is reasonable due to the mined conditions at the site and location of the pond discharge structure at the west end of the pond.

Owner:	Seminole Electric Coop. Inc.	Computed By:	Joe P. Bauer
Plant:	Hardee Power Station Unit 3	Date:	2-24-94
Project #:	23930.050 52.5406. H12	Checked By:	JS
Title:	Storm Water Detention Basin	Date:	3-7-94
		Page:	3 of 55

The following pages of calculations will be broken down into two categories:

1. PRE-DEVELOPMENT
2. POST-DEVELOPMENT

Each category will first determine the unknown parameters required to run the HEC-1 program. These parameters are listed below. The end of each category will have a computer print of the HEC-1 results with a summary at the end.

HEC-1 INPUT INFORMATION

PRE-DEVELOPMENT PARAMETERS

- Site Area
- Runoff Curve Number (CN)
- Time of Concentration (Tc) or Lag Time
- Rainfall Distribution Information

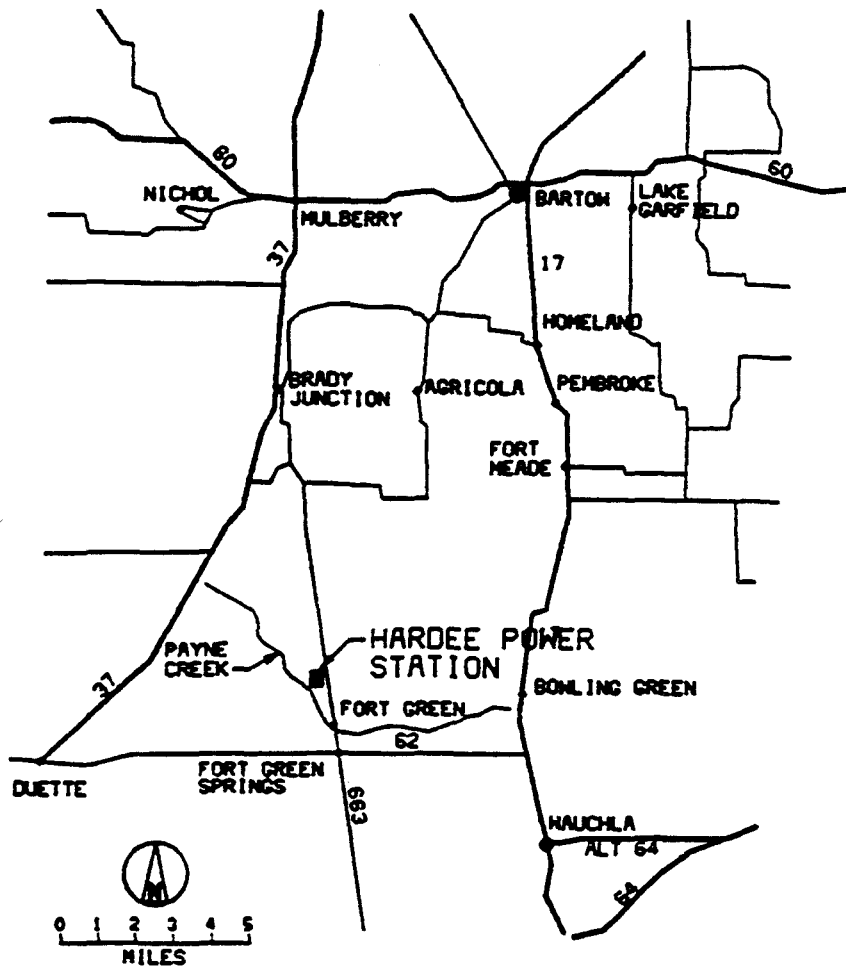
POST-DEVELOPMENT PARAMETERS

- Site Area
- Runoff Curve Number (CN)
- Time of Concentration (Tc) or Lag Time
- Rainfall Distribution Information
- Detention Basin Storage Volume Information
- Detention Basin Discharge Rate Information

APPENDIX: Tables, charts, and graphs from references are included in the appendix which is located at the end of the post-development calculations.

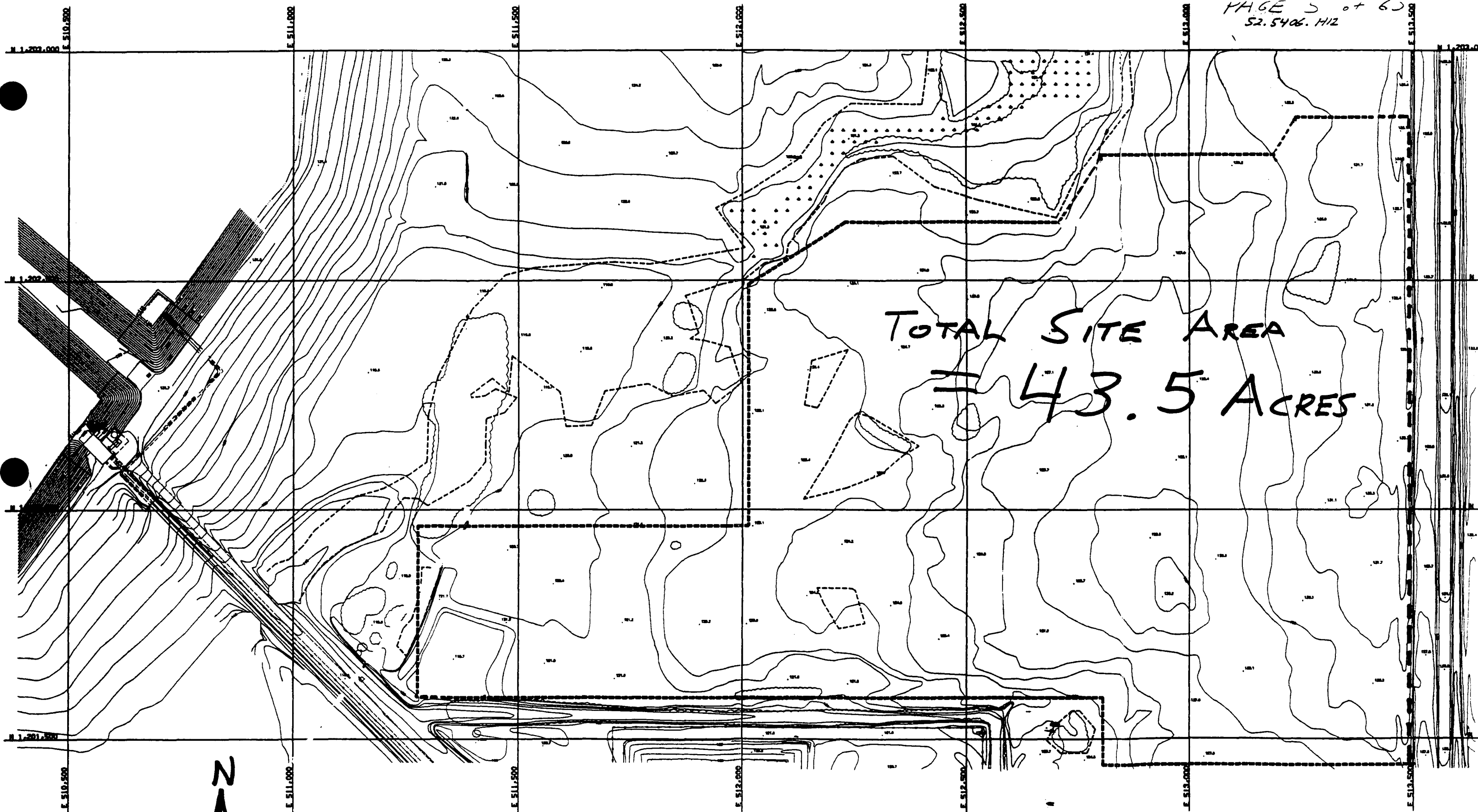
Owner: Seminole Electric Coop. Inc.
Plant: Hardee Power Station Unit 3
Project #: 23930.050 52.5403. H/2
Title: Storm Water Detention Basin
PRE-DEVELOPMENT

Computed By: Joe P. Bauer
Date: 2-24-94
Checked By: *ps*
Date: 3-7-94
Page: 4 of 5



VICINITY MAP

FIG. 1



TOTAL SITE AREA
= 43.5 ACRES

PROPOSED SITE AREA
HARDEE POWER STATION UNIT 3

FIG. 2

Owner:	Seminole Electric Coop. Inc.	Computed By:	Joe P. Bauer
Plant:	Hardee Power Station Unit 3	Date:	2-24-94
Project #:	23930.050 52.5408. H/2	Checked By:	<i>JS</i>
Title:	Storm Water Detention Basin	Date:	3-7-94
	PRE-DEVELOPMENT	Page:	6 of 65

DETERMINE THE WEIGHTED RUNOFF CURVE NUMBER (CN) (see Note 1 on Page 1)

A Curve number is a representation of the average antecedent runoff condition for a particular type of soil and vegetative cover. A Soils survey for a particular county can be used to determine the following information for a given site area. Each item affects the amount of runoff that will flow from the site area.

- Soil Type & Hydrological Soil Group (A, B, C, or D)
- Vegetative Cover Type & Use (Crops, Pasture, Woods, etc.)
- Hydrologic Condition (Poor, Fair, Good)

Using the Soil Conservation Service's (SCS) Soil Survey of Hardee County Florida, the hydrological soil groups were determined to be "D" for all land cover types. The site was assumed undrained. The cover types were mainly "Sloughs" and "Flatwoods" with some marshes and ponds. Curve numbers (CN) were determined using Tables 2-2a, b, c, & d of SCS's TR-55 (see appendix). "Sloughs" were assumed to be "herbaceous depressional areas" in "good" condition with a CN of 85. "Flatwoods" were assumed to be "pasture, grassland or range" in "good" condition with a CN of 80.

The Following table used to determine the "Weighted Curve Number".

LAND COVER	AREA (ACRES)	PERCENT OF TOTAL AREA	CURVE NUMBER (CN)	WEIGHTED CN (% x CN)
SLOUGHS	13.5	31 %	85	26.4
FLATWOODS	23.5	54 %	80	43.2
MARSH & PONDS	6.5	15 %	100	15.0
TOTAL	43.5	100 %		84.6

See Fig. 3 for the soils survey map of the proposed site area.

Therefore, the weighted pre-development CN is **84.6**.

R. 23 E. | R. 24 E.

POLK

COUNTY

1:250,000

2



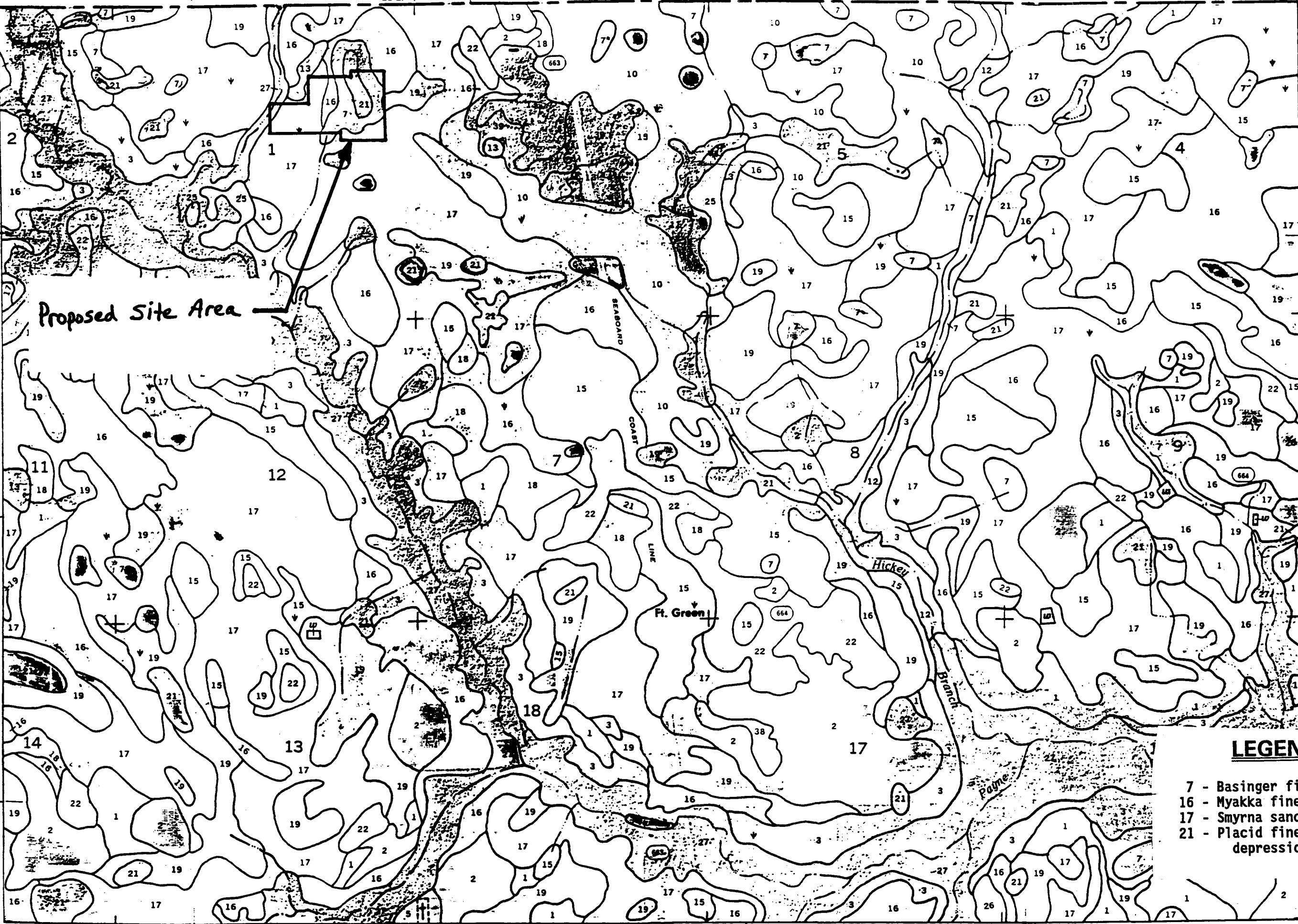
5,000 Feet

1 Kilometer

Scale: 1:200,000

(Joins sheet 1)

(Joins sheet 9)



LEGEND

- 7 - Basinger fine sand
- 16 - Myakka fine sand
- 17 - Smyrna sand
- 21 - Placid fine sand, depressional

SOILS SURVEY MAP

Fig. 3

Owner:	Seminole Electric Coop. Inc.	Computed By:	Joe P. Bauer
Plant:	Hardee Power Station Unit 3	Date:	2-24-94
Project #:	23930.050 52.5406.H12	Checked By:	<i>JS</i>
Title:	Storm Water Detention Basin	Date:	3-7-94
	PRE-DEVELOPMENT	Page:	8 of 65

DETERMINE THE STORM WATER "TIME OF CONCENTRATION" (T_c)

"Travel Time" (T_t) is the time it takes water to travel from one location to another in a watershed. T_t is a component of "Time of Concentration" (T_c), which is the time for runoff to travel from the hydraulically most distant point of the watershed to a point of interest within the watershed. T_c is computed by summing all the travel times for consecutive components of the drainage conveyance system. See Fig. 4 for a sketch of the storm water runoff pattern modeled to determine the "Time of Concentration".

How water moves through a watershed has been broken down into three basic components:

- Sheet flow
- Shallow concentrated flow
- Open channel flow

"Sheet flow" represents the first 300 feet (max.) of flow, at which point the accumulation of sheet flow becomes "shallow concentrated flow". Shallow concentrated flow will eventually contribute to "open channel flow" in the form of a ditch, creek, river, or stream. Evaluation of a particular site may have any combination of the three basic components.

Sheet Flow "Travel Time" (T_t)

$$T_t = 0.007(nL)^{0.8}/(P_2)^{0.5}s^{0.4}$$

$n = 0.24$ (dense grass) (Table 3.1 of TR-55) (appendix)

$L = 300$ feet (see Fig. 4)

$P_2 = 4.2$ inches/hour (Figure C-1 of SWFWMD) (appendix)

$s = 0.0067$ ft/ft (determined from Fig. 4)

$$T_t = 0.007[(0.24)(300)]^{0.8}/(4.2)^{0.5}(0.0067)^{0.4}$$

$$T_t = \underline{0.77 \text{ hours}}$$

Shallow Concentrated Flow "Travel Time" (T_t)

$$T_t = L/V$$

$L = 2000$ feet (length of flow - see Fig. 4))

$s = 10'/2000' = 0.005$ ft/ft (Ave. slope - see Fig. 4)

$V = 1.2$ fps (Ave. velocity) (Fig. 3-1 of TR-55) (appendix)

1 hour = 3600 seconds

$$T_t = 2000/(1.2 \times 3600) = \underline{0.46 \text{ hours}}$$

Owner:	Seminole Electric Coop. Inc.	Computed By:	Joe P. Bauer
Plant:	Hardee Power Station Unit 3	Date:	2-24-94
Project #:	23930.050 <i>52.5406. H12</i>	Checked By:	<i>JS</i>
Title:	Storm Water Detention Basin	Date:	3-7-94
	PRE-DEVELOPMENT	Page:	7 of 65

"TIME OF CONCENTRATION" (cont.)

Open Channel Flow "Travel Time" (T_t)

$$T_t = L/V$$

$$L = 0 \text{ feet (length of flow) (see Fig. 4)}$$

$$V = 1.49r^{2/3}s^{1/2}/n \text{ (Manning's Equation)}$$

$$1 \text{ hour} = 3600 \text{ seconds}$$

Open channel flow does not occur until the runoff has left the site.

$$T_t = \underline{0 \text{ hours}}$$

TIME OF CONCENTRATION = SUMMATION OF TRAVEL TIMES

$$T_c = 0.77 + 0.46 + 0 = \underline{1.23 \text{ HOURS}} \quad \checkmark$$

$$\text{LAG TIME} = 0.6 \times T_c = 0.74 \text{ hours} \quad \checkmark$$



 OWNER: SEMINOLE
 PROJECT: HARDY STATION UNIT 3
 PROJECT NO.: 23930.050 *52.5405.112*
 TITLE: STORM WATER DETENTION BASIN
 PRE-DEVELOPMENT

NAME: JOE BAUER
 DATE: 03-Mar-94
 CHECKED BY: *[Signature]*
 DATE: *11-3-94*
 PAGE: *55*

DETERMINE THE TYPE II MODIFIED RAINFALL DISTRIBUTION FOR HEC-1 INPUT.

RAINFALL DISTRIBUTION: 25 year, 24 hour storm = 8.42 inches

TIME (hr)	RAINFALL RATIOS (SCS Type II Modified)	ACCUMULATE RAINFALL (inches)	INCREMENT RAINFALL (inches)
0.0	0.000	0.00	0.00
0.5	0.006	0.05	0.05
1.0	0.012	0.10	0.05
1.5	0.019	0.16	0.06
2.0	0.025	0.21	0.05
2.5	0.032	0.27	0.06
3.0	0.039	0.33	0.06
3.5	0.047	0.40	0.07
4.0	0.054	0.45	0.06
4.5	0.062	0.52	0.07
5.0	0.071	0.60	0.08
5.5	0.080	0.67	0.08
6.0	0.089	0.75	0.08
6.5	0.099	0.83	0.08
7.0	0.110	0.93	0.09
7.5	0.122	1.03	0.10
8.0	0.134	1.13	0.10
8.5	0.148	1.25	0.12
9.0	0.164	1.38	0.13
9.5	0.181	1.52	0.14
10.0	0.201	1.69	0.17
10.5	0.226	1.90	0.21
11.0	0.258	2.17	0.27
11.5	0.308	2.59	0.42
12.0	0.607	5.11	2.52
12.5	0.719	6.05	0.94
13.0	0.757	6.37	0.32
13.5	0.785	6.61	0.24
14.0	0.807	6.79	0.19
14.5	0.826	6.95	0.16
15.0	0.842	7.09	0.13
15.5	0.857	7.22	0.13
16.0	0.870	7.33	0.11
16.5	0.882	7.43	0.10
17.0	0.893	7.52	0.09
17.5	0.904	7.61	0.09
18.0	0.913	7.69	0.08
18.5	0.923	7.77	0.08
19.0	0.931	7.84	0.07
19.5	0.940	7.91	0.08
20.0	0.948	7.98	0.07
20.5	0.955	8.04	0.06
21.0	0.962	8.10	0.06
21.5	0.969	8.16	0.06
22.0	0.976	8.22	0.06
22.5	0.983	8.28	0.06
23.0	0.989	8.33	0.05
23.5	0.995	8.38	0.05
24.0	1.000	8.42	0.04

NOTE: THE INCREMENTAL RAINFALL DATA IN THE LAST COLUMN WILL BE USED FOR INPUT FOR THE HEC-1 PROGRAM

REF.: Table C-1 of the SWFWMD Permit Information Manual. (see appendix)

COMPUTER GENERATED CALCULATIONS

Owner:	Seminole Electric Coop. Inc.	Computed By:	Joe P. Bauer
Plant:	Hardee Power Station Unit 3	Date:	2-24-94
Project #:	23930.050 52.5405, H12	Checked By:	<i>JPB</i>
Title:	Storm Water Detention Basin	Date:	3-7-94
	PRE-DEVELOPMENT	Page:	12 of 65

PROGRAM NUMBER: HEC-1

VERSION: 02 AUG 88

RUN DATE: 2-28-94

RUN TIME: 08:25:56

CASE: PRE-DEVELOPMENT

NO. OF PAGES: 9

REVIEW AND APPROVAL

1. Input Data Printout

Checked By: *J.P. Bauer* Date: *3-7-94*

2. Output Data Printout

Checked By: *JPB* Date: *3-7-94*

3. Approved:

JPB Date: *3-7-94*


```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* FEBRUARY 1981
* REVISED 02 AUG 88
*
* RUN DATE 02/28/1994 TIME 08:25:56
*
*****

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*****
*
* U.S. ARMY CORPS OF ENGINEERS
* THE HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 551-1748
*
*****

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X   X XXXXXXX XXXXX   X
X   X X   X   X   XX
X   X X   X   X   X
XXXXXXX XXXX   X   XXXXX X
X   X X   X   X   X
X   X X   X   X   X
X   X XXXXXXX XXXXX   XXX

```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
*** FREE ***
1 ID SEMINOLE ELECTRIC COOP, INC., HARDEE POWER STATION UNIT 3
2 ID PROJECT NO. 23930.030
3 ID SITE PRE-DEVELOPMENT RUNOFF
4 ID
  *DIAGRAM
5 IT 5 0 0 300
6 IO 0 0
  * 25 YR. 24 HR. INCREMENTAL PRECIPITATION (30 MIN)
7 PG 999
8 IN 30

```

PAGE 13 of 65
 52.54705.H12

9	PI	0.000	0.050	0.050	0.060	0.050	0.060	0.060	0.070	0.060	0.070
10	PI	0.080	0.080	0.080	0.080	0.090	0.100	0.100	0.120	0.130	0.140
11	PI	0.170	0.210	0.270	0.420	2.510	0.940	0.320	0.240	0.180	0.160
12	PI	0.130	0.130	0.110	0.100	0.090	0.090	0.080	0.080	0.070	0.080
13	PI	0.070	0.060	0.060	0.060	0.060	0.060	0.050	0.050	0.040	

14 KKDISCHARGE
 15 KM RUNOFF USING SCS LOSSES & DIMENSIONLESS UNIT HYDROGRAPH
 16 KO 0 0
 17 BA 0.0680
 18 PR 999
 19 PW 1
 20 LS 0 84.6
 21 UD 0.74
 22 ZZ

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT
 LINE (V) ROUTING (--->) DIVERSION OR PUMP FLOW
 NO. (.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW
 14 DISCHARG

(**) RUNOFF ALSO COMPUTED AT THIS LOCATION

 *
 * FLOOD HYDROGRAPH PACKAGE (HEC-1) *
 * FEBRUARY 1981 *
 * REVISED 02 AUG 88 *
 *
 * RUN DATE 02/28/1994 TIME 08:25:56 *
 *

 *
 * U.S. ARMY CORPS OF ENGINEERS *
 * THE HYDROLOGIC ENGINEERING CENTER *
 * 609 SECOND STREET *
 * DAVIS, CALIFORNIA 95616 *
 * (916) 551-1748 *
 *

SEMINOLE ELECTRIC COOP, INC., HARDEE POWER STATION UNIT 3
 PROJECT NO. 23930.030
 SITE PRE-DEVELOPMENT RUNOFF

6 IO

OUTPUT CONTROL VARIABLES

IPRNT	0	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

PAGE 14 of 65
 52.5406.H12

8 IN TIME DATA FOR INPUT TIME SERIES
 JXMIN 30 TIME INTERVAL IN MINUTES
 JXDATE 1 0 STARTING DATE
 JXTIME 0 STARTING TIME

IT HYDROGRAPH TIME DATA
 NMIN 5 MINUTES IN COMPUTATION INTERVAL
 IDATE 1 0 STARTING DATE
 ITIME 0000 STARTING TIME
 NQ 300 NUMBER OF HYDROGRAPH ORDINATES
 NDDATE 2 0 ENDING DATE
 NDTIME 0055 ENDING TIME
 ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS
 DRAINAGE AREA SQUARE MILES
 PRECIPITATION DEPTH INCHES
 LENGTH, ELEVATION FEET
 FLOW CUBIC FEET PER SECOND
 STORAGE VOLUME ACRE-Feet
 SURFACE AREA ACRES
 TEMPERATURE DEGREES FAHRENHEIT

*** **

 * *
 14 KK * DISCHARG * E
 * *

RUNOFF USING SCS LOSSES & DIMENSIONLESS UNIT HYDROGRAPH

16 KO OUTPUT CONTROL VARIABLES
 IPRNT 0 PRINT CONTROL
 IPLOT 0 PLOT CONTROL
 QSCAL 0. HYDROGRAPH PLOT SCALE

SUBBASIN RUNOFF DATA

17 BA SUBBASIN CHARACTERISTICS
 TAREA .07 SUBBASIN AREA

PRECIPITATION DATA

PAGE 15 OF 65
 52.5406.H12

PAGE 16 of 52
~~52~~ 52.5408.H12

PRECIPITATION STATION DATA

STATION	TOTAL	AVG. ANNUAL	WEIGHT
999	8.42	.00	1.00

TEMPORAL DISTRIBUTIONS

[illegible]

.01 .01 .01 .01 .01 .01 .01 .01 .01 .01
.01 .01 .01 .01

UNIT HYDROGRAPH
46 END-OF-PERIOD ORDINATES

1.	5.	9.	15.	22.	30.	37.	40.	42.	42.
40.	37.	33.	29.	24.	19.	16.	13.	11.	10.
8.	7.	6.	5.	4.	3.	3.	2.	2.	2.
1.	1.	1.	1.	1.	1.	1.	0.	0.	0.
0.	0.	0.	0.	0.	0.				

HYDROGRAPH AT STATION DISCHARG

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	*	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
1	0000	1	.00	.00	.00	0.	*	1	1230	151	.42	.03	.38	48.		
1	0005	2	.00	.00	.00	0.	*	1	1235	152	.16	.01	.14	60.		
1	0010	3	.00	.00	.00	0.	*	1	1240	153	.16	.01	.15	73.		
1	0015	4	.00	.00	.00	0.	*	1	1245	154	.16	.01	.15	84.		
1	0020	5	.00	.00	.00	0.	*	1	1250	155	.16	.01	.15	95.		
1	0025	6	.00	.00	.00	0.	*	1	1255	156	.16	.01	.15	103.		
1	0030	7	.00	.00	.00	0.	*	1	1300	157	.16	.01	.15	108.		
1	0035	8	.01	.01	.00	0.	*	1	1305	158	.05	.00	.05	111.		
1	0040	9	.01	.01	.00	0.	*	1	1310	159	.05	.00	.05	111.		
1	0045	10	.01	.01	.00	0.	*	1	1315	160	.05	.00	.05	109.		
1	0050	11	.01	.01	.00	0.	*	1	1320	161	.05	.00	.05	104.		
1	0055	12	.01	.01	.00	0.	*	1	1325	162	.05	.00	.05	99.		
1	0100	13	.01	.01	.00	0.	*	1	1330	163	.05	.00	.05	92.		
1	0105	14	.01	.01	.00	0.	*	1	1335	164	.04	.00	.04	85.		
1	0110	15	.01	.01	.00	0.	*	1	1340	165	.04	.00	.04	77.		
1	0115	16	.01	.01	.00	0.	*	1	1345	166	.04	.00	.04	71.		
1	0120	17	.01	.01	.00	0.	*	1	1350	167	.04	.00	.04	64.		
1	0125	18	.01	.01	.00	0.	*	1	1355	168	.04	.00	.04	59.		
1	0130	19	.01	.01	.00	0.	*	1	1400	169	.04	.00	.04	53.		
1	0135	20	.01	.01	.00	0.	*	1	1405	170	.03	.00	.03	48.		
1	0140	21	.01	.01	.00	0.	*	1	1410	171	.03	.00	.03	44.		
1	0145	22	.01	.01	.00	0.	*	1	1415	172	.03	.00	.03	40.		
1	0150	23	.01	.01	.00	0.	*	1	1420	173	.03	.00	.03	37.		
1	0155	24	.01	.01	.00	0.	*	1	1425	174	.03	.00	.03	34.		
1	0200	25	.01	.01	.00	0.	*	1	1430	175	.03	.00	.03	31.		
1	0205	26	.01	.01	.00	0.	*	1	1435	176	.03	.00	.03	29.		
1	0210	27	.01	.01	.00	0.	*	1	1440	177	.03	.00	.03	27.		
1	0215	28	.01	.01	.00	0.	*	1	1445	178	.03	.00	.03	25.		
1	0220	29	.01	.01	.00	0.	*	1	1450	179	.03	.00	.03	24.		
1	0225	30	.01	.01	.00	0.	*	1	1455	180	.03	.00	.03	22.		

← Peak

FILE 7 400
52.5406.H12

1	0230	31	.01	.01	.00	0.	*	1	1500	181	.03	.00	.03	21.
1	0235	32	.01	.01	.00	0.	*	1	1505	182	.02	.00	.02	20.
1	0240	33	.01	.01	.00	0.	*	1	1510	183	.02	.00	.02	19.
1	0245	34	.01	.01	.00	0.	*	1	1515	184	.02	.00	.02	18.
1	0250	35	.01	.01	.00	0.	*	1	1520	185	.02	.00	.02	17.
1	0255	36	.01	.01	.00	0.	*	1	1525	186	.02	.00	.02	17.
1	0300	37	.01	.01	.00	0.	*	1	1530	187	.02	.00	.02	16.
1	0305	38	.01	.01	.00	0.	*	1	1535	188	.02	.00	.02	15.
1	0310	39	.01	.01	.00	0.	*	1	1540	189	.02	.00	.02	15.
1	0315	40	.01	.01	.00	0.	*	1	1545	190	.02	.00	.02	14.
1	0320	41	.01	.01	.00	0.	*	1	1550	191	.02	.00	.02	14.
1	0325	42	.01	.01	.00	0.	*	1	1555	192	.02	.00	.02	13.
1	0330	43	.01	.01	.00	0.	*	1	1600	193	.02	.00	.02	13.
1	0335	44	.01	.01	.00	0.	*	1	1605	194	.02	.00	.02	12.
1	0340	45	.01	.01	.00	0.	*	1	1610	195	.02	.00	.02	12.
1	0345	46	.01	.01	.00	0.	*	1	1615	196	.02	.00	.02	12.
1	0350	47	.01	.01	.00	0.	*	1	1620	197	.02	.00	.02	12.
1	0355	48	.01	.01	.00	0.	*	1	1625	198	.02	.00	.02	11.
1	0400	49	.01	.01	.00	0.	*	1	1630	199	.02	.00	.02	11.
1	0405	50	.01	.01	.00	0.	*	1	1635	200	.02	.00	.02	11.
1	0410	51	.01	.01	.00	0.	*	1	1640	201	.02	.00	.02	11.
1	0415	52	.01	.01	.00	0.	*	1	1645	202	.02	.00	.02	11.
1	0420	53	.01	.01	.00	0.	*	1	1650	203	.02	.00	.02	10.
1	0425	54	.01	.01	.00	0.	*	1	1655	204	.02	.00	.02	10.
1	0430	55	.01	.01	.00	0.	*	1	1700	205	.02	.00	.02	10.
1	0435	56	.01	.01	.00	0.	*	1	1705	206	.01	.00	.01	10.
1	0440	57	.01	.01	.00	0.	*	1	1710	207	.02	.00	.01	10.
1	0445	58	.01	.01	.00	0.	*	1	1715	208	.01	.00	.01	9.
1	0450	59	.01	.01	.00	0.	*	1	1720	209	.01	.00	.01	9.
1	0455	60	.01	.01	.00	0.	*	1	1725	210	.02	.00	.01	9.
1	0500	61	.01	.01	.00	0.	*	1	1730	211	.01	.00	.01	9.
1	0505	62	.01	.01	.00	0.	*	1	1735	212	.01	.00	.01	9.
1	0510	63	.01	.01	.00	0.	*	1	1740	213	.02	.00	.01	9.
1	0515	64	.01	.01	.00	0.	*	1	1745	214	.01	.00	.01	8.
1	0520	65	.01	.01	.00	1.	*	1	1750	215	.01	.00	.01	8.
1	0525	66	.01	.01	.00	1.	*	1	1755	216	.02	.00	.01	8.
1	0530	67	.01	.01	.00	1.	*	1	1800	217	.01	.00	.01	8.
1	0535	68	.01	.01	.00	1.	*	1	1805	218	.01	.00	.01	8.
1	0540	69	.01	.01	.00	1.	*	1	1810	219	.01	.00	.01	8.
1	0545	70	.01	.01	.00	1.	*	1	1815	220	.01	.00	.01	8.
1	0550	71	.01	.01	.00	1.	*	1	1820	221	.01	.00	.01	8.
1	0555	72	.01	.01	.00	1.	*	1	1825	222	.01	.00	.01	8.
1	0600	73	.01	.01	.00	1.	*	1	1830	223	.01	.00	.01	8.
1	0605	74	.01	.01	.00	1.	*	1	1835	224	.01	.00	.01	8.
1	0610	75	.01	.01	.00	1.	*	1	1840	225	.01	.00	.01	7.
1	0615	76	.01	.01	.00	1.	*	1	1845	226	.01	.00	.01	7.
1	0620	77	.01	.01	.00	1.	*	1	1850	227	.01	.00	.01	7.
1	0625	78	.01	.01	.00	1.	*	1	1855	228	.01	.00	.01	7.
1	0630	79	.01	.01	.00	2.	*	1	1900	229	.01	.00	.01	7.

1	0635	80	.01	.01	.00	2.	*	1	1905	230	.01	.00	.01	7.
1	0640	81	.01	.01	.00	2.	*	1	1910	231	.01	.00	.01	7.
1	0645	82	.01	.01	.00	2.	*	1	1915	232	.01	.00	.01	7.
1	0650	83	.01	.01	.00	2.	*	1	1920	233	.01	.00	.01	7.
1	0655	84	.01	.01	.00	2.	*	1	1925	234	.01	.00	.01	7.
1	0700	85	.01	.01	.00	2.	*	1	1930	235	.01	.00	.01	7.
1	0705	86	.01	.01	.01	2.	*	1	1935	236	.01	.00	.01	7.
1	0710	87	.02	.01	.01	2.	*	1	1940	237	.01	.00	.01	7.
1	0715	88	.01	.01	.01	2.	*	1	1945	238	.01	.00	.01	7.
1	0720	89	.01	.01	.01	2.	*	1	1950	239	.01	.00	.01	6.
1	0725	90	.02	.01	.01	2.	*	1	1955	240	.01	.00	.01	6.
1	0730	91	.01	.01	.01	2.	*	1	2000	241	.01	.00	.01	6.
1	0735	92	.02	.01	.01	2.	*	1	2005	242	.01	.00	.01	6.
1	0740	93	.02	.01	.01	3.	*	1	2010	243	.01	.00	.01	6.
1	0745	94	.02	.01	.01	3.	*	1	2015	244	.01	.00	.01	6.
1	0750	95	.02	.01	.01	3.	*	1	2020	245	.01	.00	.01	6.
1	0755	96	.02	.01	.01	3.	*	1	2025	246	.01	.00	.01	6.
1	0800	97	.02	.01	.01	3.	*	1	2030	247	.01	.00	.01	6.
1	0805	98	.02	.01	.01	3.	*	1	2035	248	.01	.00	.01	6.
1	0810	99	.02	.01	.01	3.	*	1	2040	249	.01	.00	.01	6.
1	0815	100	.02	.01	.01	3.	*	1	2045	250	.01	.00	.01	6.
1	0820	101	.02	.01	.01	3.	*	1	2050	251	.01	.00	.01	6.
1	0825	102	.02	.01	.01	3.	*	1	2055	252	.01	.00	.01	6.
1	0830	103	.02	.01	.01	4.	*	1	2100	253	.01	.00	.01	6.
1	0835	104	.02	.01	.01	4.	*	1	2105	254	.01	.00	.01	6.
1	0840	105	.02	.01	.01	4.	*	1	2110	255	.01	.00	.01	6.
1	0845	106	.02	.01	.01	4.	*	1	2115	256	.01	.00	.01	6.
1	0850	107	.02	.01	.01	4.	*	1	2120	257	.01	.00	.01	6.
1	0855	108	.02	.01	.01	4.	*	1	2125	258	.01	.00	.01	6.
1	0900	109	.02	.01	.01	4.	*	1	2130	259	.01	.00	.01	5.
1	0905	110	.02	.01	.01	4.	*	1	2135	260	.01	.00	.01	5.
1	0910	111	.02	.01	.01	4.	*	1	2140	261	.01	.00	.01	5.
1	0915	112	.02	.01	.01	5.	*	1	2145	262	.01	.00	.01	5.
1	0920	113	.02	.01	.01	5.	*	1	2150	263	.01	.00	.01	5.
1	0925	114	.02	.01	.01	5.	*	1	2155	264	.01	.00	.01	5.
1	0930	115	.02	.01	.01	5.	*	1	2200	265	.01	.00	.01	5.
1	0935	116	.02	.01	.01	5.	*	1	2205	266	.01	.00	.01	5.
1	0940	117	.02	.01	.01	5.	*	1	2210	267	.01	.00	.01	5.
1	0945	118	.02	.01	.01	6.	*	1	2215	268	.01	.00	.01	5.
1	0950	119	.02	.01	.01	6.	*	1	2220	269	.01	.00	.01	5.
1	0955	120	.02	.01	.01	6.	*	1	2225	270	.01	.00	.01	5.
1	1000	121	.02	.01	.01	6.	*	1	2230	271	.01	.00	.01	5.
1	1005	122	.03	.01	.02	6.	*	1	2235	272	.01	.00	.01	5.
1	1010	123	.03	.01	.02	6.	*	1	2240	273	.01	.00	.01	5.
1	1015	124	.03	.01	.02	7.	*	1	2245	274	.01	.00	.01	5.
1	1020	125	.03	.01	.02	7.	*	1	2250	275	.01	.00	.01	5.
1	1025	126	.03	.01	.02	7.	*	1	2255	276	.01	.00	.01	5.
1	1030	127	.03	.01	.02	7.	*	1	2300	277	.01	.00	.01	5.
1	1035	128	.03	.01	.02	8.	*	1	2305	278	.01	.00	.01	5.

1	1040	129	.04	.01	.02	8.	*	1	2310	279	.01	.00	.01	5.
1	1045	130	.03	.01	.02	8.	*	1	2315	280	.01	.00	.01	5.
1	1050	131	.03	.01	.02	8.	*	1	2320	281	.01	.00	.01	5.
1	1055	132	.04	.01	.02	9.	*	1	2325	282	.01	.00	.01	5.
1	1100	133	.03	.01	.02	9.	*	1	2330	283	.01	.00	.01	5.
1	1105	134	.05	.01	.03	9.	*	1	2335	284	.01	.00	.01	5.
1	1110	135	.04	.01	.03	10.	*	1	2340	285	.01	.00	.01	5.
1	1115	136	.05	.01	.03	10.	*	1	2345	286	.01	.00	.01	5.
1	1120	137	.05	.01	.03	11.	*	1	2350	287	.01	.00	.01	5.
1	1125	138	.04	.01	.03	11.	*	1	2355	288	.01	.00	.01	5.
1	1130	139	.05	.01	.03	12.	*	2	0000	289	.01	.00	.01	5.
1	1135	140	.07	.02	.05	12.	*	2	0005	290	.01	.00	.01	5.
1	1140	141	.07	.02	.05	13.	*	2	0010	291	.01	.00	.01	4.
1	1145	142	.07	.02	.05	14.	*	2	0015	292	.01	.00	.01	4.
1	1150	143	.07	.02	.05	15.	*	2	0020	293	.01	.00	.01	4.
1	1155	144	.07	.01	.06	16.	*	2	0025	294	.01	.00	.01	4.
1	1200	145	.07	.01	.06	17.	*	2	0030	295	.01	.00	.01	4.
1	1205	146	.42	.08	.34	18.	*	2	0035	296	.00	.00	.00	4.
1	1210	147	.42	.06	.36	21.	*	2	0040	297	.00	.00	.00	4.
1	1215	148	.42	.05	.36	25.	*	2	0045	298	.00	.00	.00	4.
1	1220	149	.42	.05	.37	30.	*	2	0050	299	.00	.00	.00	4.
1	1225	150	.42	.04	.38	38.	*	2	0055	300	.00	.00	.00	3.

TOTAL RAINFALL = 8.42, TOTAL LOSS = 1.85, TOTAL EXCESS = 6.57

PEAK FLOW	TIME		6-HR	24-HR	72-HR	24.92-HR
(CFS)	(HR)	(CFS)				
+	111.	13.17	36.	12.	11.	11.
		(INCHES)	4.932	6.523	6.523	6.523
		(AC-FT)	18.	24.	24.	24.

CUMULATIVE AREA = .07 SQ MI

1
RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
				6-HOUR	24-HOUR	72-HOUR	
+	HYDROGRAPH AT						
+	DISCHARG	111.	13.17	36.	12.	11.	.07

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*** NORMAL END OF HEC-1 ***

- THE PEAK FLOW RATE OF 111 CFS SHALL NOT BE EXCEEDED IN THE POST-DEVELOPMENT STAGE.

Owner:	Seminole Electric Coop. Inc.	Computed By:	Joe P. Bauer
Plant:	Hardee Power Station Unit 3	Date:	2-24-94
Project #:	23930.050 52.5406.H/2	Checked By:	<i>[Signature]</i>
Title:	Storm Water Detention Basin	Date:	3-1-94
	POST-DEVELOPMENT	Page:	22 of 25

DETERMINE THE TOTAL DRAINAGE AREA CONTRIBUTING TO THE DETENTION BASIN

(See Fig. 5 for a map of the different areas)

All areas are represented in acres.

SUB-AREA	BUILDINGS & CONCRETE	ASPHALT	AGGREGATE	GRASS	WATER	TOTAL
AREA 1			0.5	11.2		11.7
AREA 2	0.5	0.5	1.6	1.3		3.9
AREA 3	0.2	0.1	1.1	0.2		1.6
AREA 4	0.5	0.2	0.3	0.6		1.6
AREA 5		0.5	3.2	8.8		12.5
AREA 6	1.0	0.4	0.5	1.3		3.2
AREA 7*						
AREA 8				0.7	5.1	5.8
AREA 9		0.1		0.4		0.5
TOTAL	2.2	1.8	7.2	24.5	5.1	40.8

- * AREA 7 = 2.7 acres is the Fuel Oil Containment Area. This area will not contribute to the Post-development runoff because the rainfall in this area will be contained inside the bermed area and will be released after the storm has passed. When the fuel oil containment area is drained, the water will be discharged directly to the reservoir after passing through an oil water separator.

The post-development drainage area + the fuel oil containment area = the pre-development drainage area.

$$40.8 \text{ acres} + 2.7 \text{ acres} = 43.5 \text{ acres}$$

Therefore, the Total Post-development Drainage Area = **40.8 Acres** ✓

NOTE: Some small areas with oil contamination potential are included in the area above. However, runoff from these areas will be collected, routed through an oil water separator, and pumped to the cooling reservoir.



Area 5³⁰

Area 7

Area 1

Area 2

Area 9

Area 6

Area 4

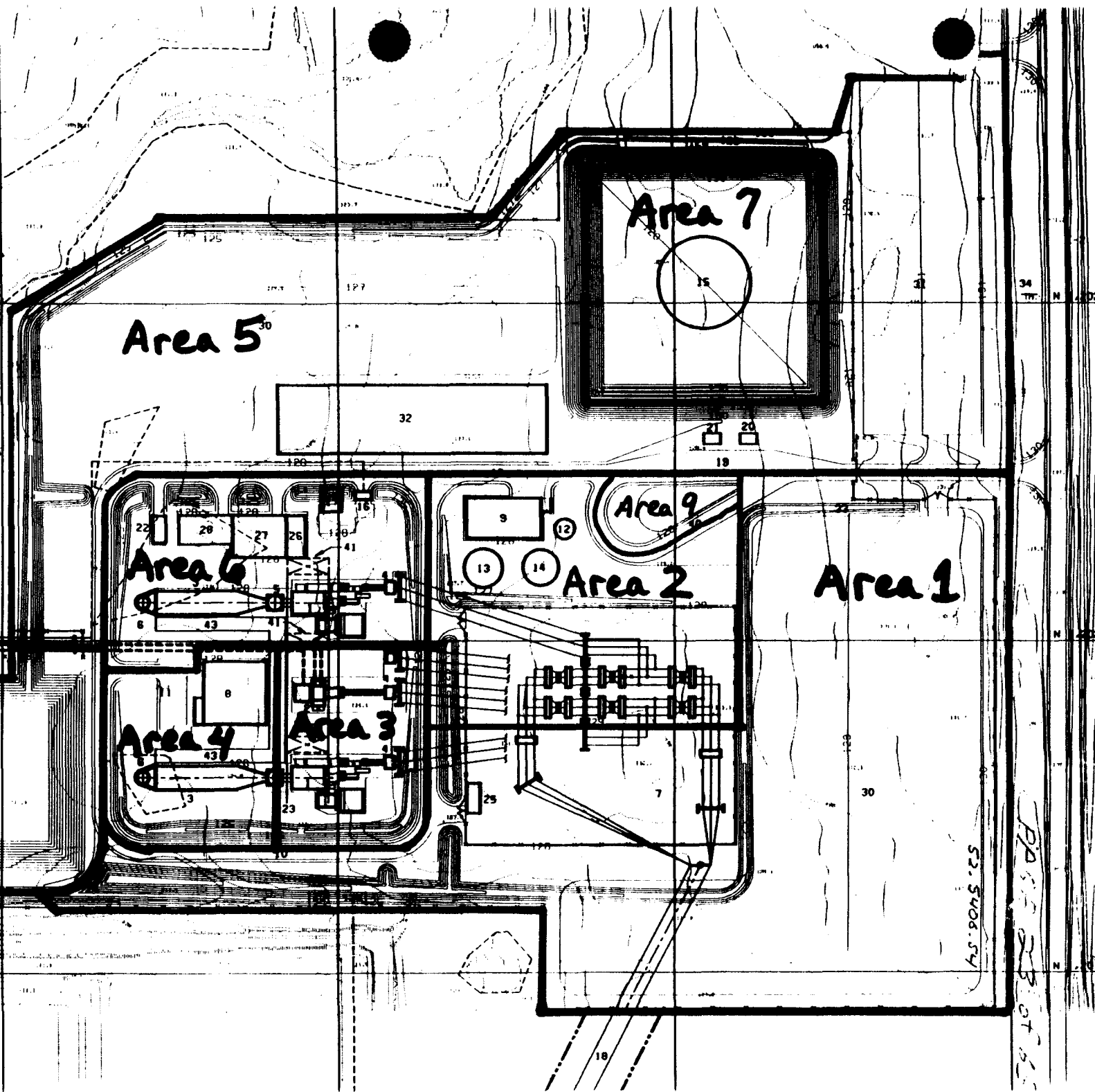
Area 3

Area 8

FIG 5

52.5406.54

PP. 52.5406.54



Owner:	Seminole Electric Coop. Inc.	Computed By:	Joe P. Bauer
Plant:	Hardee Power Station Unit 3	Date:	2-24-94
Project #:	23930.050 52.5406. H11	Checked By:	<i>JB</i>
Title:	Storm Water Detention Basin	Date:	3-7-94
	POST-DEVELOPMENT	Page:	24 of 65

DETERMINE THE WEIGHTED RUNOFF CURVE NUMBER (CN)

The Curve Number (CN) will usually increase when a site is developed. This is primarily due to the increase of impervious areas as the site is developed. These impervious areas are in the form of buildings & concrete, asphalt, and the detention basin since the basin will be partially full at all times. Other types of land cover can also increase the CN such as aggregate surfacing or some vegetation. Each different land cover will affect the amount of runoff that will flow from the site area.

The Following table is used to determine the post-development "Weighted Curve Number".

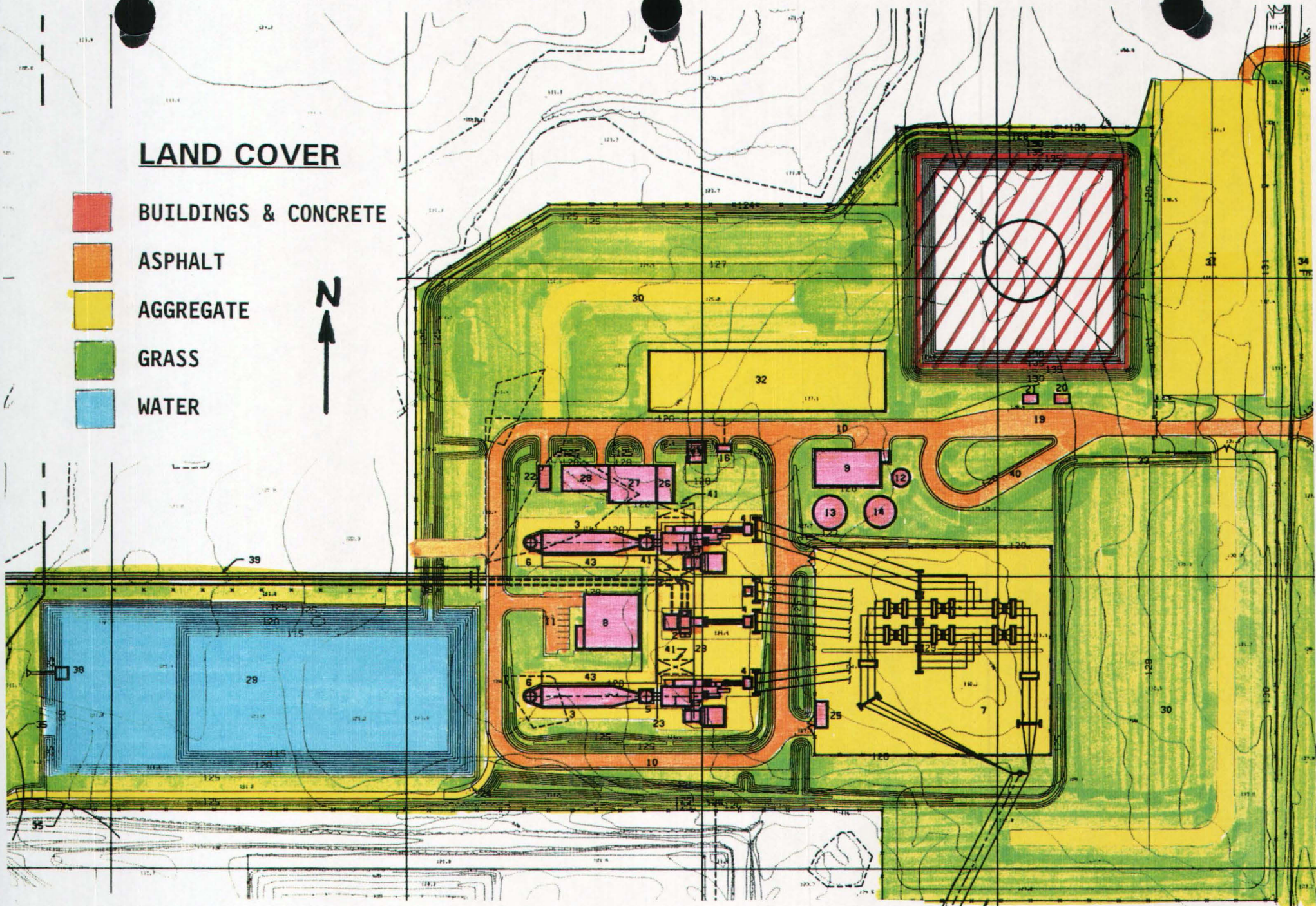
See Fig. 6 for a map of the different cover types on the site.

LAND COVER	AREA (ACRES)	PERCENT OF TOTAL AREA	CURVE NUMBER (CN)	WEIGHTED CN (% x CN)
BLDGS. & CONCRETE	2.2	5.4 %	98	5.3
ASPHALT	1.8	4.4 %	98	4.3
AGGREGATE	7.2	17.6 %	91	16.0
GRASS	24.5	60.1 %	85	51.1
WATER	5.1	12.5 %	100	12.5
TOTAL	40.8	100 %		89.2

Therefore, the weighted post-development CN is **89.2**.

LAND COVER

-  BUILDINGS & CONCRETE
-  ASPHALT
-  AGGREGATE
-  GRASS
-  WATER



THE FUEL OIL CONTAINMENT AREA DOES NOT CONTRIBUTE TO THE POST-DEVELOPMENT RUNOFF AS STATED PREVIOUSLY.

Fig. 6

Owner:	Seminole Electric Coop. Inc.	Computed By:	Joe P. Bauer
Plant:	Hardee Power Station Unit 3	Date:	2-24-94
Project #:	23930.050 <i>52.5406.H12</i>	Checked By:	<i>JB</i>
Title:	Storm Water Detention Basin	Date:	<i>3-1-94</i>
	POST-DEVELOPMENT	Page:	<i>26 of 85</i>

DETERMINE THE STORM WATER "TIME OF CONCENTRATION" (T_c)

"Travel Time" (T_t) is the time it takes water to travel from one location to another in a watershed. T_t is a component of "Time of Concentration" (T_c), which is the time for runoff to travel from the hydraulically most distant point of the watershed to a point of interest within the watershed. T_c is computed by summing all the travel times for consecutive components of the drainage conveyance system. See Fig. 7 for a sketch of the post-development site topo map of the storm water runoff pattern modeled to determine the "Time of Concentration".

How water moves through a watershed has been broken down into three basic components:

- Sheet flow
- Shallow concentrated flow
- Open channel flow

"Sheet flow" represents the first 300 feet of flow, at which point the accumulation of sheet flow becomes "shallow concentrated flow". Shallow concentrated flow will eventually contribute to "open channel flow" in the form of a ditch, creek, river, or stream. Evaluation of a particular site may have any combination of the three basic components.

Sheet Flow "Travel Time" (T_t)

$$T_t = 0.007(nL)^{0.8}/(P_2)^{0.5}s^{0.4}$$

$n = 0.15$ (short grass) (Table 3.1 of TR-55) (appendix)

$L = 300$ feet (see Fig. 7)

$P_2 = 4.2$ inches/hour (Figure C-1 of SWFWMD) (appendix)

$s = 0.005$ ft/ft (determined from Fig. 7)

$$T_t = 0.007[(0.15)(300)]^{0.8}/(4.2)^{0.5}(0.005)^{0.4}$$

$$T_t = \underline{0.60 \text{ hours}} \quad \checkmark$$

Shallow Concentrated Flow "Travel Time" (T_t)

$$T_t = L/V$$

$L = 300$ feet (length of flow) (see Fig. 7)

$s = 0.005$ ft/ft (see Fig. 7)

$V = 1.2$ fps (Ave. velocity) (Fig. 3-1 of TR-55) (appendix)

1 hour = 3600 seconds

$$T_t = 300/(1.2 \times 3600) = \underline{0.06 \text{ hours}} \quad \checkmark$$

Owner: Seminole Electric Coop. Inc.
Plant: Hardee Power Station Unit 3
Project #: 23930.050 52.5406. H12
Title: Storm Water Detention Basin
POST-DEVELOPMENT

Computed By: Joe P. Bauer
Date: 2-24-94
Checked By: JPB
Date: 3-7-94
Page: 27 of 65

"TIME OF CONCENTRATION" (cont.)

Open Channel Flow "Travel Time" (T_t)
(ditch flow)

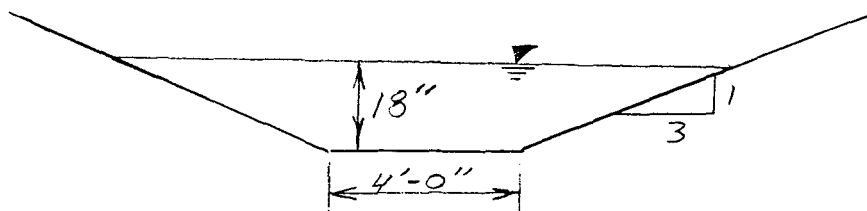
$$T_t = L/V$$

$$L = 1100 \text{ feet (length of flow) (see Fig. 7)}$$

$$V = 1.49r^{2/3}s^{1/2}/n \text{ (Manning's Equation)}$$

$$r = A/P_w = \text{area of flow/wetted perimeter}$$

From ditch calculations, the approximate depth of flow is 18 inches.



$$r = 12.75/13.5$$

$$r = 0.94 \text{ ft.}$$

$$s = 0.005 \text{ ft./ft. (Ave. ditch slope)}$$

$$n = 0.027 \text{ (short grass w/ weeds - straight)}$$

(REF. - Chow: Open Channel Hydraulics, 1988.)

$$V = 1.49(0.94)^{2/3}(0.005)^{1/2}/0.027 = 3.7 \text{ fps}$$

$$1 \text{ hour} = 3600 \text{ seconds}$$

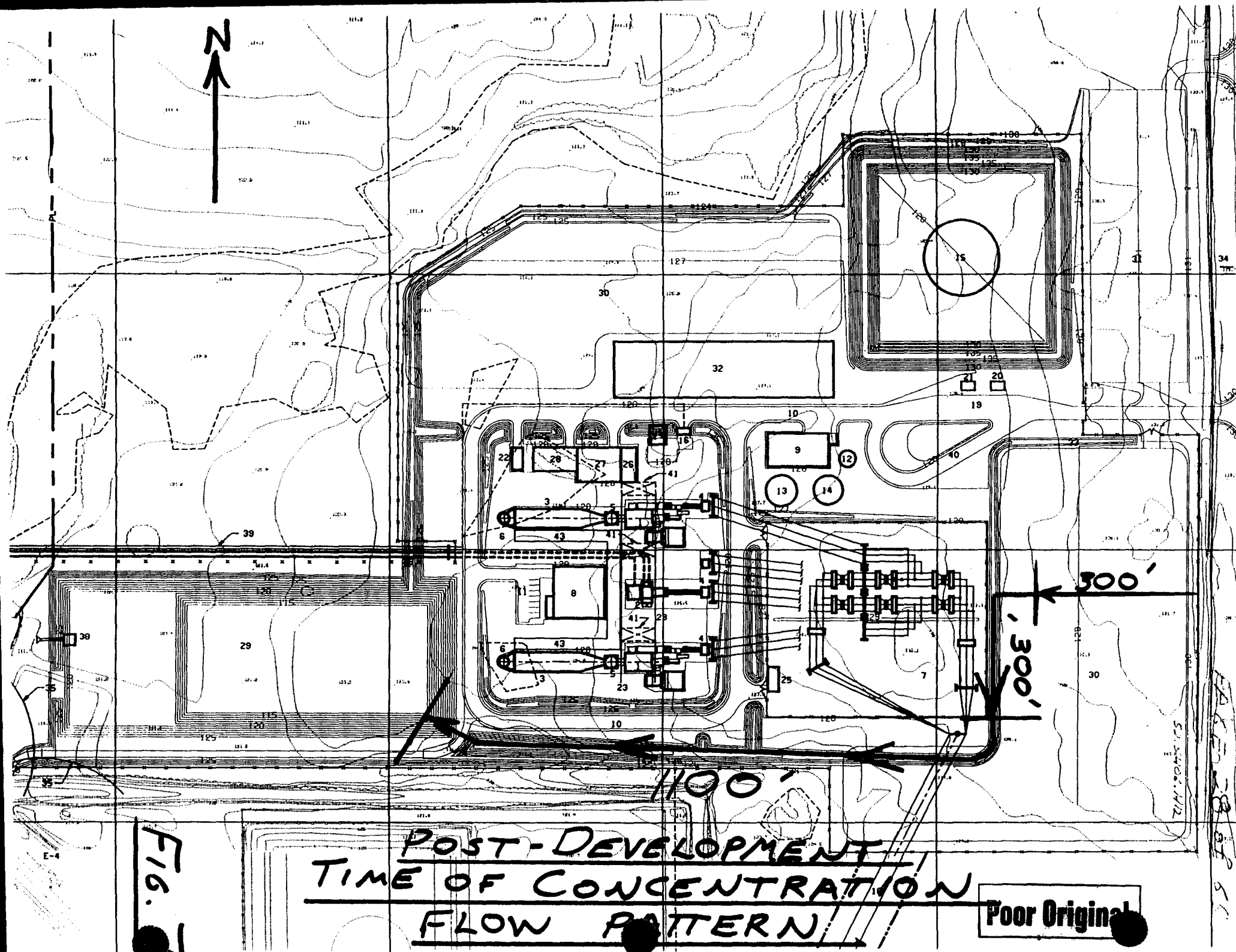
$$T_t = 1100/(3.7 \times 3600)$$

$$T_t = \underline{0.08 \text{ hours}}$$

TIME OF CONCENTRATION = SUMMATION OF TRAVEL TIMES

$$T_c = 0.60 + 0.06 + 0.08 = \underline{0.74 \text{ HOURS}}$$

$$\text{LAG TIME} = 0.6 \times T_c = 0.44 \text{ hours}$$



 OWNER: SEMINOLE
 PROJECT: HARDY STATION UNIT 3
 PROJECT NO.: 23930.050 52.5406.412
 TITLE: STORM WATER DETENTION BASIN
 POST-DEVELOPMENT

NAME: JOE BAUER
 DATE: 03-Mar-94
 CHECKED BY: [Signature]
 DATE: [Signature]
 PAGE: 29 of 55

DETERMINE THE TYPE II MODIFIED RAINFALL DISTRIBUTION FOR HEC-1 INPUT.

RAINFALL DISTRIBUTION: 25 year, 24 hour storm = 8.42 inches

TIME (hr)	RAINFALL RATIOS (SCS Type II Modified)	ACCUMULATE RAINFALL (inches)	INCREMENT RAINFALL (inches)
0.0	0.000	0.00	0.00
0.5	0.006	0.05	0.05
1.0	0.012	0.10	0.05
1.5	0.019	0.16	0.06
2.0	0.025	0.21	0.05
2.5	0.032	0.27	0.06
3.0	0.039	0.33	0.06
3.5	0.047	0.40	0.07
4.0	0.054	0.45	0.06
4.5	0.062	0.52	0.07
5.0	0.071	0.60	0.08
5.5	0.080	0.67	0.08
6.0	0.089	0.75	0.08
6.5	0.099	0.83	0.08
7.0	0.110	0.93	0.09
7.5	0.122	1.03	0.10
8.0	0.134	1.13	0.10
8.5	0.148	1.25	0.12
9.0	0.164	1.38	0.13
9.5	0.181	1.52	0.14
10.0	0.201	1.69	0.17
10.5	0.226	1.90	0.21
11.0	0.258	2.17	0.27
11.5	0.308	2.59	0.42
12.0	0.607	5.11	2.52
12.5	0.719	6.05	0.94
13.0	0.757	6.37	0.32
13.5	0.785	6.61	0.24
14.0	0.807	6.79	0.19
14.5	0.826	6.95	0.16
15.0	0.842	7.09	0.13
15.5	0.857	7.22	0.13
16.0	0.870	7.33	0.11
16.5	0.882	7.43	0.10
17.0	0.893	7.52	0.09
17.5	0.904	7.61	0.09
18.0	0.913	7.69	0.08
18.5	0.923	7.77	0.08
19.0	0.931	7.84	0.07
19.5	0.940	7.91	0.08
20.0	0.948	7.98	0.07
20.5	0.955	8.04	0.06
21.0	0.962	8.10	0.06
21.5	0.969	8.16	0.06
22.0	0.976	8.22	0.06
22.5	0.983	8.28	0.06
23.0	0.989	8.33	0.05
23.5	0.995	8.38	0.05
24.0	1.000	8.42	0.04

NOTE: THE INCREMENTAL RAINFALL DATA IN THE LAST COLUMN WILL BE USED FOR INPUT FOR THE HEC-1 PROGRA

REF.: Table C-1 of the SWFWMD Permit Information Manual. (see appendix)

Owner:	Seminole Electric Coop. Inc.	Computed By:	Joe P. Bauer
Plant:	Hardee Power Station Unit 3	Date:	2-24-94
Project #:	23930.050 52.5405.412	Checked By:	<i>[Signature]</i>
Title:	Storm Water Detention Basin	Date:	3-7-94
	POST-DEVELOPMENT	Page:	30 of 65

DETERMINE THE STORAGE VOLUME OF THE DETENTION BASIN

QUALITY TREATMENT VOLUME

The Seasonal High Water Table has been determined to 119.79 feet at the west end of the detention basin. Therefore, we will use 119.8 feet as our normal pool elevation of the detention basin. ✓

The requirements for the quality treatment volume are stated in the Southwest Florida Water Management District's Management and Storage of Surface Waters Permit Information Manual.

The quality treatment volume shall be one inch of runoff from the entire site area.

$$(40.8 \text{ acres})(1 \text{ inch})(1 \text{ foot}/12 \text{ inches}) = 3.4 \text{ Ac-ft.} \quad \checkmark$$

The quality treatment volume shall not raise the detention pond normal pool elevation of 119.8' by more than 18" (see Fig. 8). Due to the constraints of this project we will use 12" as the maximum increase of water surface elevation. ✓

Therefore, if our detention basin is 230 feet wide at the 119.8' elevation, the length of the basin will be a minimum of:

$$(3.4 \text{ Ac-ft})(43,560 \text{ s/Ac})/(230 \text{ ft}) = 644 \text{ feet.} \quad \text{USE 650 FEET.} \quad \checkmark$$

This treatment volume shall be discharged through a small pipe, or orifice. This orifice shall be sized so that the quality treatment volume shall not be discharged in less than 120 hours (5 days). In addition, the first one half of the treatment volume shall not be discharged in less than 60 hours (2.5 days). The spreadsheet on the following page shows the discharge rate, discharge volume, and discharge time for a 4" diameter orifice.

The volume of discharge from the quality treatment volume in the first 36 hours may be used as storage for the quantity treatment volume. Therefore, the stage storage for the HEC-1 program will begin at the water surface elevation after 36 hours of bleed down time.

LITTORAL ZONE

The littoral zone is a vegetated area concentrated at the outfall of the detention basin. The littoral zone shall be a minimum of 35% of the surface area of the detention basin at the control elevation. The littoral zone shall not be deeper than 3.5 feet at its deepest point (see Fig. 9). ✓

OWNER:	SEMINOLE	NAME:	JOE BAUER
PROJECT:	HARDY STATION UNIT 3	DATE:	04-Mar-94
PROJECT NO.:	23930.050 <i>52.5406.H12</i>	CHECKED BY:	<i>[Signature]</i>
TITLE:	STORM WATER DETENTION BASIN	DATE:	3-7-94
	POST-DEVELOPMENT	PAGE:	31 of 65

DETERMINE THE TIME REQUIRED TO BLEED DOWN THE QUALITY TREATMENT VOLUME.

WATER QUALITY

AREA CONTRIBUTING TO THE DETENTION BASIN = 40.8 acres
 VOLUME OF 1.0 INCH OF RUNOFF FROM THE SITE = 3.4 acre-ft
 NORMAL POOL EL. & SEASONAL HIGH WATER TABLE 119.8 feet

ORIFICE EQUATION: $Q_o = CA(2gh)^{0.5}$

Discharge Coeff. (C) = 0.60
 Orifice Diameter = 4 in.
 Orifice Area (A) = 0.09 sf

	Water depth H (in)	Peak Discharge (cfs)	Increment Volume (acre-ft/in)	Increment Discharge Time (hrs)	Accumulate Discharge Time (hrs)	Accumulate Discharge Time (days)	Accumulate Discharge Volume (acre-ft)
ELEV. 120.8 =	12	0.38	0.30	9.45	9.45	0.39	0.30
	11	0.36	0.30	9.92	19.37	0.81	0.60
	10	0.34	0.30	10.49	29.86	1.24	0.90
	9	0.32	0.30	11.17	41.03	1.71	1.19
	8	0.30	0.30	12.02	53.04	2.21	1.49
	7	0.27	0.29	13.11	66.15	2.76	1.78
	6	0.24	0.29	14.60	80.76	3.36	2.07
	5	0.21	0.29	16.80	97.55	4.06	2.36
	4	0.17	0.29	20.49	118.04	4.92	2.66
	3	0.12	0.29	28.87	146.91	6.12	2.94
	2	0.09	0.29	40.67	187.58	7.82	3.23
	1	0.02	0.29	144.76	332.34	13.85	3.52
ELEV. 119.8 =	<i>Total</i>		3.52	332.34	<i>OK</i>		

SUMMARY

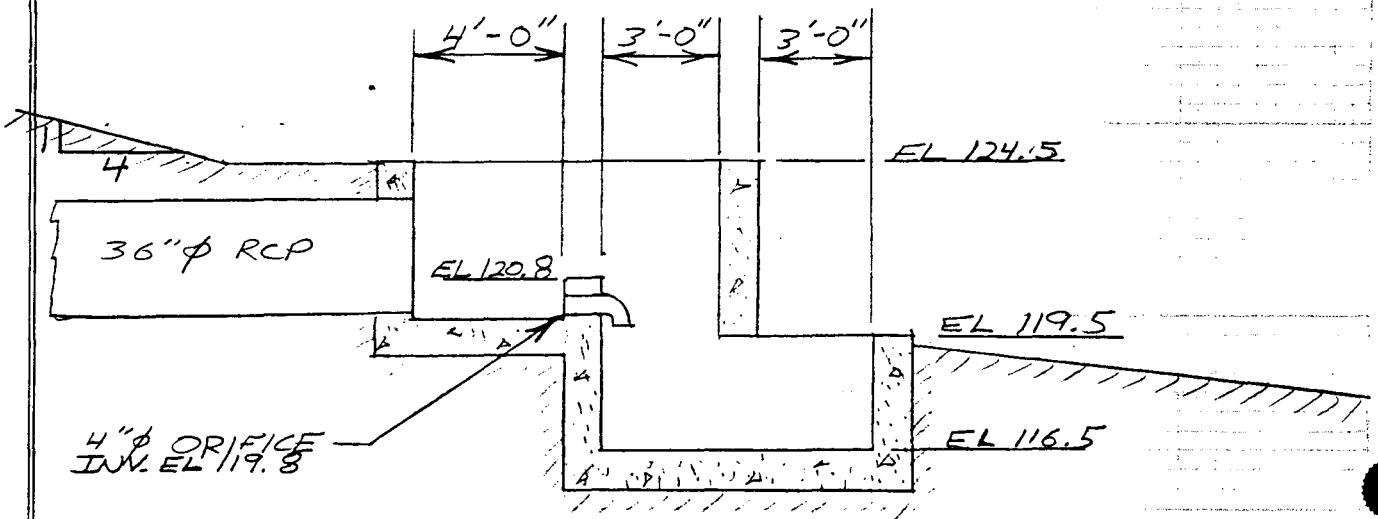
1. THE TOTAL QUALITY TREATMENT VOLUME WILL BE DISCHARGED IN APPROXIMATELY 8 DAYS.
2. THE FIRST HALF OF THE TREATMENT VOLUME WILL DISCHARGE IN NO LESS THAN 2.6 DAYS.
3. THE WATER SURFACE ELEVATION AFTER 36 HOURS OF BLEED DOWN TIME IS APPROXIMATELY 120.6'. ✓



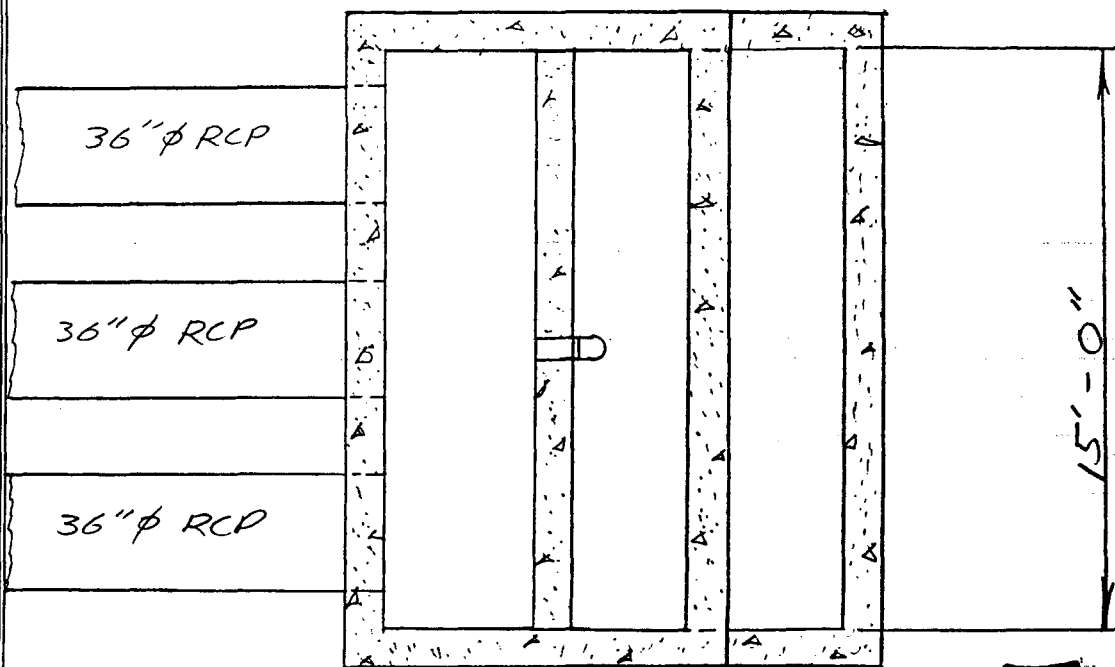
Owner SEMINOLE ELECTRIC COOP, INC
Plant HARDY POWER STATION Unit 3
Project No. 23930.030 File No. 52.5406.412
Title STORM WATER DETENTION BASIN
POST-DEVELOPMENT

Computed By JOE BAUER
Date 3-1 19 94
Checked By _____
Date _____ 19 _____
Page 32 of 65

DETENTION BASIN DISCHARGE STRUCTURE



SECTION



PLAN

FIG. 8

IN THIS SPACE

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Owner:	Seminole Electric Coop. Inc.	Computed By:	Joe P. Bauer
Plant:	Hardee Power Station Unit 3	Date:	2-24-94
Project #:	23930.050 52.5406.H12	Checked By:	<i>JSB</i>
Title:	Storm Water Detention Basin	Date:	3-7-94
	POST-DEVELOPMENT	Page:	33 of 65

QUANTITY TREATMENT VOLUME

The quantity treatment volume of the detention basin shall be such that a 25-year storm can be detained inside the basin. The maximum water surface elevation shall not overtop the emergency spillway. A quick check of the 100-year storm will be completed to verify the emergency spillway is plenty adequate to prevent overtopping of the basin dike.

The following elevations have been set for the detention basin and its discharge structure:

Normal Pool Elevation = 119.8 feet (control elevation and invert of 4" diameter orifice)

Weir Invert Elevation = 120.8 feet (overflow elevation)

Emergency Spillway EL = 123.0 feet

Top of Basin Dike EL = 125.0 feet ✓

Fig. 8 and Fig. 9 are sketches of the discharge structure and the detention basin respectively. Notice the 90 degree elbow on the four inch diameter orifice. The elbow is used to prevent surface debris from discharging. The discharge structure itself shall be designed to prevent surface debris from flowing over the discharge structure weir. *and oil*

The sedimentation area of the detention volume shall be deep enough to prevent vegetative growth. The material excavated from the sedimentation area shall also be used for fill material around the site.

The Detention basin shall be 230 feet x 650 feet measured at the normal pool elevation. The side slopes shall be 4:1. The littoral zone shall be 35% of the normal pool surface elevation or the last 227.5 feet (minimum) of the detention basin before the discharge structure.

 OWNER: SEMINOLE
 PROJECT: HARDY STATION UNIT 3
 PROJECT NO.: 23930.050 52.5406.1412
 TITLE: STORM WATER DETENTION BASIN
 POST-DEVELOPMENT

NAME: JOE BAUER
 DATE: 03-Mar-94
 CHECKED BY: *JB*
 DATE: 3-7-94
 PAGE: 34 of 65

DETERMINE THE STAGE STORAGE VOLUME OF THE DETENTION BASIN.

RECTANGULAR BASIN VOLUME (AVERAGE END AREA METHOD)

BOTTOM ELEV. = 119.80 feet (normal pool elevation)
 ELEV. INCREMENT = 0.2 feet
 BOTTOM LENGTH = 650 feet
 BOTTOM WIDTH = 230 feet
 SIDESLOPE = 4 :1

SURFACE ELEVATION (feet)	LENGTH (feet)	WIDTH (feet)	INCREMENT VOLUME		ACCUMULATE VOLUME		
			(cf)	(acre-ft)	QUALITY (cf)	QUANTITY (acre-ft)	QUANTITY (acre-ft)
119.80	650.00	230.00	0	0.00	0	0.00	
120.00	651.60	231.60	30041	0.69	30041	0.69	
120.20	653.20	233.20	30324	0.70	60365	1.39	
120.40	654.80	234.80	30607	0.70	90972	2.09	
120.60	656.40	236.40	30892	0.71	121864	2.80	0.00
120.80	658.00	238.00	31178	0.72	153042	3.51	0.72
121.00	659.60	239.60	31464	0.72	184506		1.44
121.20	661.20	241.20	31752	0.73	216258		2.17
121.40	662.80	242.80	32041	0.74	248299		2.90
121.60	664.40	244.40	32331	0.74	280630		3.64
121.80	666.00	246.00	32622	0.75	313252		4.39
122.00	667.60	247.60	32913	0.76	346165		5.15
122.20	669.20	249.20	33206	0.76	379371		5.91
122.40	670.80	250.80	33500	0.77	412871		6.68
122.60	672.40	252.40	33795	0.78	446666		7.46
122.80	674.00	254.00	34091	0.78	480757		8.24
123.00	675.60	255.60	34388	0.79	515145		9.03
123.20	677.20	257.20	34686	0.80	549831		9.82
123.40	678.80	258.80	34985	0.80	584816		10.63
123.60	680.40	260.40	35285	0.81	620101		11.44
123.80	682.00	262.00	35586	0.82	655687		12.25
124.00	683.60	263.60	35888	0.82	691575		13.08
124.20	685.20	265.20	36191	0.83	727766		13.91
124.40	686.80	266.80	36495	0.84	764262		14.75
124.60	688.40	268.40	36800	0.84	801062		15.59
124.80	690.00	270.00	37107	0.85	838169		16.44
125.00	691.60	271.60	37414	0.86	875583		17.30

Image Quality

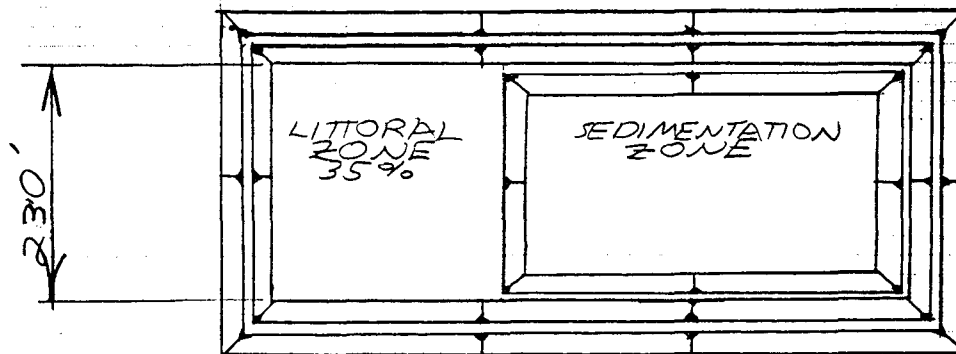
As you review the next group of images, Please note that the original documents were of poor quality.



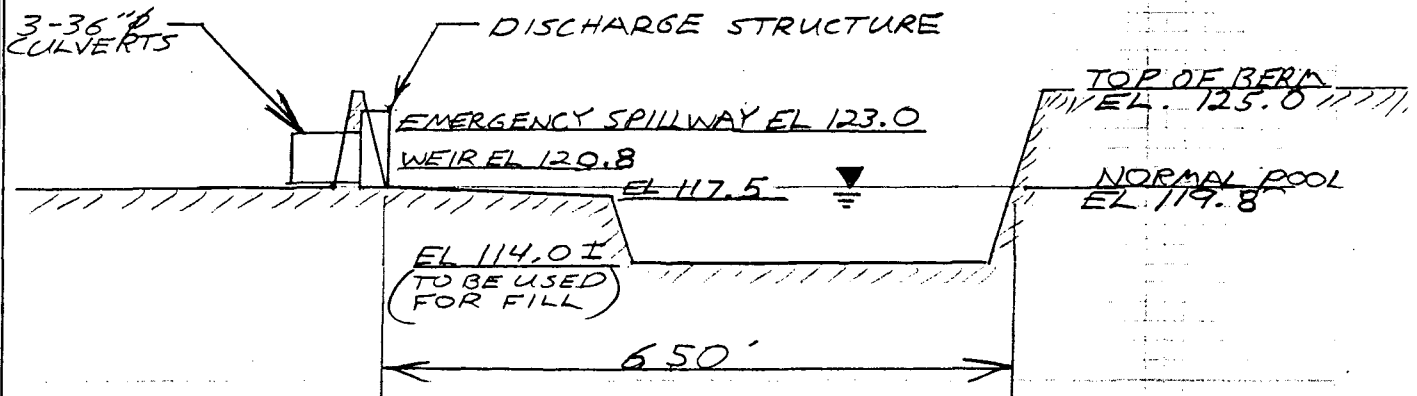
Owner SEMINOLE ELECTRIC COOP. INC
Plant HARDEE POWER STATION Unit 3
Project No 23930.03 File No. 52.5406-H12
Title STORM WATER DETENTION BASIN
POST-DEVELOPMENT

Computed By JOE BAUER
Date 2-24 1994
Checked By JB
Date 3-7 1994
Page 35 of 65

DETENTION BASIN PLAN AND SECTION



PLAN



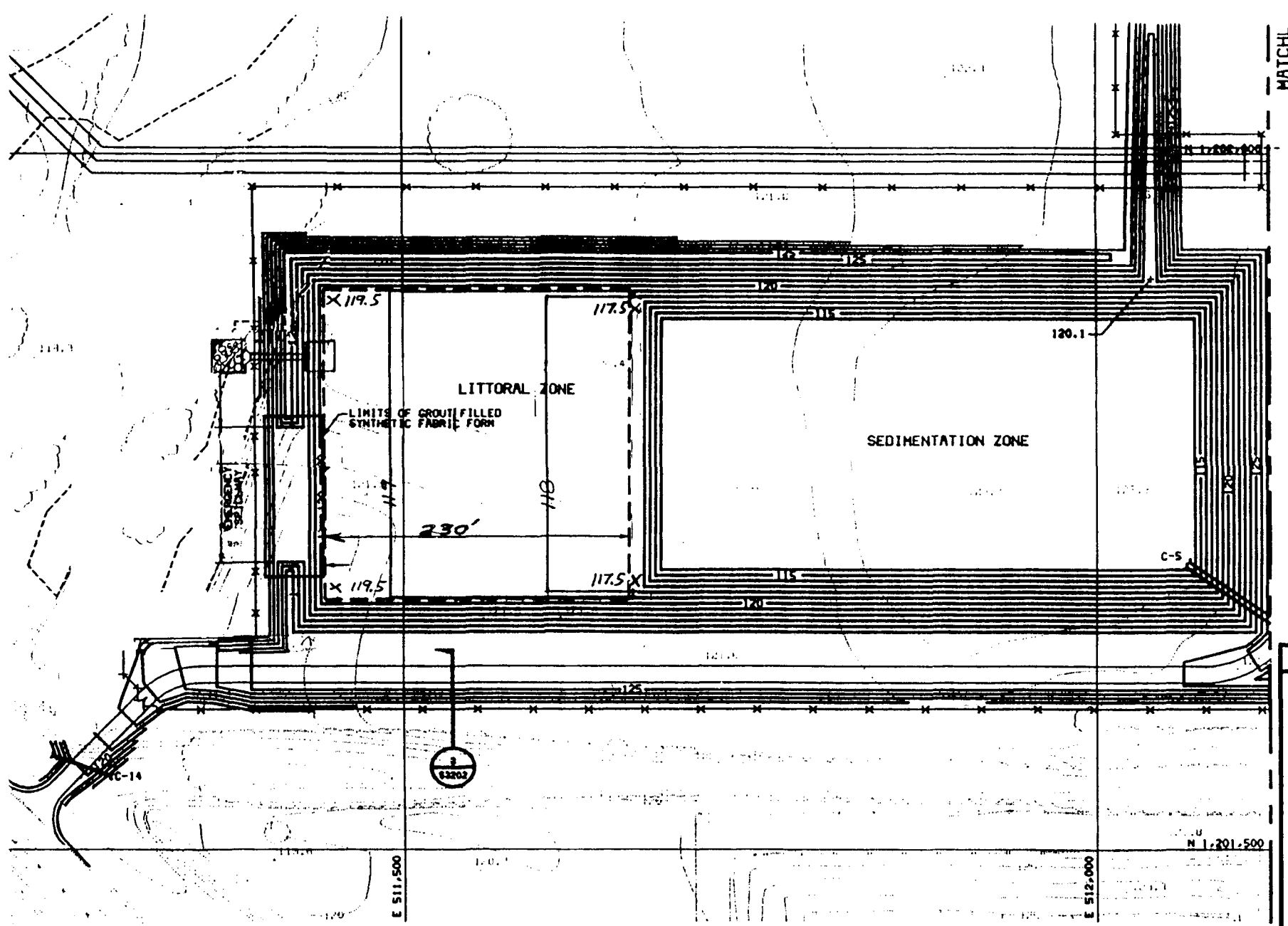
SECTION

FIG. 9

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PAGE 35A
OF 65
52.5405.H12



GENI

1. SEE DMC. \$3000 FOR DE
2. SEE DMC \$3010 FOR CUL

NOT TO BE
FOR CONSTR

DATE OF ISSUE _____

0 RECORD OF ISSUE BY CHAPFLY		50' 25' 0 50' 100' 1"=50'	I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPER- VISION AND THAT I AM A DULY REGISTERED PRO- FESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF FLORIDA		BLACK & VEATCH	SEMINOLE ELECTRIC COOP, INC. HARDEE POWER STATION UNIT 3	
			SIGNED _____ DATE _____	REG NO. _____		CHECKED _____ DATE _____	SITE - GRADING AND DRAINAGE AREA 1

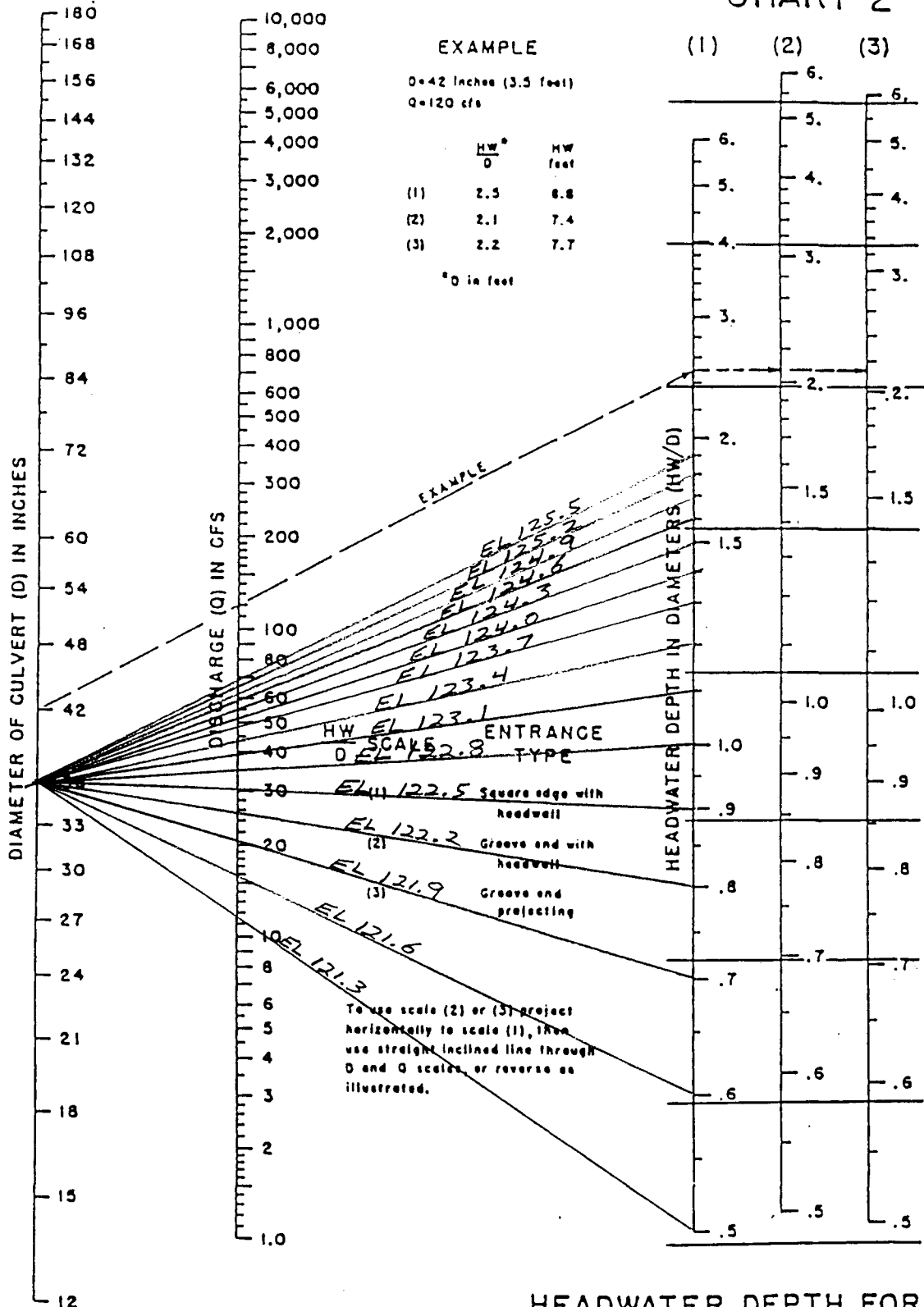
FIG. 10

NAME: JOE BAUER
DATE: 04-Mar-94
CHECKED BY: [Signature]
DATE: 3/1/94
PAGE: 58 of 65

* (The culvert discharge was determined using the culvert nomograph on the next page.)

NOMOGRAPH FOR 1-36" ϕ CULVERT FROM REF. 1

CHART 2



HEADWATER DEPTH FOR
 CONCRETE PIPE CULVERTS
 WITH INLET CONTROL

HEADWATER SCALES 283
 REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

Owner:	Seminole Electric Coop. Inc.	Computed By:	Joe P. Bauer
Plant:	Hardee Power Station Unit 3	Date:	2-24-94
Project #:	23930.050 52-5406-412	Checked By:	<i>[Signature]</i>
Title:	Storm Water Detention Basin	Date:	2-24-94
	POST-DEVELOPMENT	Page:	38 of 65

CHECK THE DETENTION BASIN DISCHARGE STRUCTURE OUTLET FOR EROSION CONTROL.

From the spreadsheet on the following page the velocity of the discharge is approximately 5.0 feet per second. After discharge the water shall be spread out over a large area, we will assume a 20' wide flow which would provide a depth of flow of approximately 14 inches and a velocity of 3.5 feet per second. A preformed scour hole shall be constructed at the discharge outlet using Grout Filled Fabric Form with Filter Points. All edges of the fabric form shall be at the same elevation so as to act as a spreader swale.

Rip rap, or gabion blankets, can be used as an alternative.

USE A PREFORMED SCOUR HOLE AND A SPREADER SWALE

If a rip rap design is used, then a median stone diameter (D_{50}) shall be determined from the following equation:

$$D_{50} = (0.0125/TW) \times (Q/D_o)^{4/3}$$

The depth of the preformed scour hole shall be one half the diameter of the discharge pipes (D_o) and the depth of rip rap shall be two feet.

The "Tailwater Depth" (TW) of the discharge pipes is 14 inches or 1.17 feet (from the spreadsheet on the next page).

$$D_{50} = (0.0125/1.17 \text{ feet}) \times (90 \text{ cfs}/3 \text{ feet})^{4/3}$$

$$D_{50} = 0.996 \text{ feet}$$

MEDIAN STONE DIAMETER SHALL BE 12 INCHES

The dimensions of the preformed scour hole are shown on Fig. 11.

REFERENCE: Practical Guidance for Estimating and Controlling Erosion at Culvert Outlets, 1972, Corps of Engineers Research Report H-72-5, Fletcher and Grace.

OWNER: SEMINOLE ELECTRIC COOP, INC.
 PROJECT: HARDEE POWER STATION UNIT 3
 PROJECT NO.: 23930.030 *52.5406. H12*
 TITLE: STORM WATE DENTENTION BASIN
 POST-DEVELOPMENT

NAME: JOE BAUER
 DATE: 07-Mar-94
 CHECKED BY: *JS 3-7-94*
 DATE:
 PAGE: *39 of 55*

NOTE: THIS WORKSHEET IS USED TO DETERMINE THE VELOCITY OF THE WATER DISCHARGING FROM THE DETENTION BASIN.

PIPE FLOW FOR VARIED SLOPES USING MANNING'S EQUATION - (based on pipe flowing full)

$$V = 1.49 * (R^{\frac{2}{3}}) * (S^{\frac{1}{2}}) / n$$

$$Q = 1.49 * A * (R^{\frac{2}{3}}) * (S^{\frac{1}{2}}) / n$$

Design Flow Rate = 30.00 cfs = 90.00 cfs / 3 Culverts
 Estimated Slope = 0.001 ft/ft
 Manning's n = 0.012 (RCP)
 Pipe Diameter = 36 in.

D PIPE DIAMETER (in)	S PIPE SLOPE	n MANNING'S n	V FLOW VELOCITY (fps)	Q FLOW RATE (cfs)	Qp/Qf Qpartial/ Qfull
36	0.001	0.012	3.24	22.91	1.31
36	0.002	0.012	4.58	32.40	0.93
36	0.003	0.012	5.81	39.68	0.78
36	0.004	0.012	6.48	45.82	0.66
36	0.005	0.012	7.25	51.23	0.59
36	0.006	0.012	7.94	56.12	0.53
36	0.007	0.012	8.58	60.62	0.49
36	0.008	0.012	9.17	64.80	0.46
36	0.009	0.012	9.72	68.73	0.44

← *V = 5.0 fps (APPROX.)*

DETERMINE THE VELOCITY AND DEPTH OF FLOW AFTER PIPE DISCHARGE.

DEPTH OF FLOW IN TRAPEZOIDAL DITCH AFTER DISCHARGE

$$V = 1.49 * (R^{\frac{2}{3}}) * (S^{\frac{1}{2}}) / n$$

$$Q = 1.49 * A * (R^{\frac{2}{3}}) * (S^{\frac{1}{2}}) / n$$

CL SLOPE = 0.005 ft/ft
 MANNING'S n = 0.03 (grass)
 BOTTOM WIDTH = 20 feet
 DITCH SIDESLOPES = 3 : 1
 ESTIMATED FLOW DEPTH = 1 inches
 25 YEAR PEAK FLOW RATE = 90.00 cfs

d DEPTH OF FLOW (in)	A AREA OF FLOW (sq ft)	P WETTED PERIMETER (ft)	R HYDRA. RADIUS (ft)	Q PEAK FLOW (cfs)	V FLOW VELOCITY (fps)
1	1.69	20.53	0.08	1.12	0.88
2	3.42	21.05	0.16	3.57	1.04
3	5.19	21.58	0.24	7.04	1.38
4	7.00	22.11	0.32	11.42	1.63
5	8.85	22.64	0.39	16.63	1.88
6	10.75	23.18	0.46	22.63	2.11
7	12.69	23.69	0.54	29.39	2.32
8	14.67	24.22	0.61	36.87	2.51
9	16.69	24.74	0.67	45.07	2.70
10	18.75	25.27	0.74	53.97	2.88
11	20.85	25.80	0.81	63.56	3.05
12	23.00	26.32	0.87	73.82	3.21
13	25.19	26.85	0.94	84.76	3.37
14	27.42	27.38	1.00	96.38	3.52
15	29.69	27.91	1.08	108.66	3.66
16	32.00	28.43	1.13	121.80	3.80
17	34.35	28.96	1.19	135.20	3.94
18	36.75	29.49	1.25	149.47	4.07

← *90 cfs @ < 3.5 fps*

SUMMARY:



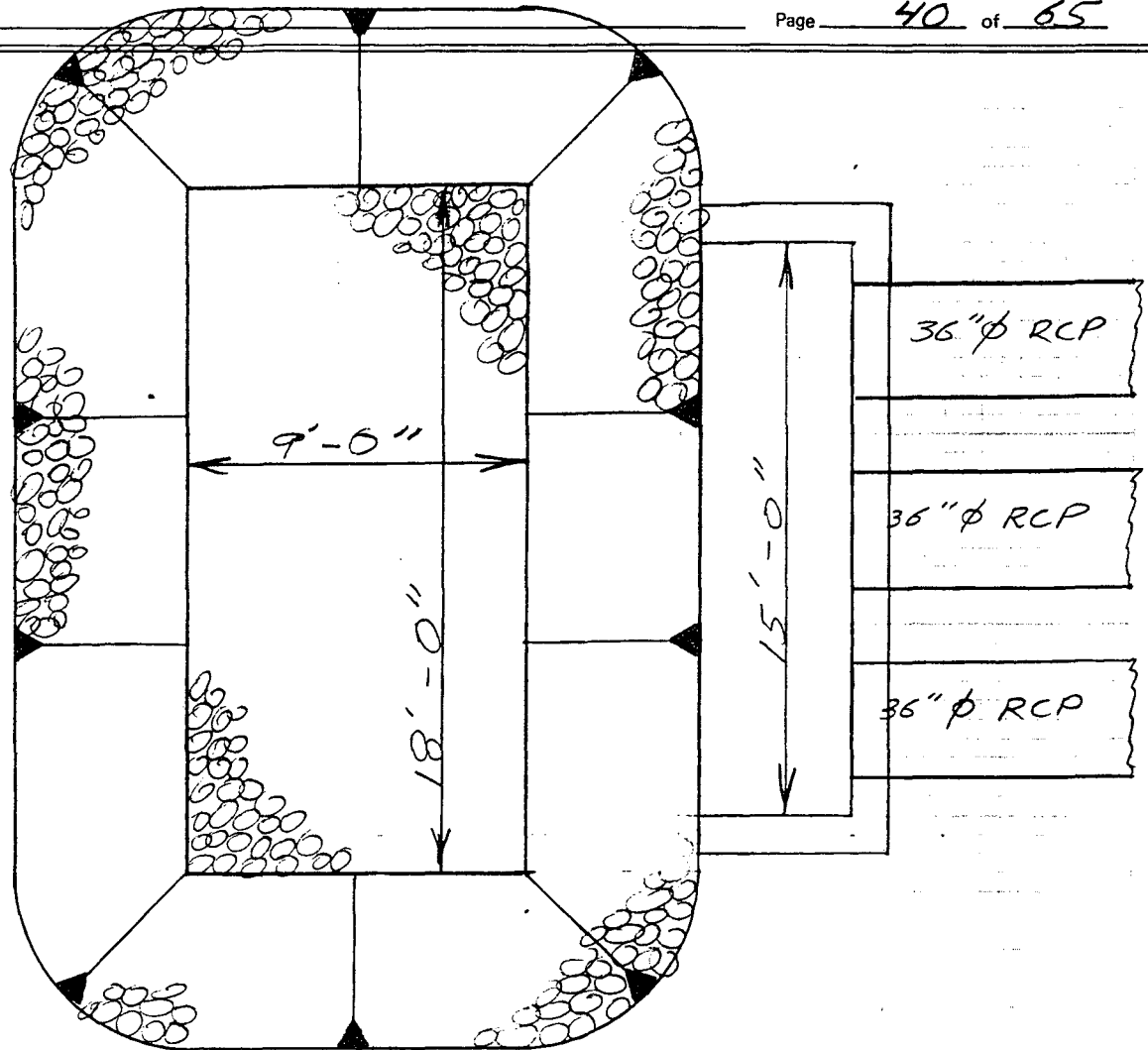
Owner SEMINOLE ELECTRIC COOP, INC
 Plant HARDEE POWER STATION Unit 3
 Project No. 23930.030 File No. 52.5406.H12
 Title STORM WATER DETENTION BASIN

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 Date 3-1 1994
 Checked By [Signature]
 Date 3-7 1994
 Page 40 of 65

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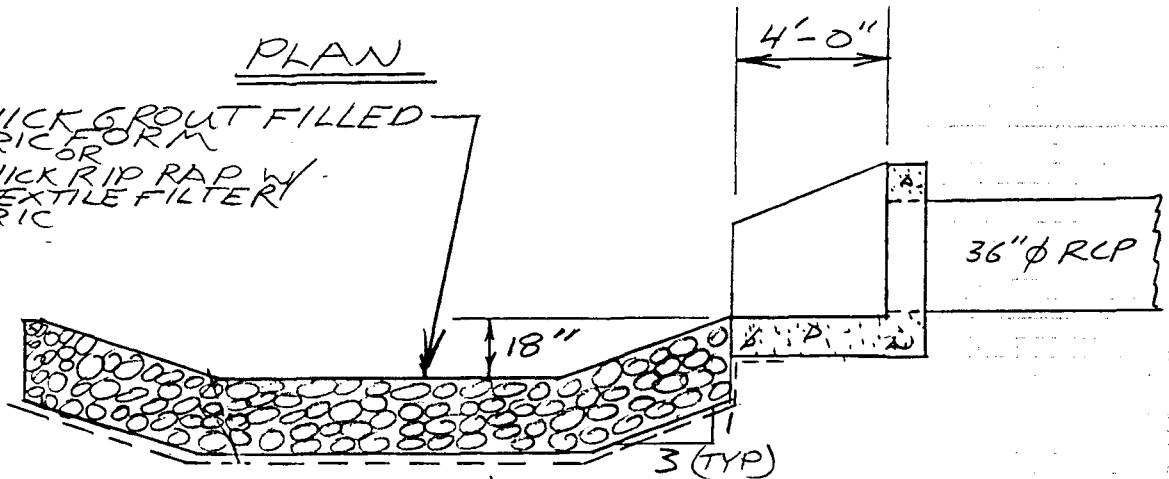
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PLAN

4" THICK GROUT FILLED
FABRIC FORM
OR
2" THICK RIP RAP W/
GEOTEXTILE FILTER
FABRIC



SECTION

DETENTION BASIN OUTLET
PREFORMED SCOUR HOLE AND
SPREADER SWALE

FIG. 11

Owner:	Seminole Electric Coop. Inc.	Computed By:	Joe P. Bauer
Plant:	Hardee Power Station Unit 3	Date:	2-24-94
Project #:	23930.050 <i>SD. 5406. H12</i>	Checked By:	<i>BB</i>
Title:	Storm Water Detention Basin	Date:	<i>3-7-94</i>
	POST-DEVELOPMENT	Page:	<i>41</i> of <i>65</i>

CHECK THE EMERGENCY SPILLWAY FOR OVERTOPPING DURING 100 YEAR STORM.

The emergency spillway shall discharge the peak flow from a 100 year storm. Assume the normal discharge structure is plugged and the pond is full when the peak occurs.

Peak Flow Rate

Drainage Area (A) = 40.8 Acres

Time of Concentration (T_c) = 20 minutes (assumed, very conservative)

Runoff Coefficient (C) = 0.90 (paved or saturated soil)

Rainfall Intensity (i) = 7.9 inches/hour (from intensity-duration-frequency Curves of REF. 1, See the Zone 8 curve on the next page.)

$$Q_{100} = CiA$$

$$Q_{100} = (0.90)(7.9)(40.8)$$

$$Q_{100} = \underline{290 \text{ cfs}}$$

The emergency spillway shall be designed to pass the peak discharge of a 100-year storm and still allow a one foot freeboard. Therefore, if the spillway is at elevation 123.0 feet and the top of the berm is at 125.0 feet, solve the equation below for "L" given "h" equals 1.0 feet.

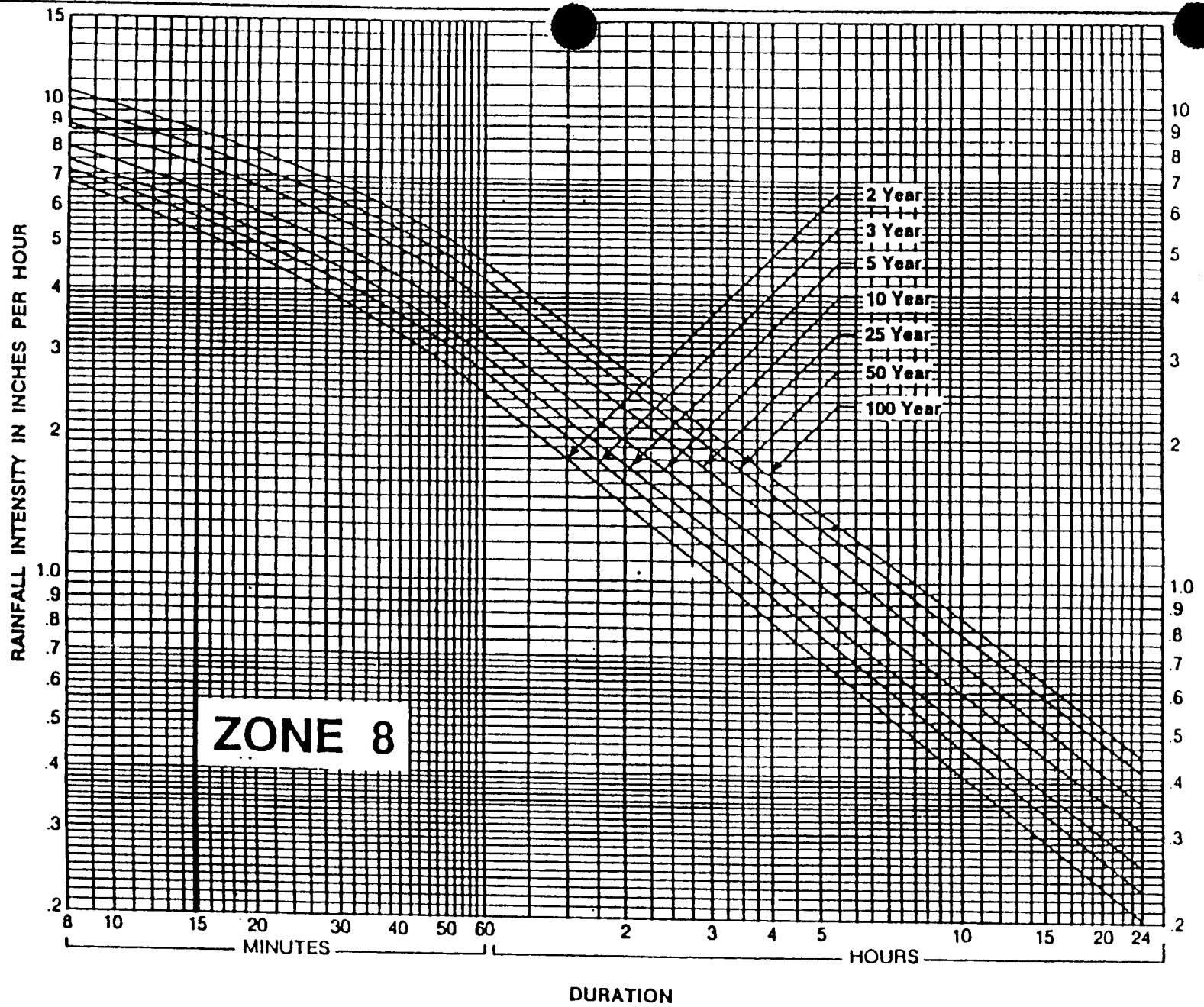
$$Q_w = 2.65Lh^{3/2}$$

$$290 = 2.65L(1.0)^{3/2}$$

$$L = 290 / (2.65 \times 1.0)$$

$$L = 109.4 \text{ feet}$$

USE AN EMERGENCY SPILLWAY WITH A LENGTH OF 110 FEET.



Rainfall Intensity-Duration-Frequency Curves for Zone 8

PAGE 42 of 51
52.5408.142

COMPUTER GENERATED CALCULATIONS

Owner:	Seminole Electric Coop. Inc.	Computed By:	Joe P. Bauer
Plant:	Hardee Power Station Unit 3	Date:	2-24-94
Project #:	23930.050 52.5406. H12	Checked By:	<i>JPB</i> 3-8-94
Title:	Storm Water Detention Basin	Date:	
	POST-DEVELOPMENT	Page:	43 of 65

<u>PROGRAM NUMBER:</u>	HEC-1	<u>VERSION:</u>	02 AUG 88
<u>RUN DATE:</u>	3-08-94	<u>RUN TIME:</u>	16:28:24
<u>CASE:</u>	POST-DEVELOPMENT	<u>NO. OF PAGES:</u>	13

REVIEW AND APPROVAL

1. Input Data Printout

Checked By: J.B. Baker Date: 3-8-94

2. Output Data Printout

Checked By: *JPB* Date: 3-8-94

3. Approved:

JPB Date: 3-8-94

```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* FEBRUARY 1981
* REVISED 02 AUG 88
*
* RUN DATE 03/08/1994 TIME 16:28:24
*
*****

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*
* U.S. ARMY CORPS OF ENGINEERS
* THE HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 551-1748
*
*****

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X X XXXXXX XXXX X
X X X X X XX
X X X X X
XXXXXXX XXXX XXXX X
X X X X X
X X X X X
X X XXXXXX XXXX XXX

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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

*** FREE ***

```

1 ID SEMINOLE ELECTRIC COOP, INC., HARDEE POWER STATION UNIT 3
2 ID PROJECT NO. 23930.030
3 ID SITE RUNOFF DETENTION BASIN
4 ID
  *DIAGRAM
5 IT 5 0 0 300
6 IO 0 0
  * 25 YR. 24 HR. INCREMENTAL PRECIPITATION (30 MIN)
7 PG 999
8 IN 30

```

PAGE 44 of 65
52.5406.H12

9	PI	0.000	0.050	0.050	0.060	0.050	0.060	0.060	0.070	0.060	0.070
10	PI	0.080	0.080	0.080	0.080	0.090	0.100	0.100	0.120	0.130	0.140
11	PI	0.170	0.210	0.270	0.420	2.510	0.940	0.320	0.240	0.180	0.160
12	PI	0.130	0.130	0.110	0.100	0.090	0.090	0.080	0.080	0.070	0.080
13	PI	0.070	0.060	0.060	0.060	0.060	0.060	0.050	0.050	0.040	

14 KK BASININFLOW
 15 KM RUNOFF USING SCS LOSSES & DIMENSIONLESS UNIT HYDROGRAPH
 16 KO 0 0
 17 BA 0.06375
 18 PR 999
 19 PW 1
 20 LS 0 89.2
 21 UD .44

22 KKRESERVOIR
 23 KM RESERVOIR ROUTING
 24 RS 1 ELEV 120.6
 25 SV 0.00 1.44 5.15 9.03 13.08 17.30
 26 SE 120.6 121. 122. 123. 124. 125.
 27 SQ 0.0 0.38 4.45 26.88 59.75 93.00 114.99 237.04 447.50 708.50
 28 SE 119.8 120.8 121.0 121.5 122.0 122.5 123.0 123.5 124.0 124.5
 29 SS 123.0 110 2.65 1.5
 30 ST 125.0 800. 2.65 1.5
 31 ZZ

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT
 LINE (V) ROUTING (--->) DIVERSION OR PUMP FLOW
 NO. (.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW
 14 BASIN
 V
 V
 22 RESERVOI

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

 *
 * FLOOD HYDROGRAPH PACKAGE (HEC-1) *
 * FEBRUARY 1981 *
 * REVISED 02 AUG 88 *
 *
 * RUN DATE 03/08/1994 TIME 16:28:24 *
 *

 *
 * U.S. ARMY CORPS OF ENGINEERS *
 * THE HYDROLOGIC ENGINEERING CENTER *
 * 609 SECOND STREET *
 * DAVIS, CALIFORNIA 95616 *
 * (916) 551-1748 *
 *

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 53.5406.H12

SEMINOLE ELECTRIC COOP, INC., HARDEE POWER STATION UNIT 3
PROJECT NO. 23930.030
SITE RUNOFF DETENTION BASIN

6 IO OUTPUT CONTROL VARIABLES
 IPRNT 0 PRINT CONTROL
 IPLOT 0 PLOT CONTROL
 QSCAL 0. HYDROGRAPH PLOT SCALE

8 IN TIME DATA FOR INPUT TIME SERIES
 JXMIN 30 TIME INTERVAL IN MINUTES
 JXDATE 1 0 STARTING DATE
 JXTIME 0 0 STARTING TIME

IT HYDROGRAPH TIME DATA
 NMIN 5 MINUTES IN COMPUTATION INTERVAL
 IDATE 1 0 STARTING DATE
 ITIME 0000 STARTING TIME
 NQ 300 NUMBER OF HYDROGRAPH ORDINATES
 NDDATE 2 0 ENDING DATE
 NDTIME 0055 ENDING TIME
 ICENT 19 CENTURY MARK

 COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS
 DRAINAGE AREA SQUARE MILES
 PRECIPITATION DEPTH INCHES
 LENGTH, ELEVATION FEET
 FLOW CUBIC FEET PER SECOND
 STORAGE VOLUME ACRE-Feet
 SURFACE AREA ACRES
 TEMPERATURE DEGREES FAHRENHEIT

*** **

14 KK *****
 * *
 * BASIN * INFLOW
 * *

RUNOFF USING SCS LOSSES & DIMENSIONLESS UNIT HYDROGRAPH

PAGE 46 of 65
52.5406.H12

16 KO OUTPUT CONTROL VARIABLES
 IPRNT 0 PRINT CONTROL
 IPLOT 0 PLOT CONTROL
 QSCAL 0. HYDROGRAPH PLOT SCALE

SUBBASIN RUNOFF DATA

17 BA SUBBASIN CHARACTERISTICS
 TAREA .06 SUBBASIN AREA

PRECIPITATION DATA

18 PR RECORDING STATIONS 999
 19 PW WEIGHTS 1.00

20 LS SCS LOSS RATE
 STRTL .24 INITIAL ABSTRACTION
 CRVNR 89.20 CURVE NUMBER
 RTIMP .00 PERCENT IMPERVIOUS AREA

21 UD SCS DIMENSIONLESS UNITGRAPH
 TLAG .44 LAG

PRECIPITATION STATION DATA

STATION	TOTAL	AVG. ANNUAL	WEIGHT
999	8.42	.00	1.00

TEMPORAL DISTRIBUTIONS

STATION	999	WEIGHT =	1.00							
.00	.00	.00	.00	.00	.00	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02
.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02
.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02
.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02
.03	.03	.03	.03	.03	.03	.03	.04	.03	.03	.03
.04	.03	.05	.04	.05	.05	.04	.05	.07	.07	.07
.07	.07	.07	.07	.42	.42	.42	.42	.42	.42	.42
.16	.16	.16	.16	.16	.16	.05	.05	.05	.05	.05

.05	.05	.04	.04	.04	.04	.04	.04	.03	.03
.03	.03	.03	.03	.03	.03	.03	.03	.03	.03
.02	.02	.02	.02	.02	.02	.02	.02	.02	.02
.02	.02	.02	.02	.02	.02	.02	.02	.02	.02
.02	.02	.02	.02	.01	.02	.01	.01	.02	.01
.01	.02	.01	.01	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01

UNIT HYDROGRAPH
28 END-OF-PERIOD ORDINATES

5.	16.	32.	52.	62.	64.	59.	51.	39.	28.
21.	16.	12.	9.	7.	5.	4.	3.	2.	
1.	1.	1.	1.	0.	0.	0.	0.		

HYDROGRAPH AT STATION BASIN

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	*	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
1	0000	1	.00	.00	.00	0.	*	1	1230	151	.42	.02	.40	104.		
1	0005	2	.00	.00	.00	0.	*	1	1235	152	.16	.01	.15	123.		
1	0010	3	.00	.00	.00	0.	*	1	1240	153	.16	.01	.15	136.		
1	0015	4	.00	.00	.00	0.	*	1	1245	154	.16	.01	.15	142.		
1	0020	5	.00	.00	.00	0.	*	1	1250	155	.16	.01	.15	139.		
1	0025	6	.00	.00	.00	0.	*	1	1255	156	.16	.00	.15	132.		
1	0030	7	.00	.00	.00	0.	*	1	1300	157	.16	.00	.15	122.		
1	0035	8	.01	.01	.00	0.	*	1	1305	158	.05	.00	.05	111.		
1	0040	9	.01	.01	.00	0.	*	1	1310	159	.05	.00	.05	101.		
1	0045	10	.01	.01	.00	0.	*	1	1315	160	.05	.00	.05	90.		
1	0050	11	.01	.01	.00	0.	*	1	1320	161	.05	.00	.05	80.		
1	0055	12	.01	.01	.00	0.	*	1	1325	162	.05	.00	.05	70.		
1	0100	13	.01	.01	.00	0.	*	1	1330	163	.05	.00	.05	61.		
1	0105	14	.01	.01	.00	0.	*	1	1335	164	.04	.00	.04	53.		
1	0110	15	.01	.01	.00	0.	*	1	1340	165	.04	.00	.04	46.		
1	0115	16	.01	.01	.00	0.	*	1	1345	166	.04	.00	.04	40.		
1	0120	17	.01	.01	.00	0.	*	1	1350	167	.04	.00	.04	36.		
1	0125	18	.01	.01	.00	0.	*	1	1355	168	.04	.00	.04	32.		
1	0130	19	.01	.01	.00	0.	*	1	1400	169	.04	.00	.04	29.		
1	0135	20	.01	.01	.00	0.	*	1	1405	170	.03	.00	.03	27.		

← PEAK INFLOW

1	0140	21	.01	.01	.00	0.	*	1	1410	171	.03	.00	.03	25.
1	0145	22	.01	.01	.00	0.	*	1	1415	172	.03	.00	.03	23.
1	0150	23	.01	.01	.00	0.	*	1	1420	173	.03	.00	.03	21.
1	0155	24	.01	.01	.00	0.	*	1	1425	174	.03	.00	.03	20.
1	0200	25	.01	.01	.00	0.	*	1	1430	175	.03	.00	.03	19.
1	0205	26	.01	.01	.00	0.	*	1	1435	176	.03	.00	.03	18.
1	0210	27	.01	.01	.00	0.	*	1	1440	177	.03	.00	.03	17.
1	0215	28	.01	.01	.00	0.	*	1	1445	178	.03	.00	.03	16.
1	0220	29	.01	.01	.00	0.	*	1	1450	179	.03	.00	.03	15.
1	0225	30	.01	.01	.00	0.	*	1	1455	180	.03	.00	.03	15.
1	0230	31	.01	.01	.00	0.	*	1	1500	181	.03	.00	.03	14.
1	0235	32	.01	.01	.00	0.	*	1	1505	182	.02	.00	.02	14.
1	0240	33	.01	.01	.00	0.	*	1	1510	183	.02	.00	.02	14.
1	0245	34	.01	.01	.00	0.	*	1	1515	184	.02	.00	.02	13.
1	0250	35	.01	.01	.00	0.	*	1	1520	185	.02	.00	.02	13.
1	0255	36	.01	.01	.00	0.	*	1	1525	186	.02	.00	.02	12.
1	0300	37	.01	.01	.00	0.	*	1	1530	187	.02	.00	.02	12.
1	0305	38	.01	.01	.00	0.	*	1	1535	188	.02	.00	.02	12.
1	0310	39	.01	.01	.00	0.	*	1	1540	189	.02	.00	.02	11.
1	0315	40	.01	.01	.00	0.	*	1	1545	190	.02	.00	.02	11.
1	0320	41	.01	.01	.00	0.	*	1	1550	191	.02	.00	.02	11.
1	0325	42	.01	.01	.00	0.	*	1	1555	192	.02	.00	.02	11.
1	0330	43	.01	.01	.00	0.	*	1	1600	193	.02	.00	.02	11.
1	0335	44	.01	.01	.00	0.	*	1	1605	194	.02	.00	.02	11.
1	0340	45	.01	.01	.00	0.	*	1	1610	195	.02	.00	.02	11.
1	0345	46	.01	.01	.00	0.	*	1	1615	196	.02	.00	.02	10.
1	0350	47	.01	.01	.00	0.	*	1	1620	197	.02	.00	.02	10.
1	0355	48	.01	.01	.00	1.	*	1	1625	198	.02	.00	.02	10.
1	0400	49	.01	.01	.00	1.	*	1	1630	199	.02	.00	.02	10.
1	0405	50	.01	.01	.00	1.	*	1	1635	200	.02	.00	.02	10.
1	0410	51	.01	.01	.00	1.	*	1	1640	201	.02	.00	.02	9.
1	0415	52	.01	.01	.00	1.	*	1	1645	202	.02	.00	.02	9.
1	0420	53	.01	.01	.00	1.	*	1	1650	203	.02	.00	.02	9.
1	0425	54	.01	.01	.00	1.	*	1	1655	204	.02	.00	.02	9.
1	0430	55	.01	.01	.00	1.	*	1	1700	205	.02	.00	.02	9.
1	0435	56	.01	.01	.00	1.	*	1	1705	206	.01	.00	.01	8.
1	0440	57	.01	.01	.00	1.	*	1	1710	207	.02	.00	.01	8.
1	0445	58	.01	.01	.00	1.	*	1	1715	208	.01	.00	.01	8.
1	0450	59	.01	.01	.00	1.	*	1	1720	209	.01	.00	.01	8.
1	0455	60	.01	.01	.00	1.	*	1	1725	210	.02	.00	.01	8.
1	0500	61	.01	.01	.00	1.	*	1	1730	211	.01	.00	.01	8.
1	0505	62	.01	.01	.00	2.	*	1	1735	212	.01	.00	.01	8.
1	0510	63	.01	.01	.00	2.	*	1	1740	213	.02	.00	.01	8.
1	0515	64	.01	.01	.01	2.	*	1	1745	214	.01	.00	.01	7.
1	0520	65	.01	.01	.01	2.	*	1	1750	215	.01	.00	.01	7.
1	0525	66	.01	.01	.01	2.	*	1	1755	216	.02	.00	.01	7.
1	0530	67	.01	.01	.01	2.	*	1	1800	217	.01	.00	.01	7.
1	0535	68	.01	.01	.01	2.	*	1	1805	218	.01	.00	.01	7.
1	0540	69	.01	.01	.01	2.	*	1	1810	219	.01	.00	.01	7.

1	0545	70	.01	.01	.01	2.	*	1	1815	220	.01	.00	.01	7.
1	0550	71	.01	.01	.01	2.	*	1	1820	221	.01	.00	.01	7.
1	0555	72	.01	.01	.01	3.	*	1	1825	222	.01	.00	.01	7.
1	0600	73	.01	.01	.01	3.	*	1	1830	223	.01	.00	.01	7.
1	0605	74	.01	.01	.01	3.	*	1	1835	224	.01	.00	.01	7.
1	0610	75	.01	.01	.01	3.	*	1	1840	225	.01	.00	.01	7.
1	0615	76	.01	.01	.01	3.	*	1	1845	226	.01	.00	.01	7.
1	0620	77	.01	.01	.01	3.	*	1	1850	227	.01	.00	.01	7.
1	0625	78	.01	.01	.01	3.	*	1	1855	228	.01	.00	.01	7.
1	0630	79	.01	.01	.01	3.	*	1	1900	229	.01	.00	.01	7.
1	0635	80	.01	.01	.01	3.	*	1	1905	230	.01	.00	.01	7.
1	0640	81	.01	.01	.01	3.	*	1	1910	231	.01	.00	.01	6.
1	0645	82	.01	.01	.01	3.	*	1	1915	232	.01	.00	.01	6.
1	0650	83	.01	.01	.01	3.	*	1	1920	233	.01	.00	.01	6.
1	0655	84	.01	.01	.01	3.	*	1	1925	234	.01	.00	.01	6.
1	0700	85	.01	.01	.01	3.	*	1	1930	235	.01	.00	.01	6.
1	0705	86	.01	.01	.01	3.	*	1	1935	236	.01	.00	.01	6.
1	0710	87	.02	.01	.01	3.	*	1	1940	237	.01	.00	.01	6.
1	0715	88	.01	.01	.01	4.	*	1	1945	238	.01	.00	.01	6.
1	0720	89	.01	.01	.01	4.	*	1	1950	239	.01	.00	.01	6.
1	0725	90	.02	.01	.01	4.	*	1	1955	240	.01	.00	.01	6.
1	0730	91	.01	.01	.01	4.	*	1	2000	241	.01	.00	.01	6.
1	0735	92	.02	.01	.01	4.	*	1	2005	242	.01	.00	.01	6.
1	0740	93	.02	.01	.01	4.	*	1	2010	243	.01	.00	.01	6.
1	0745	94	.02	.01	.01	4.	*	1	2015	244	.01	.00	.01	6.
1	0750	95	.02	.01	.01	4.	*	1	2020	245	.01	.00	.01	6.
1	0755	96	.02	.01	.01	4.	*	1	2025	246	.01	.00	.01	6.
1	0800	97	.02	.01	.01	5.	*	1	2030	247	.01	.00	.01	6.
1	0805	98	.02	.01	.01	5.	*	1	2035	248	.01	.00	.01	6.
1	0810	99	.02	.01	.01	5.	*	1	2040	249	.01	.00	.01	6.
1	0815	100	.02	.01	.01	5.	*	1	2045	250	.01	.00	.01	6.
1	0820	101	.02	.01	.01	5.	*	1	2050	251	.01	.00	.01	6.
1	0825	102	.02	.01	.01	5.	*	1	2055	252	.01	.00	.01	5.
1	0830	103	.02	.01	.01	5.	*	1	2100	253	.01	.00	.01	5.
1	0835	104	.02	.01	.01	5.	*	1	2105	254	.01	.00	.01	5.
1	0840	105	.02	.01	.01	5.	*	1	2110	255	.01	.00	.01	5.
1	0845	106	.02	.01	.01	5.	*	1	2115	256	.01	.00	.01	5.
1	0850	107	.02	.01	.01	6.	*	1	2120	257	.01	.00	.01	5.
1	0855	108	.02	.01	.01	6.	*	1	2125	258	.01	.00	.01	5.
1	0900	109	.02	.01	.01	6.	*	1	2130	259	.01	.00	.01	5.
1	0905	110	.02	.01	.02	6.	*	1	2135	260	.01	.00	.01	5.
1	0910	111	.02	.01	.02	6.	*	1	2140	261	.01	.00	.01	5.
1	0915	112	.02	.01	.02	7.	*	1	2145	262	.01	.00	.01	5.
1	0920	113	.02	.01	.02	7.	*	1	2150	263	.01	.00	.01	5.
1	0925	114	.02	.01	.02	7.	*	1	2155	264	.01	.00	.01	5.
1	0930	115	.02	.01	.02	7.	*	1	2200	265	.01	.00	.01	5.
1	0935	116	.02	.01	.02	7.	*	1	2205	266	.01	.00	.01	5.
1	0940	117	.02	.01	.02	7.	*	1	2210	267	.01	.00	.01	5.
1	0945	118	.02	.01	.02	8.	*	1	2215	268	.01	.00	.01	5.

1	0950	119	.02	.01	.02	8.	*	1	2220	269	.01	.00	.01	5.
1	0955	120	.02	.01	.02	8.	*	1	2225	270	.01	.00	.01	5.
1	1000	121	.02	.01	.02	8.	*	1	2230	271	.01	.00	.01	5.
1	1005	122	.03	.01	.02	8.	*	1	2235	272	.01	.00	.01	5.
1	1010	123	.03	.01	.02	8.	*	1	2240	273	.01	.00	.01	5.
1	1015	124	.03	.01	.02	9.	*	1	2245	274	.01	.00	.01	5.
1	1020	125	.03	.01	.02	9.	*	1	2250	275	.01	.00	.01	5.
1	1025	126	.03	.01	.02	9.	*	1	2255	276	.01	.00	.01	5.
1	1030	127	.03	.01	.02	10.	*	1	2300	277	.01	.00	.01	5.
1	1035	128	.03	.01	.03	10.	*	1	2305	278	.01	.00	.01	5.
1	1040	129	.04	.01	.03	10.	*	1	2310	279	.01	.00	.01	5.
1	1045	130	.03	.01	.03	11.	*	1	2315	280	.01	.00	.01	5.
1	1050	131	.03	.01	.03	11.	*	1	2320	281	.01	.00	.01	5.
1	1055	132	.04	.01	.03	12.	*	1	2325	282	.01	.00	.01	5.
1	1100	133	.03	.01	.03	12.	*	1	2330	283	.01	.00	.01	4.
1	1105	134	.05	.01	.04	13.	*	1	2335	284	.01	.00	.01	4.
1	1110	135	.04	.01	.04	13.	*	1	2340	285	.01	.00	.01	4.
1	1115	136	.05	.01	.04	14.	*	1	2345	286	.01	.00	.01	4.
1	1120	137	.05	.01	.04	14.	*	1	2350	287	.01	.00	.01	4.
1	1125	138	.04	.01	.04	15.	*	1	2355	288	.01	.00	.01	4.
1	1130	139	.05	.01	.04	16.	*	2	0000	289	.01	.00	.01	4.
1	1135	140	.07	.01	.06	17.	*	2	0005	290	.01	.00	.01	4.
1	1140	141	.07	.01	.06	17.	*	2	0010	291	.01	.00	.01	4.
1	1145	142	.07	.01	.06	19.	*	2	0015	292	.01	.00	.01	4.
1	1150	143	.07	.01	.06	20.	*	2	0020	293	.01	.00	.01	4.
1	1155	144	.07	.01	.06	22.	*	2	0025	294	.01	.00	.01	4.
1	1200	145	.07	.01	.06	23.	*	2	0030	295	.01	.00	.01	4.
1	1205	146	.42	.04	.38	27.	*	2	0035	296	.00	.00	.00	4.
1	1210	147	.42	.03	.38	33.	*	2	0040	297	.00	.00	.00	3.
1	1215	148	.42	.03	.39	44.	*	2	0045	298	.00	.00	.00	3.
1	1220	149	.42	.02	.39	62.	*	2	0050	299	.00	.00	.00	3.
1	1225	150	.42	.02	.40	82.	*	2	0055	300	.00	.00	.00	2.

TOTAL RAINFALL = 8.42, TOTAL LOSS = 1.30, TOTAL EXCESS = 7.12

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
(CFS)	(HR)	6-HR	24-HR	72-HR	24.92-HR
+	142.	12.75	36.	12.	12.
		(CFS)	5.261	7.106	7.106
		(INCHES)	18.	24.	24.
		(AC-FT)			
CUMULATIVE AREA =		.06 SQ MI			

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22 KK

* RESERVOI * R
* *

RESERVOIR ROUTING

HYDROGRAPH ROUTING DATA

24 RS

STORAGE ROUTING

NSTPS 1 NUMBER OF SUBREACHES
ITYP ELEV TYPE OF INITIAL CONDITION
RSVRIC 120.60 INITIAL CONDITION
X .00 WORKING R AND D COEFFICIENT

25 SV

STORAGE .0 1.4 5.2 9.0 13.1 17.3

26 SE

ELEVATION 120.60 121.00 122.00 123.00 124.00 125.00

27 SQ

DISCHARGE 0. 0. 4. 27. 60. 93. 115. 237. 448. 709.

28 SE

ELEVATION 119.80 120.80 121.00 121.50 122.00 122.50 123.00 123.50 124.00 124.50

29 SS

SPILLWAY

CREL 123.00 SPILLWAY CREST ELEVATION
SPWID 110.00 SPILLWAY WIDTH
COQW 2.65 WEIR COEFFICIENT
EXPW 1.50 EXPONENT OF HEAD

30 ST

TOP OF DAM

TOPEL 125.00 ELEVATION AT TOP OF DAM
DAMWID 800.00 DAM WIDTH
COQD 2.65 WEIR COEFFICIENT
EXPD 1.50 EXPONENT OF HEAD

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

(INCLUDING FLOW OVER DAM)

STORAGE	.00	.00	.72	1.44	3.30	5.15	7.09	9.03	11.06	13.08
OUTFLOW	.00	.30	.38	4.45	26.88	59.75	93.00	114.99	237.04	447.50
ELEVATION	119.80	120.60	120.80	121.00	121.50	122.00	122.50	123.00	123.50	124.00

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STORAGE	15.19	17.30
OUTFLOW	708.50	969.50
ELEVATION	124.50	125.00

HYDROGRAPH AT STATION RESERVOI

* DA MON HRMN ORD						* DA MON HRMN ORD						* DA MON HRMN ORD					
OUTFLOW	STORAGE	STAGE	OUTFLOW	STORAGE	STAGE	OUTFLOW	STORAGE	STAGE	OUTFLOW	STORAGE	STAGE	OUTFLOW	STORAGE	STAGE	OUTFLOW	STORAGE	STAGE
1	0000	1	0.	.0	120.6	1	0820	101	1.	.8	120.8	1	1640	201	14.	2.2	121.2
1	0005	2	0.	.0	120.6	1	0825	102	1.	.8	120.8	1	1645	202	14.	2.2	121.2
1	0010	3	0.	.0	120.6	1	0830	103	1.	.9	120.8	1	1650	203	13.	2.2	121.2
1	0015	4	0.	.0	120.6	1	0835	104	1.	.9	120.8	1	1655	204	13.	2.1	121.2
1	0020	5	0.	.0	120.6	1	0840	105	1.	.9	120.9	1	1700	205	13.	2.1	121.2
1	0025	6	0.	.0	120.6	1	0845	106	2.	.9	120.9	1	1705	206	12.	2.1	121.2
1	0030	7	0.	.0	120.6	1	0850	107	2.	1.0	120.9	1	1710	207	12.	2.1	121.2
1	0035	8	0.	.0	120.6	1	0855	108	2.	1.0	120.9	1	1715	208	12.	2.0	121.2
1	0040	9	0.	.0	120.6	1	0900	109	2.	1.0	120.9	1	1720	209	11.	2.0	121.2
1	0045	10	0.	.0	120.6	1	0905	110	2.	1.0	120.9	1	1725	210	11.	2.0	121.1
1	0050	11	0.	.0	120.6	1	0910	111	2.	1.1	120.9	1	1730	211	11.	2.0	121.1
1	0055	12	0.	.0	120.6	1	0915	112	2.	1.1	120.9	1	1735	212	11.	2.0	121.1
1	0100	13	0.	.0	120.6	1	0920	113	3.	1.1	120.9	1	1740	213	10.	1.9	121.1
1	0105	14	0.	.0	120.6	1	0925	114	3.	1.1	120.9	1	1745	214	10.	1.9	121.1
1	0110	15	0.	.0	120.6	1	0930	115	3.	1.2	120.9	1	1750	215	10.	1.9	121.1
1	0115	16	0.	.0	120.6	1	0935	116	3.	1.2	120.9	1	1755	216	10.	1.9	121.1
1	0120	17	0.	.0	120.6	1	0940	117	3.	1.2	120.9	1	1800	217	10.	1.9	121.1
1	0125	18	0.	.0	120.6	1	0945	118	3.	1.3	120.9	1	1805	218	9.	1.8	121.1
1	0130	19	0.	.0	120.6	1	0950	119	4.	1.3	121.0	1	1810	219	9.	1.8	121.1
1	0135	20	0.	.0	120.6	1	0955	120	4.	1.3	121.0	1	1815	220	9.	1.8	121.1
1	0140	21	0.	.0	120.6	1	1000	121	4.	1.3	121.0	1	1820	221	9.	1.8	121.1
1	0145	22	0.	.0	120.6	1	1005	122	4.	1.4	121.0	1	1825	222	9.	1.8	121.1
1	0150	23	0.	.0	120.6	1	1010	123	4.	1.4	121.0	1	1830	223	9.	1.8	121.1
1	0155	24	0.	.0	120.6	1	1015	124	4.	1.4	121.0	1	1835	224	8.	1.8	121.1
1	0200	25	0.	.0	120.6	1	1020	125	5.	1.4	121.0	1	1840	225	8.	1.8	121.1
1	0205	26	0.	.0	120.6	1	1025	126	5.	1.5	121.0	1	1845	226	8.	1.8	121.1
1	0210	27	0.	.0	120.6	1	1030	127	5.	1.5	121.0	1	1850	227	8.	1.7	121.1
1	0215	28	0.	.0	120.6	1	1035	128	6.	1.5	121.0	1	1855	228	8.	1.7	121.1
1	0220	29	0.	.0	120.6	1	1040	129	6.	1.6	121.0	1	1900	229	8.	1.7	121.1
1	0225	30	0.	.0	120.6	1	1045	130	6.	1.6	121.0	1	1905	230	8.	1.7	121.1
1	0230	31	0.	.0	120.6	1	1050	131	7.	1.6	121.1	1	1910	231	8.	1.7	121.1
1	0235	32	0.	.0	120.6	1	1055	132	7.	1.7	121.1	1	1915	232	8.	1.7	121.1
1	0240	33	0.	.0	120.6	1	1100	133	7.	1.7	121.1	1	1920	233	7.	1.7	121.1
1	0245	34	0.	.0	120.6	1	1105	134	8.	1.7	121.1	1	1925	234	7.	1.7	121.1
1	0250	35	0.	.0	120.6	1	1110	135	8.	1.8	121.1	1	1930	235	7.	1.7	121.1
1	0255	36	0.	.0	120.6	1	1115	136	9.	1.8	121.1	1	1935	236	7.	1.7	121.1
1	0300	37	0.	.0	120.6	1	1120	137	9.	1.8	121.1	1	1940	237	7.	1.7	121.1

1	0305	38	0.	.0	120.6	*	1	1125	138	10.	1.9	121.1	*	1	1945	238	7.	1.6	121.1
1	0310	39	0.	.0	120.6	*	1	1130	139	10.	1.9	121.1	*	1	1950	239	7.	1.6	121.1
1	0315	40	0.	.0	120.6	*	1	1135	140	10.	1.9	121.1	*	1	1955	240	7.	1.6	121.1
1	0320	41	0.	.0	120.6	*	1	1140	141	11.	2.0	121.1	*	1	2000	241	7.	1.6	121.1
1	0325	42	0.	.0	120.6	*	1	1145	142	12.	2.0	121.2	*	1	2005	242	7.	1.6	121.1
1	0330	43	0.	.0	120.6	*	1	1150	143	12.	2.1	121.2	*	1	2010	243	7.	1.6	121.0
1	0335	44	0.	.0	120.6	*	1	1155	144	13.	2.1	121.2	*	1	2015	244	7.	1.6	121.0
1	0340	45	0.	.0	120.6	*	1	1200	145	14.	2.2	121.2	*	1	2020	245	7.	1.6	121.0
1	0345	46	0.	.0	120.6	*	1	1205	146	15.	2.3	121.2	*	1	2025	246	7.	1.6	121.0
1	0350	47	0.	.0	120.6	*	1	1210	147	16.	2.4	121.3	*	1	2030	247	7.	1.6	121.0
1	0355	48	0.	.0	120.6	*	1	1215	148	18.	2.5	121.3	*	1	2035	248	6.	1.6	121.0
1	0400	49	0.	.0	120.6	*	1	1220	149	20.	2.8	121.4	*	1	2040	249	6.	1.6	121.0
1	0405	50	0.	.0	120.6	*	1	1225	150	24.	3.1	121.4	*	1	2045	250	6.	1.6	121.0
1	0410	51	0.	.0	120.6	*	1	1230	151	31.	3.5	121.6	*	1	2050	251	6.	1.6	121.0
1	0415	52	0.	.0	120.6	*	1	1235	152	41.	4.1	121.7	*	1	2055	252	6.	1.6	121.0
1	0420	53	0.	.0	120.6	*	1	1240	153	51.	4.6	121.9	*	1	2100	253	6.	1.6	121.0
1	0425	54	0.	.0	120.6	*	1	1245	154	61.	5.2	122.0	*	1	2105	254	6.	1.6	121.0
1	0430	55	0.	.0	120.6	*	1	1250	155	70.	5.7	122.2	*	1	2110	255	6.	1.6	121.0
1	0435	56	0.	.0	120.6	*	1	1255	156	77.	6.2	122.3	*	1	2115	256	6.	1.6	121.0
1	0440	57	0.	.0	120.6	*	1	1300	157	83.	6.5	122.3	*	1	2120	257	6.	1.6	121.0
1	0445	58	0.	.0	120.6	*	1	1305	158	87.	6.7	122.4	*	1	2125	258	6.	1.6	121.0
1	0450	59	0.	.1	120.6	*	1	1310	159	89.	6.8	122.4	*	1	2130	259	6.	1.5	121.0
1	0455	60	0.	.1	120.6	*	1	1315	160	90.	6.9	122.4	*	1	2135	260	6.	1.5	121.0
1	0500	61	0.	.1	120.6	*	1	1320	161	89.	6.9	122.4	*	1	2140	261	6.	1.5	121.0
1	0505	62	0.	.1	120.6	*	1	1325	162	87.	6.8	122.4	*	1	2145	262	6.	1.5	121.0
1	0510	63	0.	.1	120.6	*	1	1330	163	85.	6.6	122.4	*	1	2150	263	6.	1.5	121.0
1	0515	64	0.	.1	120.6	*	1	1335	164	82.	6.4	122.3	*	1	2155	264	5.	1.5	121.0
1	0520	65	0.	.1	120.6	*	1	1340	165	78.	6.2	122.3	*	1	2200	265	5.	1.5	121.0
1	0525	66	0.	.1	120.6	*	1	1345	166	74.	6.0	122.2	*	1	2205	266	5.	1.5	121.0
1	0530	67	0.	.1	120.6	*	1	1350	167	70.	5.8	122.2	*	1	2210	267	5.	1.5	121.0
1	0535	68	0.	.1	120.6	*	1	1355	168	66.	5.5	122.1	*	1	2215	268	5.	1.5	121.0
1	0540	69	0.	.1	120.6	*	1	1400	169	62.	5.3	122.0	*	1	2220	269	5.	1.5	121.0
1	0545	70	0.	.2	120.6	*	1	1405	170	58.	5.1	122.0	*	1	2225	270	5.	1.5	121.0
1	0550	71	0.	.2	120.6	*	1	1410	171	54.	4.9	121.9	*	1	2230	271	5.	1.5	121.0
1	0555	72	0.	.2	120.7	*	1	1415	172	51.	4.7	121.9	*	1	2235	272	5.	1.5	121.0
1	0600	73	0.	.2	120.7	*	1	1420	173	48.	4.5	121.8	*	1	2240	273	5.	1.5	121.0
1	0605	74	0.	.2	120.7	*	1	1425	174	45.	4.3	121.8	*	1	2245	274	5.	1.5	121.0
1	0610	75	0.	.2	120.7	*	1	1430	175	42.	4.1	121.7	*	1	2250	275	5.	1.5	121.0
1	0615	76	0.	.3	120.7	*	1	1435	176	39.	4.0	121.7	*	1	2255	276	5.	1.5	121.0
1	0620	77	0.	.3	120.7	*	1	1440	177	37.	3.8	121.6	*	1	2300	277	5.	1.5	121.0
1	0625	78	0.	.3	120.7	*	1	1445	178	34.	3.7	121.6	*	1	2305	278	5.	1.5	121.0
1	0630	79	0.	.3	120.7	*	1	1450	179	32.	3.6	121.6	*	1	2310	279	5.	1.5	121.0
1	0635	80	0.	.3	120.7	*	1	1455	180	30.	3.5	121.6	*	1	2315	280	5.	1.5	121.0
1	0640	81	0.	.3	120.7	*	1	1500	181	28.	3.4	121.5	*	1	2320	281	5.	1.5	121.0
1	0645	82	0.	.4	120.7	*	1	1505	182	27.	3.3	121.5	*	1	2325	282	5.	1.5	121.0
1	0650	83	0.	.4	120.7	*	1	1510	183	26.	3.2	121.5	*	1	2330	283	5.	1.5	121.0
1	0655	84	0.	.4	120.7	*	1	1515	184	25.	3.1	121.5	*	1	2335	284	5.	1.5	121.0
1	0700	85	0.	.4	120.7	*	1	1520	185	24.	3.0	121.4	*	1	2340	285	5.	1.5	121.0
1	0705	86	0.	.4	120.7	*	1	1525	186	23.	3.0	121.4	*	1	2345	286	5.	1.5	121.0

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1	0710	87	0.	.5	120.7	*	1	1530	187	22.	2.9	121.4	*	1	2350	287	5.	1.5	121.0
1	0715	88	0.	.5	120.7	*	1	1535	188	21.	2.8	121.4	*	1	2355	288	5.	1.5	121.0
1	0720	89	0.	.5	120.7	*	1	1540	189	21.	2.8	121.4	*	2	0000	289	5.	1.5	121.0
1	0725	90	0.	.5	120.7	*	1	1545	190	20.	2.7	121.3	*	2	0005	290	5.	1.5	121.0
1	0730	91	0.	.5	120.8	*	1	1550	191	19.	2.7	121.3	*	2	0010	291	5.	1.4	121.0
1	0735	92	0.	.6	120.8	*	1	1555	192	18.	2.6	121.3	*	2	0015	292	5.	1.4	121.0
1	0740	93	0.	.6	120.8	*	1	1600	193	18.	2.5	121.3	*	2	0020	293	4.	1.4	121.0
1	0745	94	0.	.6	120.8	*	1	1605	194	17.	2.5	121.3	*	2	0025	294	4.	1.4	121.0
1	0750	95	0.	.6	120.8	*	1	1610	195	17.	2.5	121.3	*	2	0030	295	4.	1.4	121.0
1	0755	96	0.	.7	120.8	*	1	1615	196	16.	2.4	121.3	*	2	0035	296	4.	1.4	121.0
1	0800	97	0.	.7	120.8	*	1	1620	197	16.	2.4	121.3	*	2	0040	297	4.	1.4	121.0
1	0805	98	0.	.7	120.8	*	1	1625	198	15.	2.3	121.2	*	2	0045	298	4.	1.4	121.0
1	0810	99	1.	.8	120.8	*	1	1630	199	15.	2.3	121.2	*	2	0050	299	4.	1.4	121.0
1	0815	100	1.	.8	120.8	*	1	1635	200	14.	2.3	121.2	*	2	0055	300	4.	1.4	121.0

PEAK OUTFLOW IS 90. AT TIME 13.25 HOURS

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
(CFS)	(HR)	6-HR	24-HR	72-HR	24.92-HR
90.	13.25	35.	11.	11.	11.
(INCHES)		5.156	6.684	6.685	6.685
(AC-FT)		18.	23.	23.	23.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
(AC-FT)	(HR)	6-HR	24-HR	72-HR	24.92-HR
7.	13.25	4.	2.	2.	2.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
(FEET)	(HR)	6-HR	24-HR	72-HR	24.92-HR
122.45	13.25	121.59	121.05	121.03	121.03

CUMULATIVE AREA = .06 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
				6-HOUR	24-HOUR	72-HOUR			
+									

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+	HYDROGRAPH AT	BASIN	142.	12.75	36.	12.	12.	.06		
+	ROUTED TO	RESERVOI	90.	13.25	35.	11.	11.	.06	122.45	13.25
+										
1	SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION RESERVOI									

PLAN 1		INITIAL VALUE	SPILLWAY CREST		TOP OF DAM	
	ELEVATION	120.60	123.00		125.00	
	STORAGE	0.	9.		17.	
	OUTFLOW	0.	115.		970.	

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	122.45	.00	7.	90.	.00	13.25	.00

*** NORMAL END OF HEC-1 ***

SUMMARY

Owner:	Seminole Electric Coop. Inc.	Computed By:	Joe P. Bauer
Plant:	Hardee Power Station Unit 3	Date:	2-24-94
Project #:	23930.050 52.5406. H/2	Checked By:	<i>[Signature]</i>
Title:	Storm Water Detention Basin	Date:	3-7-94
	POST-DEVELOPMENT	Page:	57 of 65

The following is the final data on the Storm Water Detention Basin.

- Basin Dimensions: 230 feet x 650 feet
- Control Elevation: 119.80 feet (4" orifice)
- Overflow Elevation: 120.80 feet (15' weir)
- Spillway Elevation: 123.00 feet (110' weir)
- Top of Berm Elevation: 125.00 feet
- Littoral Zone @ 35%: 230 feet x 230 feet

- Max. Surface Elev.: 122.45 feet (25 year storm)

- Pre-development Peak Flow Rate: 111 cfs
- Post-development Peak Flow Rate: 90 cfs

APPENDIX

Table 2-2c.—Runoff curve numbers for other agricultural lands¹

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. ²	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. ³	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods—grass combination (orchard or tree farm). ⁵	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. ⁶	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

¹Average runoff condition, and $I_a = 0.2S$.

²Poor: < 50% ground cover or heavily grazed with no mulch.

Fair: 50 to 75% ground cover and not heavily grazed.

Good: > 75% ground cover and lightly or only occasionally grazed.

³Poor: < 50% ground cover.

Fair: 50 to 75% ground cover.

Good: > 75% ground cover.

⁴Actual curve number is less than 30; use CN = 30 for runoff computations.

⁵CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

⁶Poor: Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.

Fair: Woods are grazed but not burned, and some forest litter covers the soil.

Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Table 2-2d.—Runoff curve numbers for arid and semiarid rangelands¹

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition ²	A ³	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, creosote, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

¹Average runoff condition, and $I_a = 0.2S$. For range in humid regions, use table 2-2c.²Poor: < 30% ground cover (litter, grass, and brush overstory).

Fair: 30 to 70% ground cover.

Good: > 70% ground cover.

³Curve numbers for group A have been developed only for desert shrub.

Sheet flow

Sheet flow is flow over plane surfaces. It usually occurs in the headwater of streams. With sheet flow, the friction value (Manning's n) is an effective roughness coefficient that includes the effect of raindrop impact; drag over the plane surface; obstacles such as litter, crop ridges, and rocks; and erosion and transportation of sediment. These n values are for very shallow flow depths of about 0.1 foot or so. Table 3-1 gives Manning's n values for sheet flow for various surface conditions.

For sheet flow of less than 300 feet, use Manning's kinematic solution (Overton and Meadows 1976) to compute T_t :

$$T_t = \frac{0.007 (nL)^{0.8}}{(P_2)^{0.5} s^{0.4}} \quad [\text{Eq. 3-3}]$$

Table 3-1.—Roughness coefficients (Manning's n) for sheet flow

Surface description	n^1
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover $\leq 20\%$	0.06
Residue cover $> 20\%$	0.17
Grass:	
Short grass prairie	0.15
Dense grasses ²	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods: ³	
Light underbrush	0.40
Dense underbrush	0.80

¹The n values are a composite of information compiled by Engman (1986).

²Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.

³When selecting n , consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

where

T_t = travel time (hr),

n = Manning's roughness coefficient (table 3-1),

L = flow length (ft),

P_2 = 2-year, 24-hour rainfall (in), and

s = slope of hydraulic grade line (land slope, ft/ft).

This simplified form of the Manning's kinematic solution is based on the following: (1) shallow steady uniform flow, (2) constant intensity of rainfall excess (that part of a rain available for runoff), (3) rainfall duration of 24 hours, and (4) minor effect of infiltration on travel time. Rainfall depth can be obtained from appendix B.

Shallow concentrated flow

After a maximum of 300 feet, sheet flow usually becomes shallow concentrated flow. The average velocity for this flow can be determined from figure 3-1, in which average velocity is a function of watercourse slope and type of channel. For slopes less than 0.005 ft/ft, use equations given in appendix F for figure 3-1. Tillage can affect the direction of shallow concentrated flow. Flow may not always be directly down the watershed slope if tillage runs across the slope.

After determining average velocity in figure 3-1, use equation 3-1 to estimate travel time for the shallow concentrated flow segment.

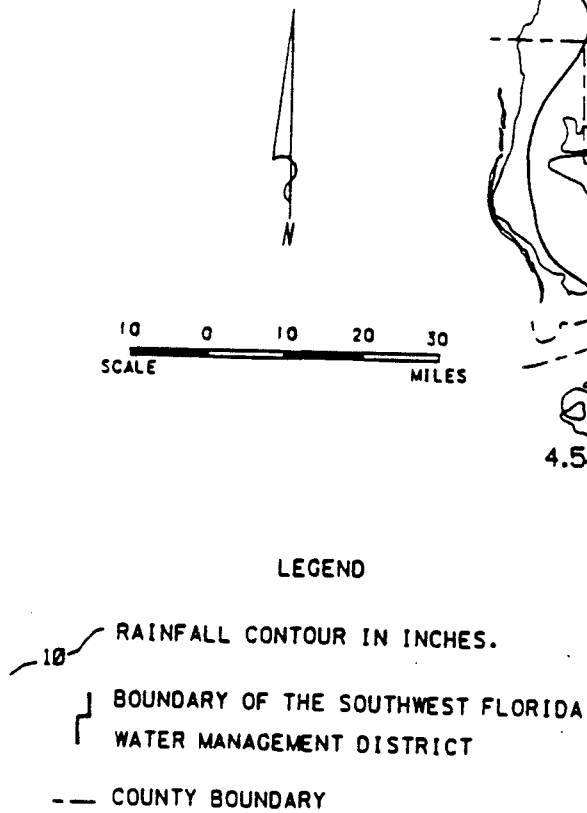
Open channels

Open channels are assumed to begin where surveyed cross section information has been obtained, where channels are visible on aerial photographs, or where blue lines (indicating streams) appear on United States Geological Survey (USGS) quadrangle sheets. Manning's equation or water surface profile information can be used to estimate average flow velocity. Average flow velocity is usually determined for bank-full elevation.

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

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TWENTY FOUR HOUR
TWO YEAR
RETURN PERIOD
RAINFALL MAP



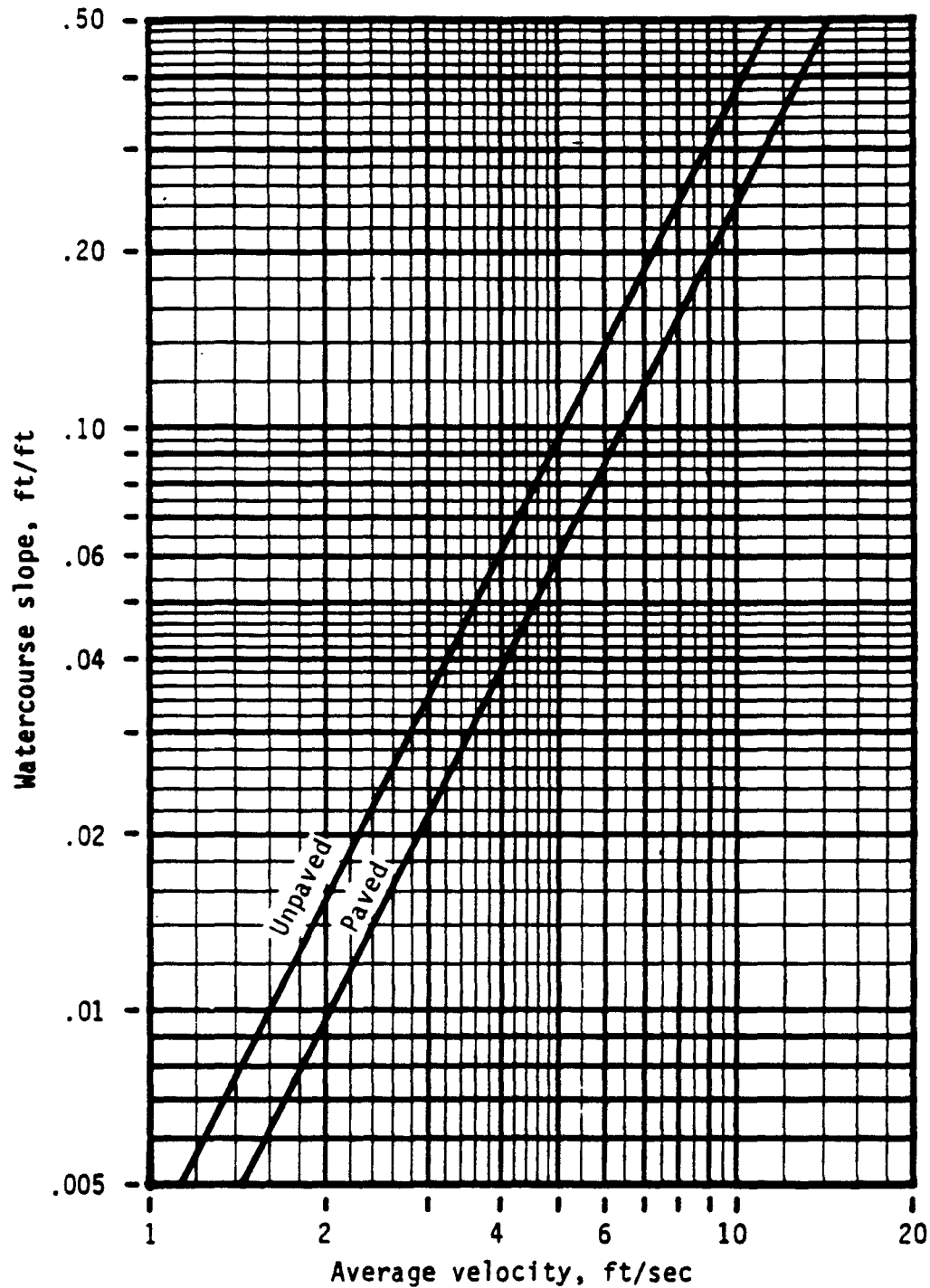
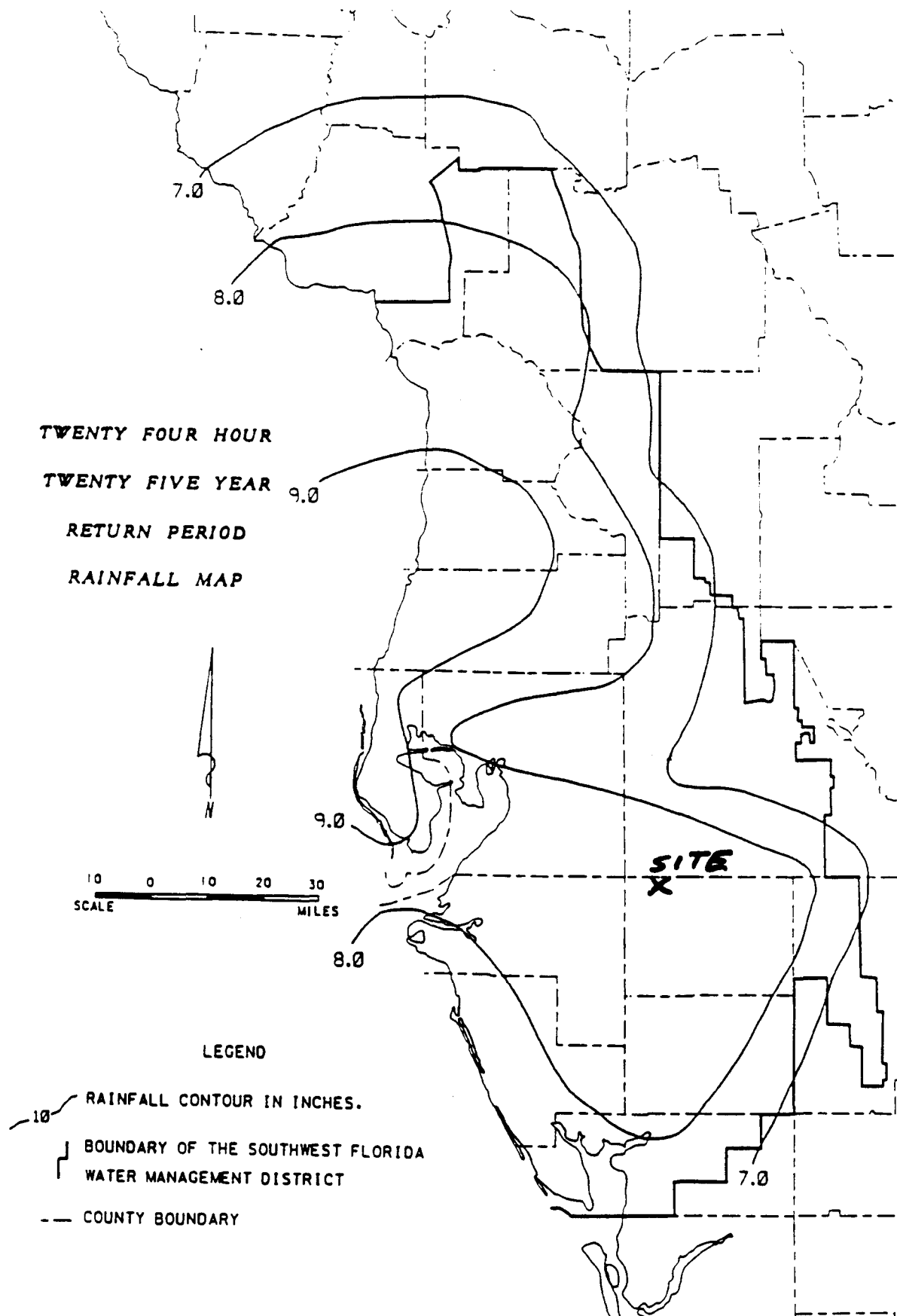


Figure 3-1.—Average velocities for estimating travel time for shallow concentrated flow.

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT



SW FLORIDA WATER MANAGE. DIST.

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TABLE C-1 RAINFALL RATIOS (ACCUMULATED TOTAL 24-HOUR TOTAL)

<u>TIME (HR.)</u>	<u>SCS TYPE II FL. MODIFIED</u>
0.0	.000
0.5	.006
1.0	.012
1.5	.019
2.0	.025
2.5	.032
3.0	.039
3.5	.047
4.0	.054
4.5	.062
5.0	.071
5.5	.080
6.0	.089
6.5	.099
7.0	.110
7.5	.122
8.0	.134
8.5	.148
9.0	.164
9.5	.181
10.0	.201
10.5	.226
11.0	.258
11.5	.308
12.0	.607
12.5	.719
13.0	.757
13.5	.785
14.0	.807
14.5	.826
15.0	.842
15.5	.857
16.0	.870
16.5	.882
17.0	.893
17.5	.904
18.0	.913
18.5	.923
19.0	.931
19.5	.940
20.0	.948
20.5	.955
21.0	.962
21.5	.969
22.0	.976
22.5	.983
23.0	.989
23.5	.995
24.0	1.000

PART 3

DEWATERING

SECI 23930
03-08-94



Owner Seminole Electric Cooperative, Inc
Plant Hardee 3 Unit _____
Project No. 23930 File No. 52.5405. H06
Title Dewatering

Computed By MMP
Date 01/26 1994
Checked By JB Baker
Date 01/26 1994
Page 1 of 6

Objective: Estimate dewatering flows for cooling water pipe excavation and intake structure excavation. Revised: 3-9-94
M.C. Schuler

References:

1. Navy Manual NAVFAC P-418, "Dewatering and Groundwater Control", November 1983.
2. TECO POWER SERVICES CORP, HARDEE POWER STATION "SOILS & FOUNDATIONS"
B&V Project 16419, File 16419.41.0607, Issued 06590, Rev 0.
3. Construction Dewatering by J. Patrick Powers 2nd Ed 1992.
4. Preliminary Geotechnical and Foundation Engineering Study, Hardee Power Station, Hardee County, Florida. Performed by Atlanta Testing & Engineering for Seminole Electric Cooperative, Inc. May 21, 1993

DO NOT WRITE IN THIS SPACE

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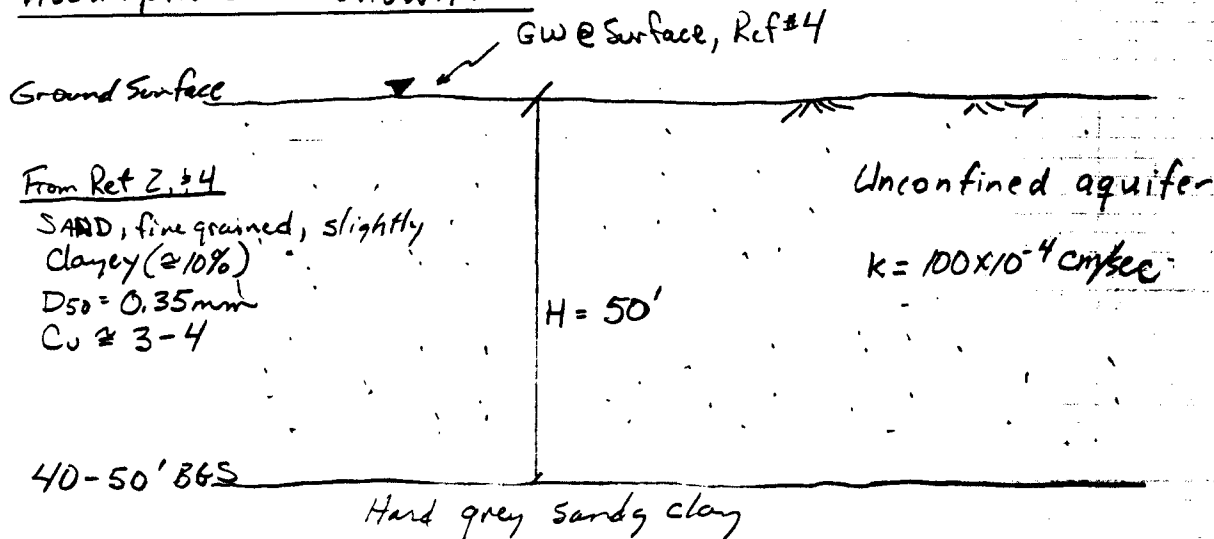


Owner SECI
Plant Hardee 3 Unit _____
Project No. 23930 File No. 52.5406. H06
Title Dewatering

Computed By MMP
Date 01/26 19 94
Checked By JDL
Date 01/26 19 94
Page 2 of 6

Revised 3-9-94
MCS

Assumptions as shown:



Permeability

From Ref # 2 & 4, calculation of grain size parameters

$$D_{50} = 0.35 \text{ mm}$$

$$C_u = \frac{D_{60}}{D_{10}} \approx 3-4 \text{ Varies with fine content}$$

Using charts of Ref # 3, estimate $K \approx 100 \times 10^{-4} \text{ cm/sec}$
See attached charts.

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Owner SECS Computed By MMP
 Plant Harbor 3 Date 01/26 19 94
 Project No. 23930 File No. 52-5406-H06 Checked By JAO
 Title Dewatering Date 01/26 19 94
 Page 3 of 6

Revised 3-9-94
MCS

Cooling Water Pipes

- 2- 60" dia. pipes
- Required excavation depth = 13' ✓
- $1\frac{1}{2}H$ to $1V$ side slopes
- Wellpoints both sides, partially penetrating ✓
- Two-line seepage source

Estimate "radius of influence"

drawdown = say $15'-0' = 15' = H - h_w$

$$R = C (H - h_w) \sqrt{k}$$

(Ref. 1, p. 4-24)

say $C = 2.0$

$H - h_w = 15 \text{ ft.}$

$k = 100 \times 10^{-4} \text{ cm/sec}$

$$R = 2.0 (15) \sqrt{100} = 300 \text{ ft.}$$

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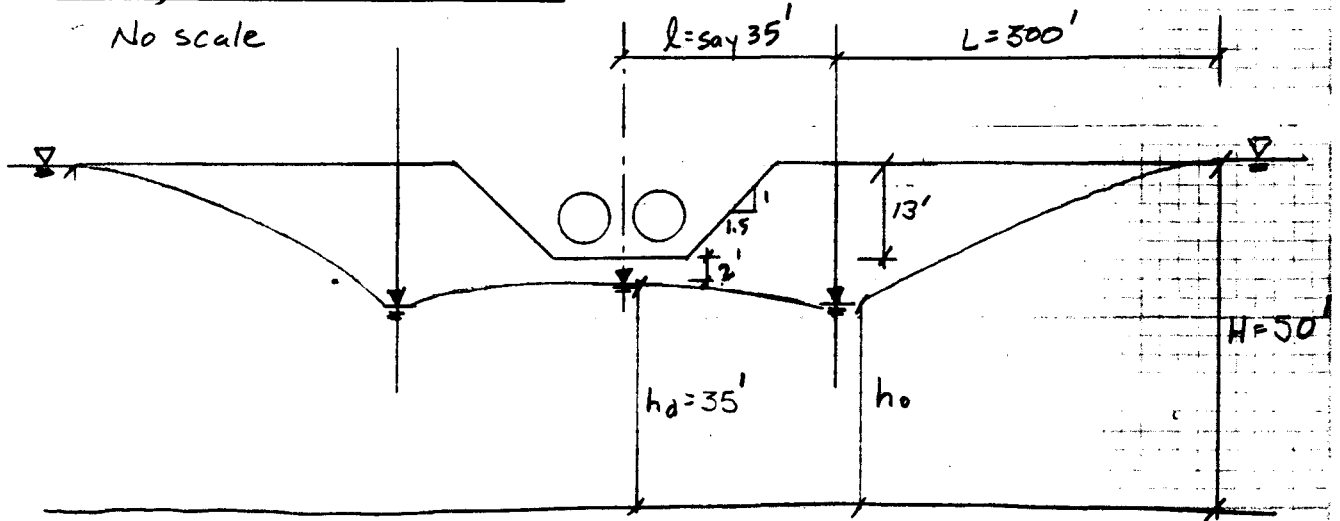
Owner TECT
Plant Harden 3 Unit _____
Project No. 23930 File No. 52.5406.406
Title Dewatering

Computed By MMP
Date 01/26 1994
Checked By JRS
Date 01/26 1994
Page 4 of 6

Cooling Water Pipes (cont'd)

Revised 3-9-94
MCS

No scale



Determine h_o :

$$h_d = h_o \left[\frac{C_1 C_2}{L} (H - h_o) + 1 \right] \quad (\text{Ref. 1, p. 4-6})$$

$$h_d = 35', \quad C_1 \approx 0.9, \quad C_2 \approx 1.4, \quad H = 50', \quad L = 300'$$

$$35' = h_o \left[\frac{0.9(1.9)}{300} (50 - h_o) + 1 \right] \quad 31$$

$$\underline{h_o \approx 31.5'}$$

Determine flow

$$Q_p = \left(0.73 + 0.27 \frac{H - h_o}{H} \right) \frac{kx}{2L} (H^2 - h_o^2) \quad (\text{Ref. 1, p. 4-4})$$

for one slot (line of wellpoints)

$$H = 50 \text{ ft}, \quad h_o = 31.5 \text{ ft}, \quad k = 100 \times 10^{-4} \text{ cm/sec} = 2 \times 10^{-2} \text{ ft/min}$$

$$\text{say } x = 200 \text{ ft (max trench open} = 150')$$

$$L = 300 \text{ ft}$$

$$Q_p = \left(0.73 + 0.27 \left(\frac{18.5}{50} \right) \right) \frac{2 \times 10^{-2} (200)}{2 (300)} (50^2 - 31.5^2) = 8.34 \text{ ft}^3/\text{min}$$

$$\underline{Q_p = 62 \text{ gpm per line} = 125 \text{ gpm total per 150 ft of open trench}}$$

DO NOT WRITE IN THIS SPACE



Owner SECI
Plant Hardu 3 Unit _____
Project No. 23930 File No. 52.5406. HQ6
Title Dewatering
Computed By MMP
Date 01/26 1994
Checked By JBB
Date 01/26 1994
Page 5 of 6

Intake Structure

Revised 3-3-94
MCS

- Excavation by sheet piles, 25' x 55'
- Required excavation depth = 13'
- Required groundwater depth = 15'
- Use rectangular array of wellpoints assume also 25' x 55'
- Circular source

$$A_e = \frac{4}{\pi} \sqrt{b_1 b_2}$$

(Ref. 1, p. 4-15)

$$b_1 = 12.5'$$

$$b_2 = 27.5'$$

$$A_e = \frac{4}{\pi} \sqrt{(12.5)(27.5)} = 23.6'$$

$$\text{Drawdown} = 15' - 0' = 15'$$

$$R = \text{say } 3.0 (15) \sqrt{100} = 450'$$

Because adjacent to body of water use R = 40' ✓

Determine flow for partial penetration

$$Q = \frac{\pi K [(H-s)^2 - t^2]}{\ln(R/r_w)} \left[1 + \left(0.30 + \frac{10r_w}{H} \right) \sin \frac{1.85}{H} \right] \quad (\text{Ref. 1, p. 4-12})$$

$$K = 2 \times 10^{-2} \text{ ft/min}, H = 50 \text{ ft}, s \approx 50 - 25 = 25', R = 40'$$

$$\text{say } h' = 0', t = \text{say } 25 - 19 = 5'$$

$$r_w = A_e$$

DO NOT WRITE IN THIS SPACE

PGN-175A



Owner SECS Computed By MMP
Plant Hardee 3 Date 01/26 1994
Project No. 23930 File No. 52.5406. HOS Checked By JDB
Title Dewatering Date 01/26 1994
Page 6 of 6

Revised 3-9-94
MCS

$$\frac{\pi K [(H-s)^2 - t^2]}{\ln(R/r_w)} = \frac{\pi (2 \times 10^{-2}) [(50-25)^2 - (5)^2]}{\ln(40/23.6)} = 27.0$$

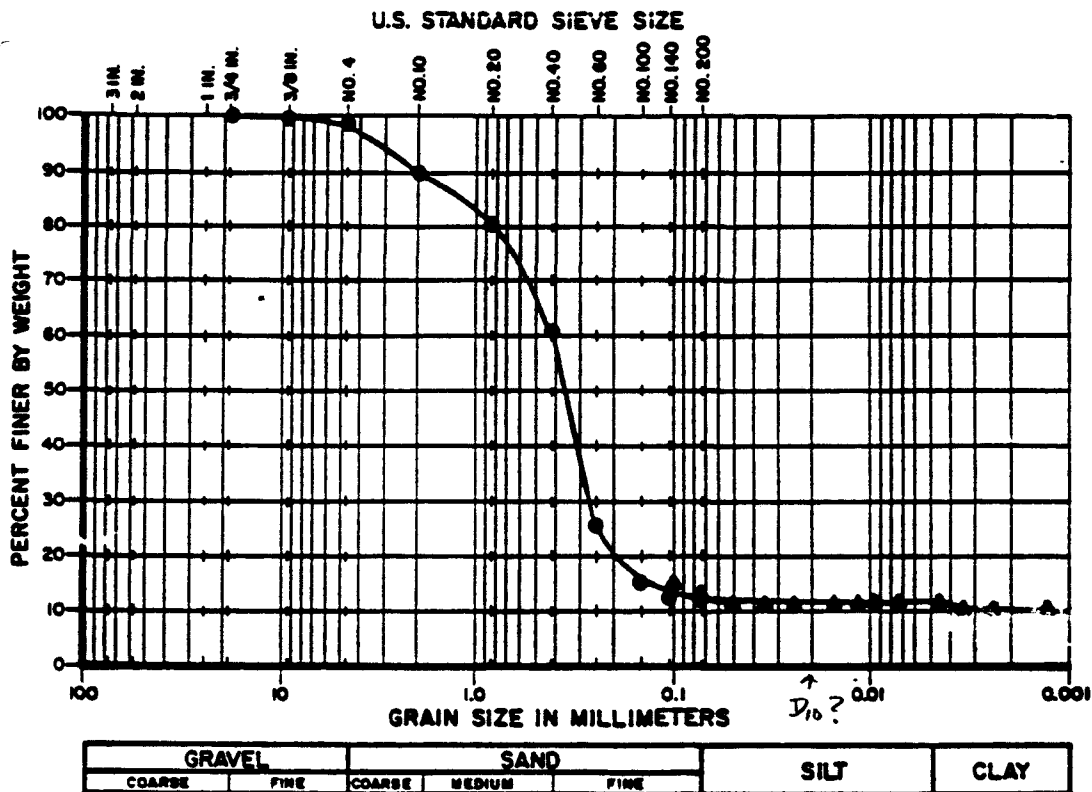
$$\left[1 + \left(0.30 + \frac{10r_w}{\pi} \right) \sin \frac{1.85}{H} \right] = \left[1 + \left(0.30 + \frac{10(23.6)}{50} \right) \left(\sin \frac{1.8(25)}{50} \right) \right]$$

5.02 0.0157

$$= 1.08$$

$$\underline{Q = 27.0 (1.08) = 29.13 \text{ ft}^3/\text{min} = \underline{218 \text{ gpm}}}$$

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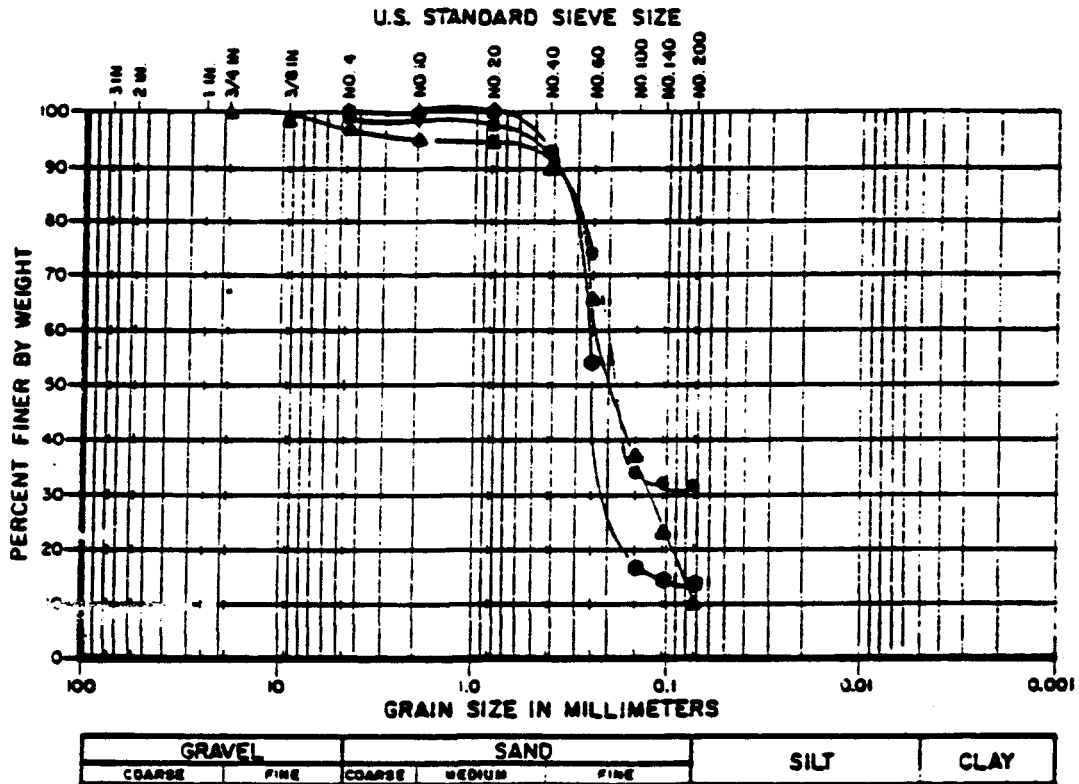
TEST NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
A-1	US-6	15.0'-17.0'		GRAYISH BROWN SLIGHTLY CLAYEY FINE SAND	SC
			●	SIEVE ANALYSIS	
			▲	HYDROMETER	

$$D_{50} = 0.35 \text{ mm}$$

$$C_u = \frac{P_{60}}{P_{10}} = \frac{0.40}{0.02} = 20$$

Ref #2

GRAIN SIZE DISTRIBUTION		
Ardaman & Associates, Inc. Consulting Engineers in Soil Mechanics, Foundations, and Material Testing		
SEMINOLE ELECTRIC COOPERATIVE INC. 4040 MEGAWATT COMBUSTION GENERATOR AGRICO-SOUTH SITE		
DRAWN BY: HAD	CHECKED BY:	DATE: 12/16/88
FILE NO. 88-9155A	APPROVED BY:	



TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CL. S.S.
1	2	2.5-4'	▲		
1	17	70-71.5'	●		
1	14	65-66.5'	●		

For 2.5-4.0 Ft
 $D_{50} = 0.2$

$$C_u = \frac{D_{60}}{D_{10}} = \frac{0.25}{0.07} = 3.6$$

Ref #2

GRAIN SIZE DISTRIBUTION		
Ardaman & Associates, Inc. Consulting Engineers in Soil Mechanics, Foundations, and Material Testing		
SEMINOLE ELECTRIC CO-OP. INC. 440 MV COMBUSTION TURBINE AGRICO SOUTH SITE		
DRAWN BY:	CHECKED BY:	DATE:
FILE NO.	APPROVED BY:	
82-0155A		

Ref #3

44 / SOILS AND WATER

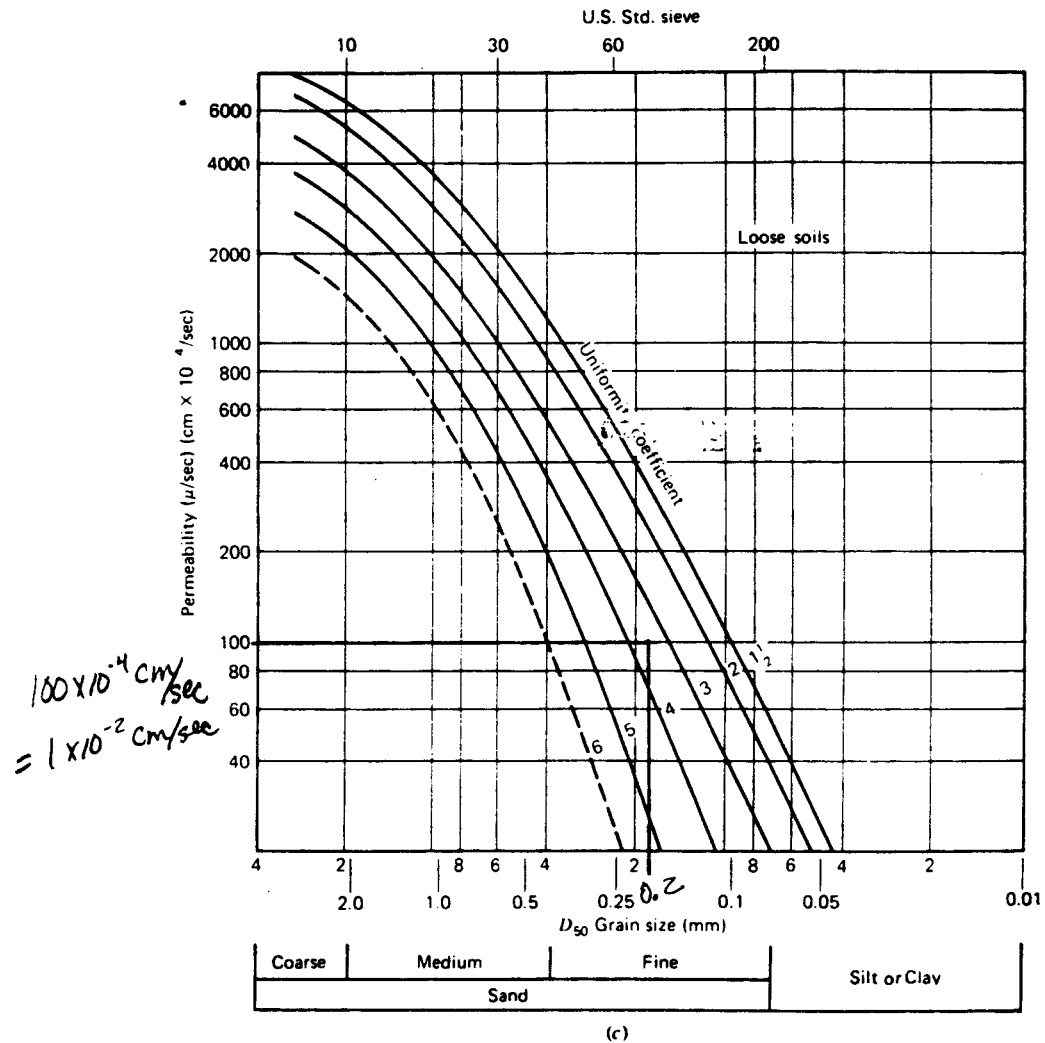


Figure 3.4 (Continued)

ments may be deliberately disaggregated in the laboratory before sieving. The effective pore size *in situ* may be significantly larger than that indicated by grain size. On a project in the Middle East where K turned out to be much higher than estimated from grain size curves, a sample was recovered from the excavation with the structure of the weakly cemented sand carefully preserved. After determining the *in situ* dry weight the sample was disaggregated and sieved. The sand even in a loose state had a significantly higher γ_D than the original sample.

APPENDIX C
CHECKLIST ITEMS

SECI 23930
03-08-94

SEMINOLE ELECTRIC COOPERATIVE, INC.

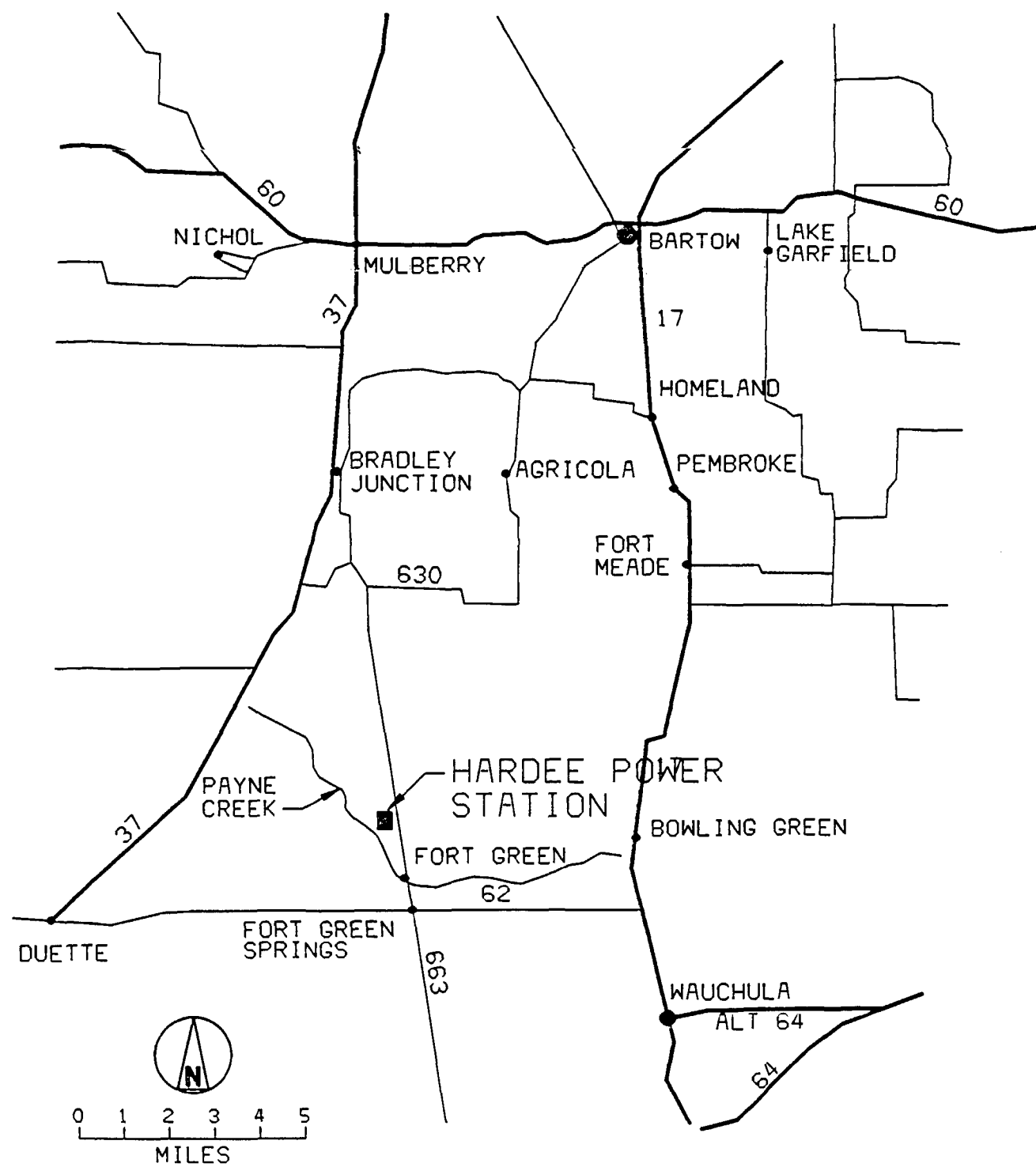
HARDEE POWER STATION UNIT 3

FORT GREEN, FLORIDA

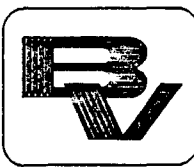
CONTRACT 71.0201 - SITE DEVELOPMENT

TABLE OF CONTENTS

DRAWING NUMBER	DRAWING TITLE
23930-CSTU-S1001	SITE ARRANGEMENT
23930-CSTU-S1050	TOPOGRAPHIC SURVEY SHEET 1
23930-CSTU-S1051	TOPOGRAPHIC SURVEY SHEET 2
23930-CSTF-S3000	SITE - GRADING AND DRAINAGE KEY PLAN, GENERAL NOTES & LEGEND
23930-CSTF-S3001	SITE - GRADING AND DRAINAGE AREA 1
23930-CSTF-S3002	SITE - GRADING AND DRAINAGE AREA 2
23930-CSTF-S3010	SITE - GRADING AND DRAINAGE SECTIONS AND DETAILS - SHEET 1
23930-CSTF-S3011	SITE - GRADING AND DRAINAGE FUEL UNLOADING & STORAGE AREA DETAILS
23930-CSTF-S3021	SITE - EROSION AND SEDIMENTATION CONTROL PLAN
17532-CSTA-S3200	SITE - ROADS ROADS, FENCING, AND SURFACING PLAN
17532-CSTA-S3201	SITE - ROADS ROADS, FENCING, AND SURFACING PLAN
17532-CSTA-S3202	SITE - ROADS SECTIONS AND DETAILS



VICINITY MAP



BLACK & VEATCH
KANSAS CITY, MISSOURI
PROJECT 23930

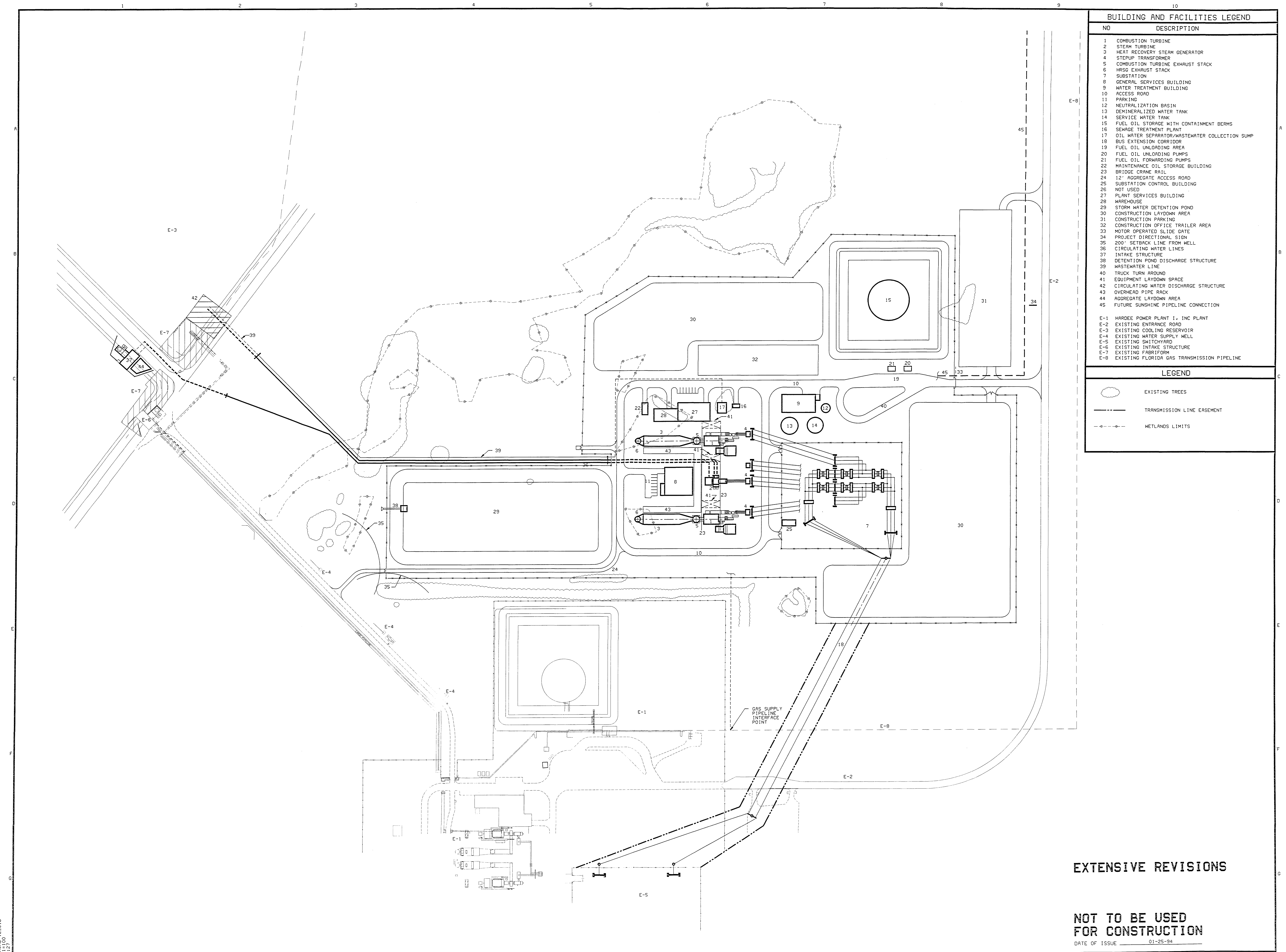
EXTENSIVE REVISIONS

NOT TO BE USED
FOR CONSTRUCTION
DATE OF ISSUE 03-15-94

1994

I HEREBY CERTIFY THAT THIS DOCUMENT WAS
PREPARED BY ME OR UNDER MY DIRECT SUPER-
VISION AND THAT I AM A DULY REGISTERED PRO-
FESSIONAL ENGINEER UNDER THE LAWS OF THE
STATE OF FLORIDA
SIGNED _____
DATE _____ REG. NO. _____

PROJECT	DRAWING NUMBER	REV
23930-CSTF-S0001		B



BUILDING AND FACILITIES LEGEND	
NO	DESCRIPTION
1	COMBUSTION TURBINE
2	STEAM TURBINE
3	HEAT RECOVERY STEAM GENERATOR
4	STEPUP TRANSFORMER
5	COMBUSTION TURBINE EXHAUST STACK
6	HRSG EXHAUST STACK
7	SUBSTATION
8	GENERAL SERVICES BUILDING
9	WATER TREATMENT BUILDING
10	ACCESS ROAD
11	PARKING
12	NEUTRALIZATION BASIN
13	DEMINERALIZED WATER TANK
14	SERVICE WATER TANK
15	FUEL OIL STORAGE WITH CONTAINMENT BERMS
16	SEWAGE TREATMENT PLANT
17	OIL WATER SEPARATOR/WASTEWATER COLLECTION SUMP
18	BUS EXTENSION CORRIDOR
19	FUEL OIL UNLOADING AREA
20	FUEL OIL UNLOADING PUMPS
21	FUEL OIL FORWARDING PUMPS
22	MAINTENANCE OIL STORAGE BUILDING
23	BRIDGE CRANE RAIL
24	12' AGGREGATE ACCESS ROAD
25	SUBSTATION CONTROL BUILDING
26	NOT USED
27	PLANT SERVICES BUILDING
28	WAREHOUSE
29	STORM WATER DETENTION POND
30	CONSTRUCTION LAYDOWN AREA
31	CONSTRUCTION PARKING
32	CONSTRUCTION OFFICE TRAILER AREA
33	MOTOR OPERATED SLIDE GATE
34	PROJECT DIRECTIONAL SIGN
35	200' SETBACK LINE FROM WELL
36	CIRCULATING WATER LINES
37	INTAKE STRUCTURE
38	DETENTION POND DISCHARGE STRUCTURE
39	WASTEWATER LINE
40	TRUCK TURN AROUND
41	EQUIPMENT LAYDOWN SPACE
42	CIRCULATING WATER DISCHARGE STRUCTURE
43	OVERHEAD PIPE RACK
44	AGGREGATE LAYDOWN AREA
45	FUTURE SUNSHINE PIPELINE CONNECTION
E-1	HARDEE POWER PLANT 1, INC PLANT
E-2	EXISTING ENTRANCE ROAD
E-3	EXISTING COOLING RESERVOIR
E-4	EXISTING WATER SUPPLY WELL
E-5	EXISTING SWITCHYARD
E-6	EXISTING INTAKE STRUCTURE
E-7	EXISTING FABRIFORM
E-8	EXISTING FLORIDA GAS TRANSMISSION PIPELINE

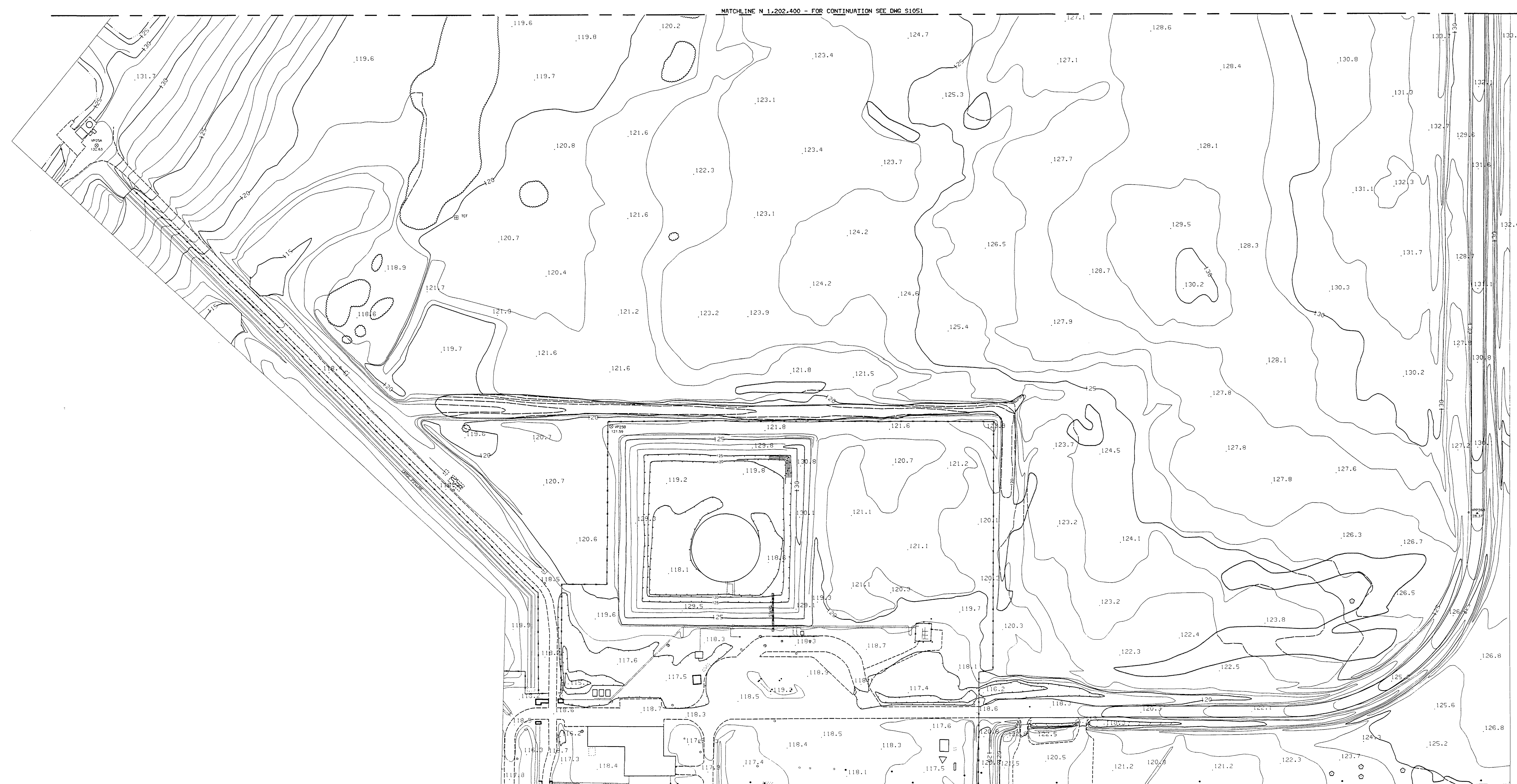
LEGEND	
	EXISTING TREES
	TRANSMISSION LINE EASEMENT
	WETLANDS LIMITS

EXTENSIVE REVISIONS

NOT TO BE USED
FOR CONSTRUCTION

DATE OF ISSUE 01-25-94

0773930RABER ACAD 12-c1b 01/25/94 11:22:13		I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPER- VISION AND THAT I AM A DULY REGISTERED PRO- FESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF FLORIDA		BLACK & VEATCH		SEMINOLE ELECTRIC COOP, INC. HARDEE POWER STATION UNIT 3		PROJECT 23930-CSTU-S1001		DRAWING NUMBER 1	
NO		DATE		REVISIONS AND RECORD OF ISSUE		BY CHK/APP/PLM		OVERALL SITE ARRANGEMENT		CODE AREA	
1		03/07/94		PERMIT ISSUE		JBB		DATE			
0		01/25/94		PERMIT ISSUE							



NOTE:

THIS TOPOGRAPHIC SURVEY WAS PREPARED BY KUCERA SOUTH, INC.,
LAKELAND, FLORIDA, FROM PHOTOGRAPHY DATED 6-29-93. THE
ORIGINAL PHOTOGRAMMETRY WAS AT 1"=50' WITH A ONE FOOT
CONTOUR INTERVAL.

NOT TO BE USED
FOR CONSTRUCTION

DATE OF ISSUE 03-15-94

 BLACK & VEATCH	SEMINOLE ELECTRIC COOP, INC. HARDEE POWER STATION UNIT 3		PROJECT 23930-CSTU-S1050	DRAWING NUMBER A
	ENGINEER _____	DRAWN _____	CODE _____	AREA _____
	CHECKED _____	DATE _____	TOPOGRAPHIC SURVEY SHEET 1	

1 2 3 4 5 6 7 8 9 10

A

B

C

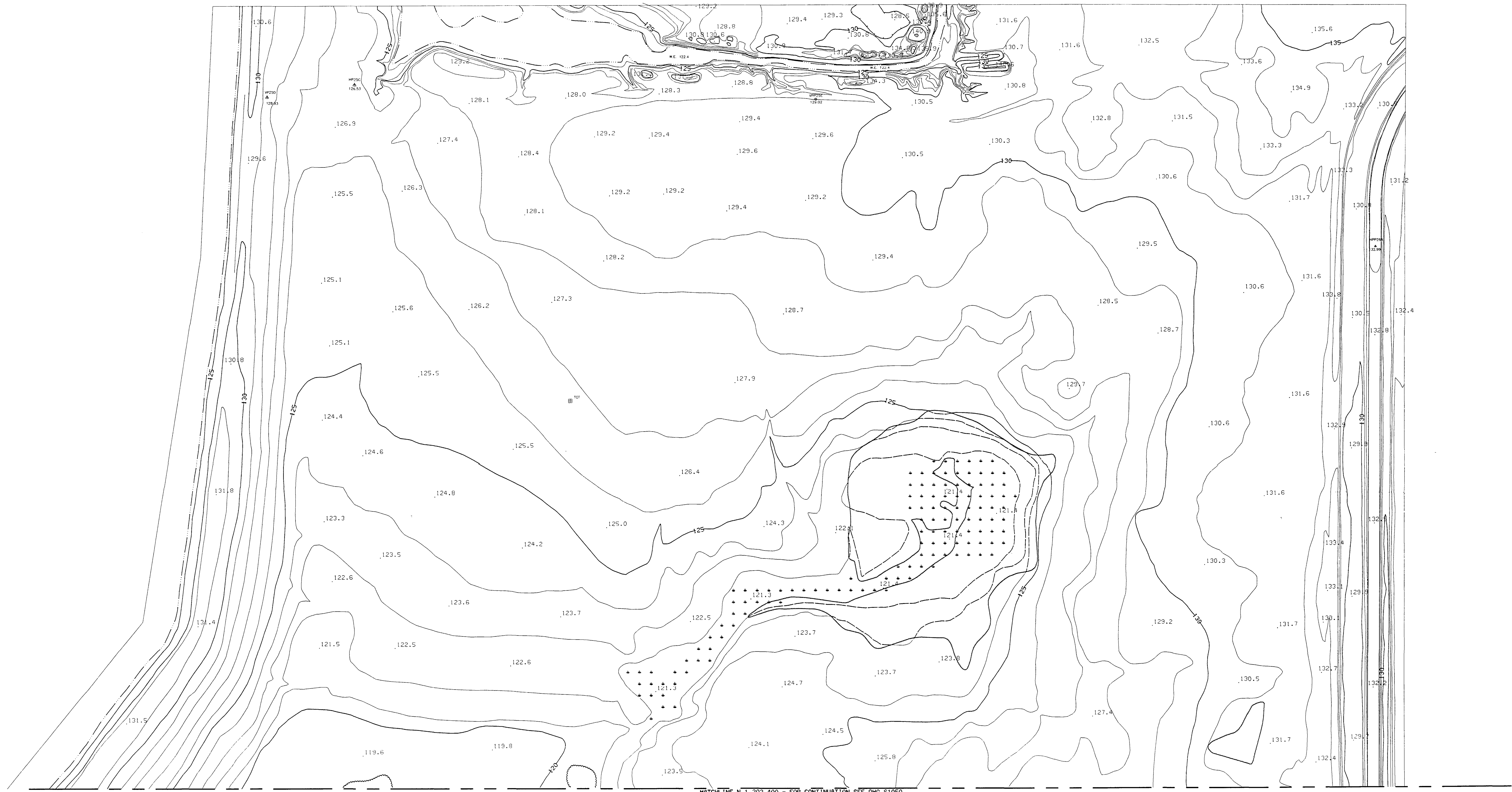
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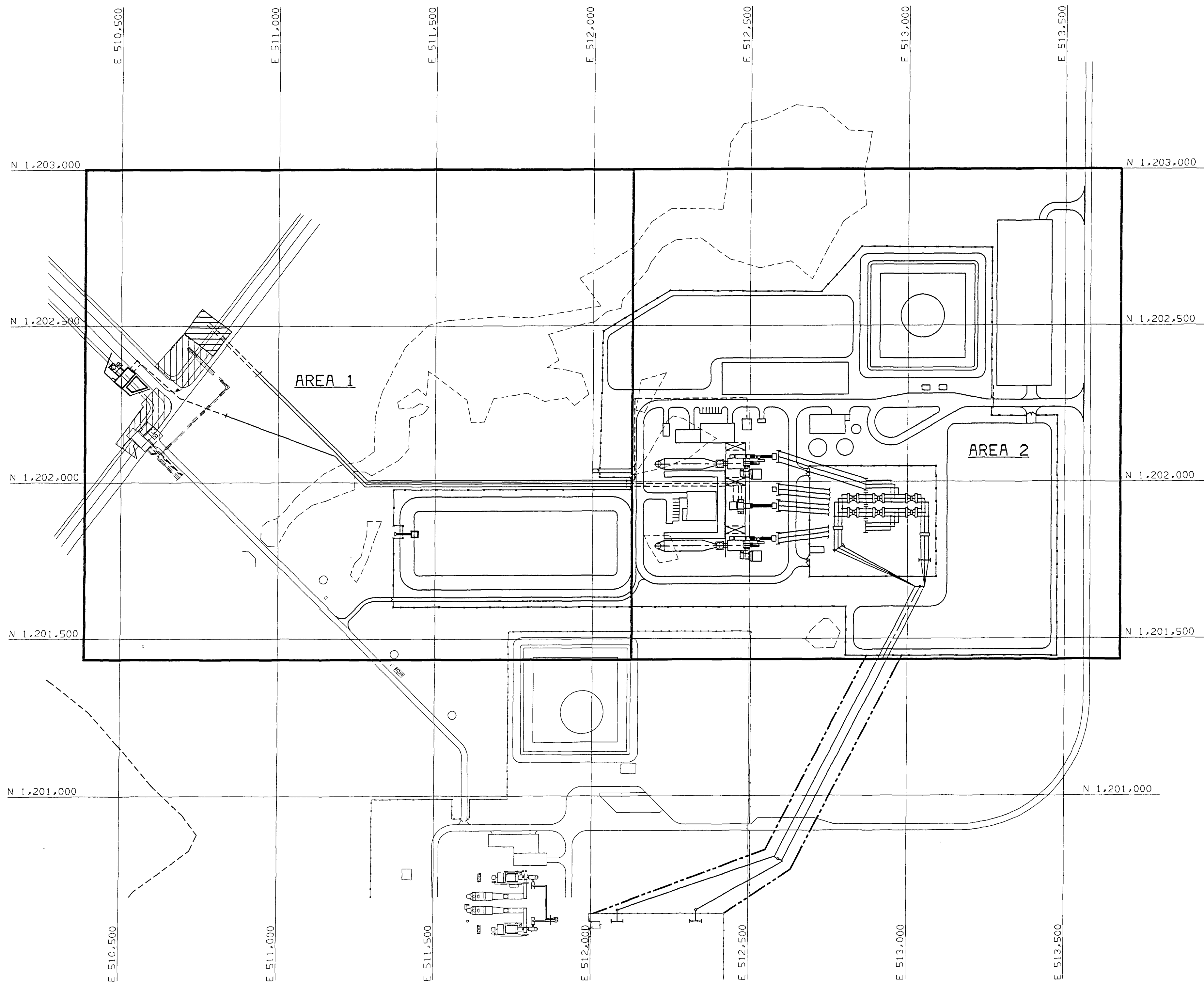
E

F

G

07/25/2008 ACAD 12-clb 03/14/2004 11:05:58





KEY PLAN
NO SCALE

LEGEND
APPLICABLE TO ALL S3000 & S3200 SERIES DRAWINGS

- NEW SECURITY FENCING
- EXISTING FENCING
- EXISTING CONTOUR
- EXISTING SPOT ELEVATION
- FINISH CONTOUR
- FINISH SPOT ELEVATION
- MATCHLINE
- GRADE TO DRAIN (DIRECTION OF ARROW)
- SLOPE INDICATOR
- FUTURE INSTALLATION
- EXISTING STRUCTURE
- CULVERT AND DESIGNATION NUMBER

- RIPRAP
- AGGREGATE SURFACING
- CONCRETE (PAVEMENT, PRECAST, OR CAST-IN-PLACE)
- ASPHALTIC CONCRETE PAVEMENT
- SECTION OR DETAIL NUMBER
DRAWING DESIGNATION NUMBER
- EXISTING POWER POLE
- WETLANDS LIMITS

ABBREVIATIONS
APPLICABLE TO ALL S3000 & S3200 SERIES DRAWINGS

- APPROX - APPROXIMATE
- ASPH - ASPHALT
- BCCMP - BITUMINOUS COATED CORRUGATED METAL PIPE
- BM - BENCH MARK
- BOB - BOTTOM OF DUCT BANK
- CHDPE - CORRUGATED HIGH DENSITY POLYETHYLENE PIPE
- CJ - CONTRACTION JOINT
- CL - CENTER LINE
- CMP - CORRUGATED METAL PIPE
- CONC - CONCRETE
- CY - CUBIC YARD
- Δ - DELTA ANGLE OF HORIZONTAL CURVE
- DIP - DUCTILE IRON PIPE
- DWG - DRAWING
- E - EAST
- EL - ELEVATION
- EJ - EXPANSION JOINT
- FDN - FOUNDATION
- FF - FINISHED FLOOR
- HP - HIGH POINT
- INV - INVERT
- LVC - LENGTH OF VERTICAL CURVE
- L - LENGTH OF HORIZONTAL CURVE
- LT - LEFT
- MSL - MEAN SEA LEVEL
- N - NORTH
- NO - NUMBER
- NTS - NOT TO SCALE
- PC - POINT OF CURVATURE
- PI - POINT OF INTERSECTION
- PL - PROPERTY LINE OR PLATE
- PLCS - PLACES
- PT - POINT OF TANGENCY
- PVC - POINT OF VERTICAL CURVATURE
- PVI - POINT OF VERTICAL INTERSECTION
- PVT - POINT OF VERTICAL TANGENCY
- R - RADIUS
- RR - RAILROAD
- RCP - REINFORCED CONCRETE PIPE
- REF - REFERENCE
- REV - REVISION
- RT - RIGHT
- R/W - RIGHT OF WAY
- S - SOUTH
- T - TANGENT
- T/C - TOP OF CONCRETE
- T/P - TOP OF PAVEMENT
- T/G - TOP OF GRATE
- TYP - TYPICAL
- W - WEST
- W/ - WITH
- W/O - WITHOUT
- WP - WORK POINT

GRADING NOTES
APPLICABLE TO ALL S3000 & S3200 SERIES DRAWINGS

- NEW CONTOURS AND GRADE ELEVATIONS SHOWN ON THE SITE GRADING AND DRAINAGE PLANS INDICATE FINISH GRADE, TOP OF AGGREGATE SURFACING, AND TOP OF PAVEMENT UNLESS NOTED OTHERWISE.
- EXISTING TOPOGRAPHY SHOWN ON THESE PLANS WAS TAKEN FROM A SURVEY DATED 6-29-93 BY KUCERA SOUTH INC., - LAKELAND, FLORIDA. THE CONTRACTOR SHALL FIELD VERIFY LOCATIONS AND ELEVATIONS TO HIS SATISFACTION.
- GRADE BETWEEN CONTOURS SHOWN ON SITE GRADING AND DRAINAGE PLANS SHALL SLOPE UNIFORMLY BETWEEN THOSE CONTOURS UNLESS NOTED OTHERWISE.
- ALL CUT AND FILL SLOPES SHALL BE 3 HORIZONTAL TO 1 VERTICAL UNLESS NOTED OTHERWISE.
- DITCH HIGH POINTS ARE DESIGNATED BY "H".
- INTERSECTIONS SHALL BE GRADED TO DRAIN WITH A MINIMUM CROSS SLOPE OF 1%.

GENERAL NOTES
APPLICABLE TO ALL S3000 & S3200 SERIES DRAWINGS

- SEE KEY ON THIS DWG FOR ARRANGEMENT OF SITE GRADING AND DRAINAGE PLANS.
- INTERSECTIONS OF PAVED ROADS SHALL HAVE THE INDICATED RADIUS, MEASURED TO EDGE OF PAVEMENT.
- EXISTING RAILROADS, ROADS, AND UTILITY LOCATIONS ARE SUBJECT TO FIELD VERIFICATION BY THE CONSTRUCTION MANAGER.
- ROADS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE TYPICAL ROAD CROSS SECTIONS AND DETAILS SHOWN ON DRAWING S3202. AT VERTICAL ALIGNMENT CHANGES, A MINIMUM 30' VERTICAL CURVE UNLESS OTHERWISE SHOWN ON THE DRAWINGS, SHALL BE CONSTRUCTED TO PROVIDE A SMOOTH TRANSITION.
- SEE DWG S3010 FOR FENCE DETAILS.
- ALL WORK SHOWN ON S3000 & S3200 SERIES DRAWINGS SHALL BE COMPLETED UNDER CONTRACT 71.0201 UNLESS NOTED OTHERWISE.

EXTENSIVE REVISIONS

NOT TO BE USED
FOR CONSTRUCTION

DATE OF ISSUE 03-15-94

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF FLORIDA

BLACK & VEATCH

SEMINOLE ELECTRIC COOP., INC.
HARDEE POWER STATION UNIT 3

PROJECT DRAWING NUMBER
23930-CSTF-S3000

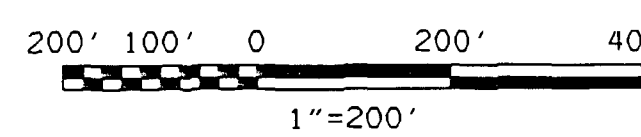
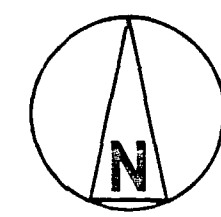
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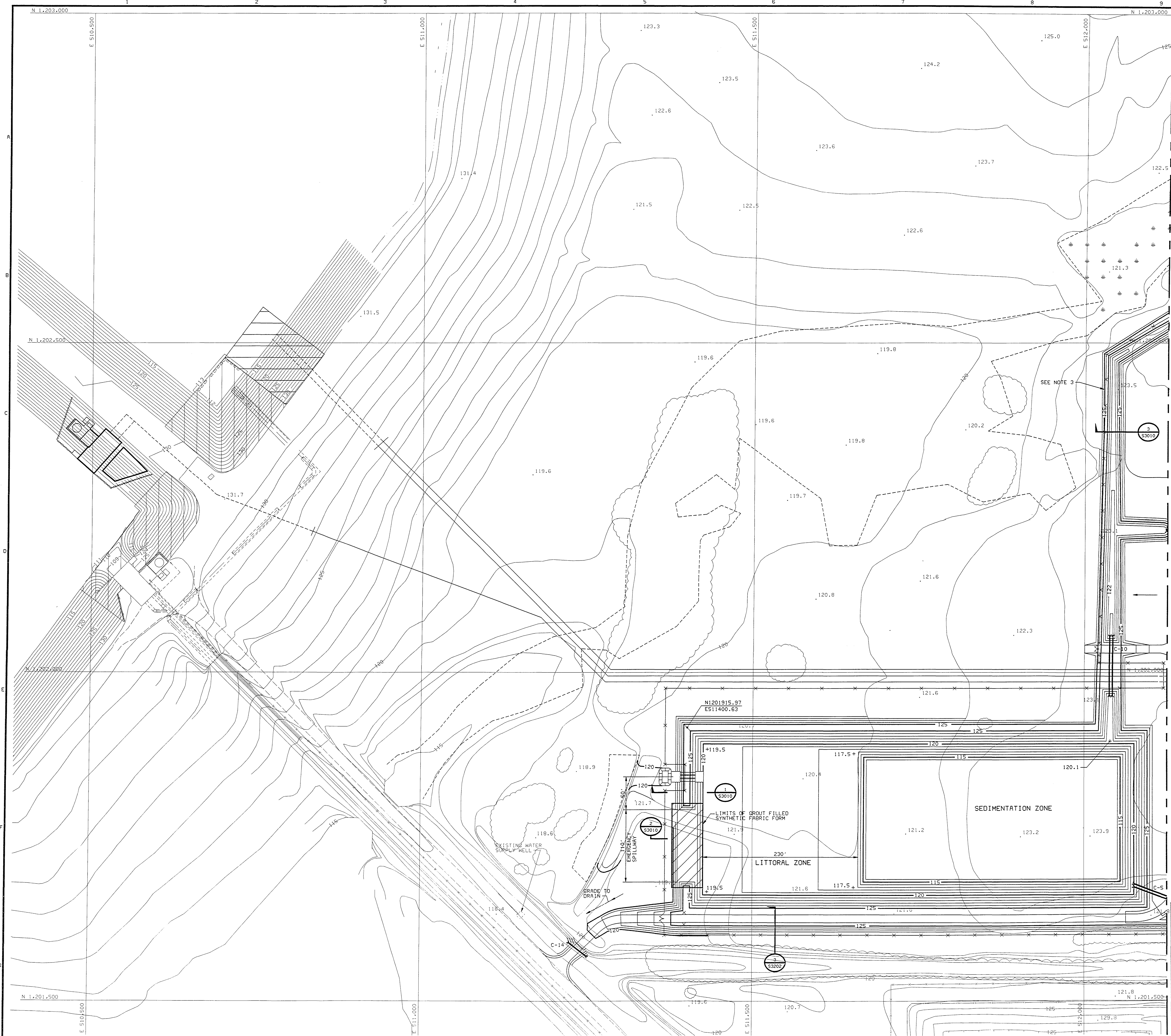
ENGINEER DRAWN HG
CHECKED DATE

SITE - GRADING AND DRAINAGE
KEY PLAN, GENERAL NOTES, & LEGEND

CODE
AREA

NO	DATE	REVISIONS AND RECORD OF ISSUE	BY	CHK	APP	PLM
8	03-15-94	REVIEW ISSUE				
A	01-28-94	REVIEW ISSUE				





MATCHLINE E512,125 - FOR CONTINUATION SEE DWG S3002

GENERAL NOTES

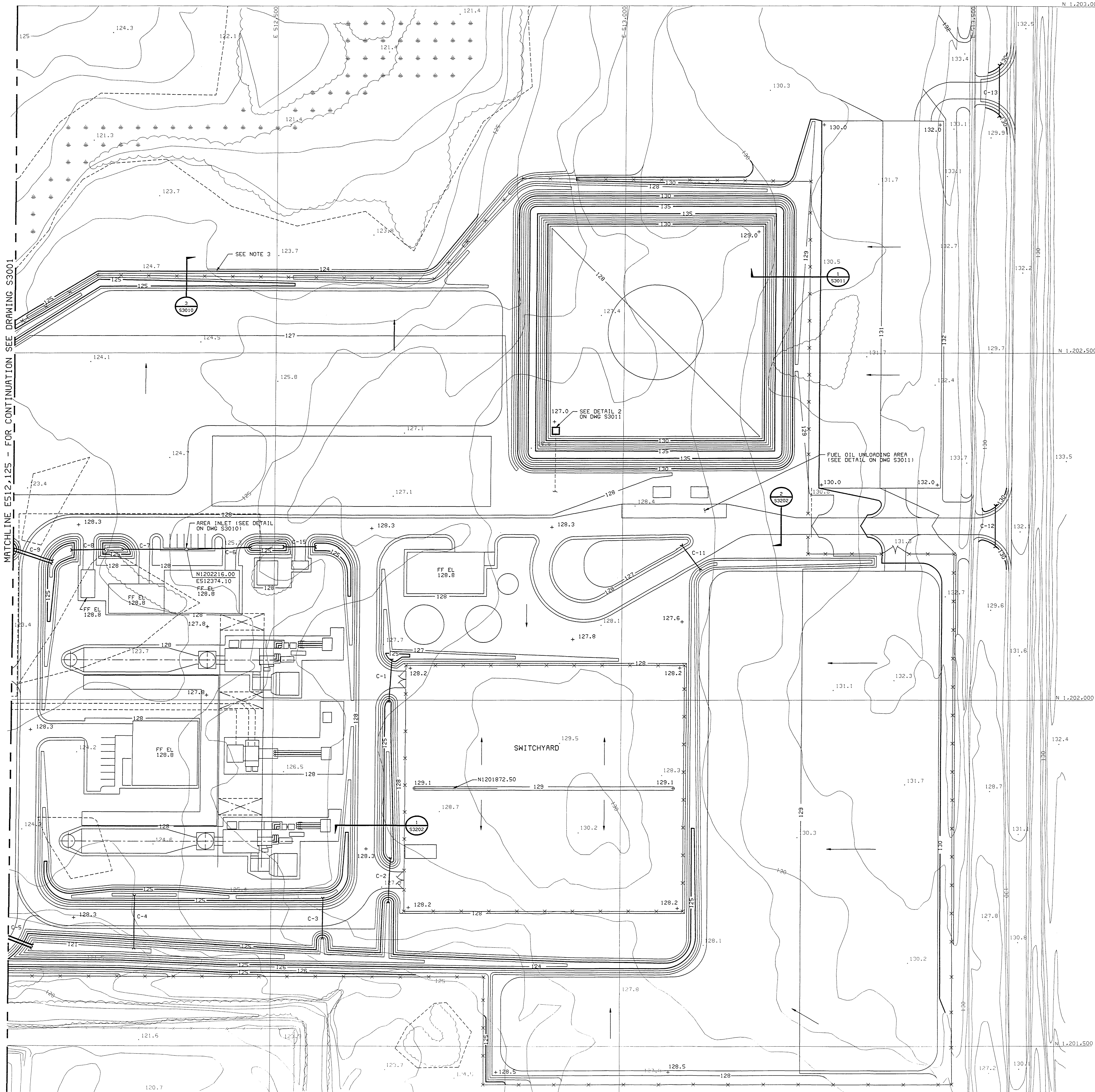
1. SEE DWG. S3000 FOR GENERAL NOTES AND LEGEND.
2. SEE DWG S3010 FOR CULVERT DETAILS AND BEDDING REQUIREMENTS.
3. THE BERM ALONG THE NORTHWEST SIDE OF THE SITE SHALL FOLLOW THE PROPOSED FENCE. SEE DWG. S3200 @ S3201 FOR LOCATION.

EXTENSIVE REVISIONS

NOT TO BE USED
FOR CONSTRUCTION

DATE OF ISSUE 3-15-94

										B 03-15-94 REVIEW ISSUE			50' 25' 0 50' 100' 1"=50'	I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF FLORIDA SIGNED _____ DATE _____ REG. NO. _____	 BLACK & VEATCH	SEMINOLE ELECTRIC COOP., INC. HARDEE POWER STATION UNIT 3	PROJECT DRAWING NUMBER 23930-CSTF-S3001	REV B	
										A 01-28-94 REVIEW ISSUE									
										NO DATE REVISIONS AND RECORD OF ISSUE BY CHK/APP/PLM									



MATCHLINE ES12.125 - FOR CONTINUATION SEE DRAWING S3001

GENERAL NOTES

1. SEE DWG. S3000 FOR GENERAL NOTES AND LEGEND.

2. SEE DWG S3010 FOR CULVERT DETAILS AND BEDDING REQUIREMENTS.

3. THE BERM ALONG THE NORTHWEST SIDE OF THE SITE SHALL FOLLOW THE PROPOSED FENCE. SEE DWG. S3200 & S3201 FOR FENCE LOCATION.

EXTENSIVE REVISIONS

NOT TO BE USED
FOR CONSTRUCTION

DATE OF ISSUE 03-15-94

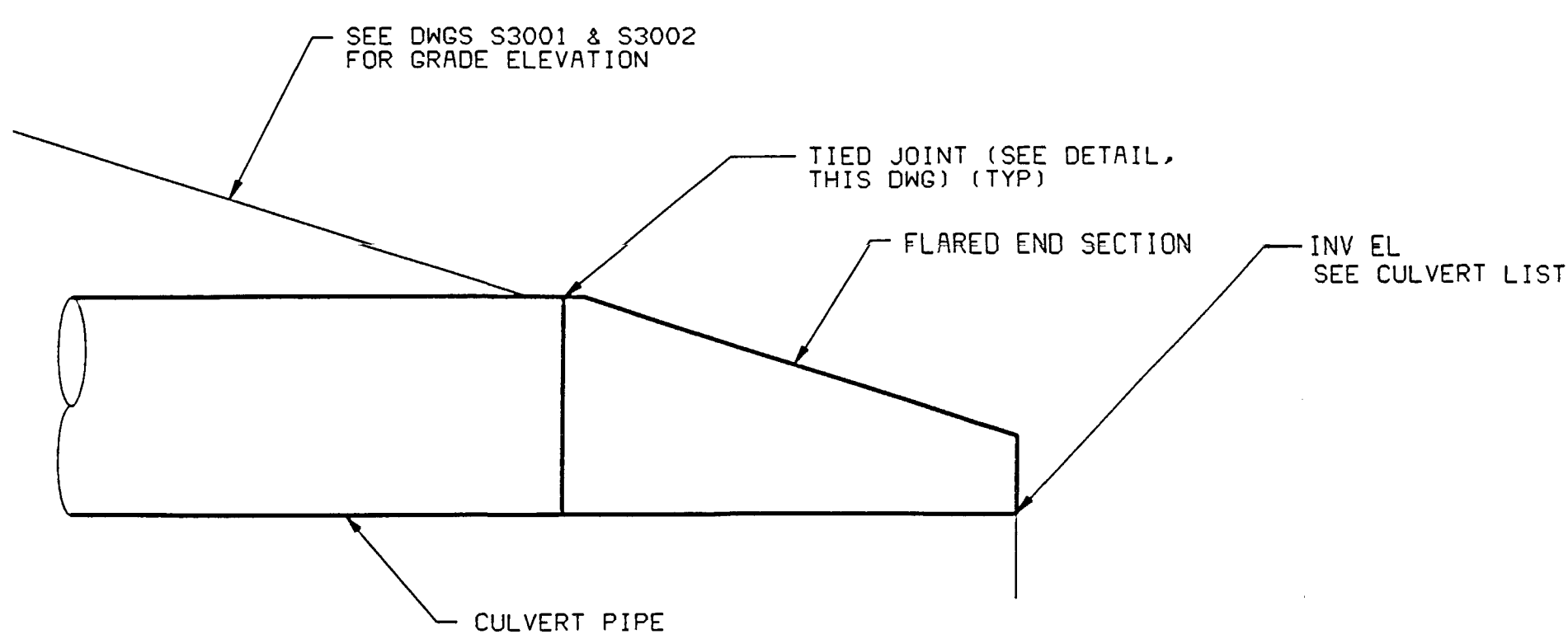
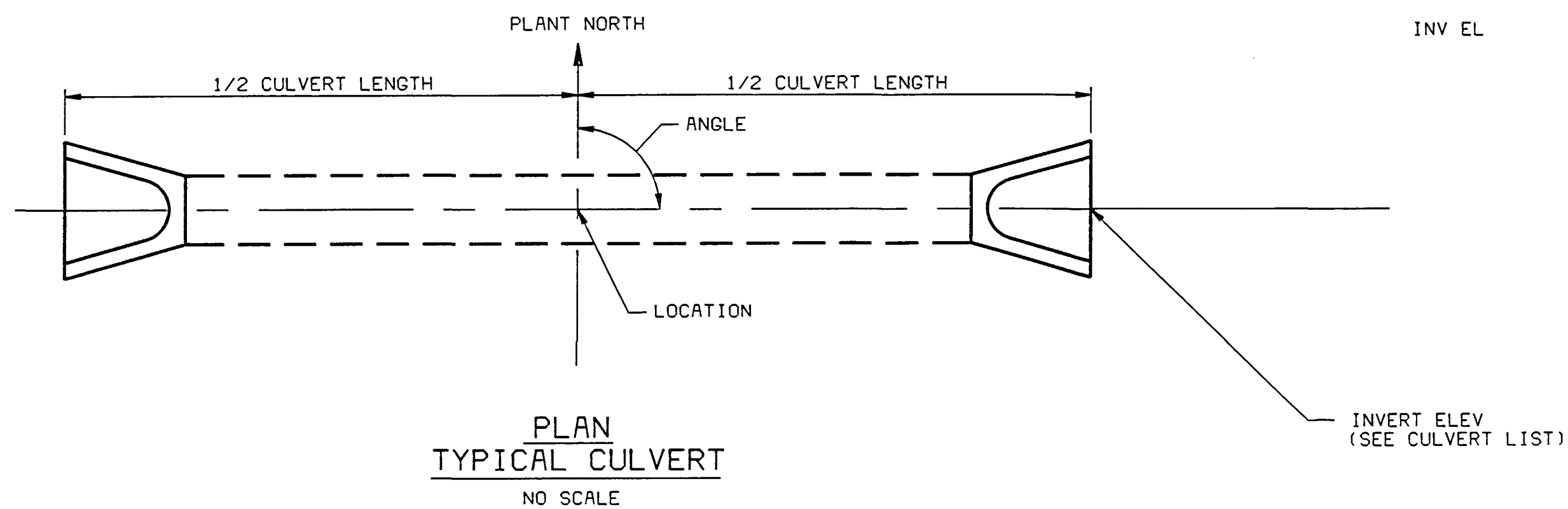
07/26/2006
03/14/94 10:15:56
ACD 12.c1b

BLACK & VEATCH		SEMINOLE ELECTRIC COOP, INC HARDEE POWER STATION UNIT 3		PROJECT 23930-CSTF-S3002	DRAWING NUMBER B
ENGINEER		SITE - GRADING AND DRAINAGE AREA 2		CODE	REV
CHECKED				AREA	
DATE					
I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF FLORIDA					
SIGNED					
DATE					
REG NO.					
BY CHK/APP/FLM					
NO					
DATE					
REVISIONS AND RECORD OF ISSUE					
B 03-15-94 REVIEW ISSUE					
A 01-28-94 REVIEW ISSUE					

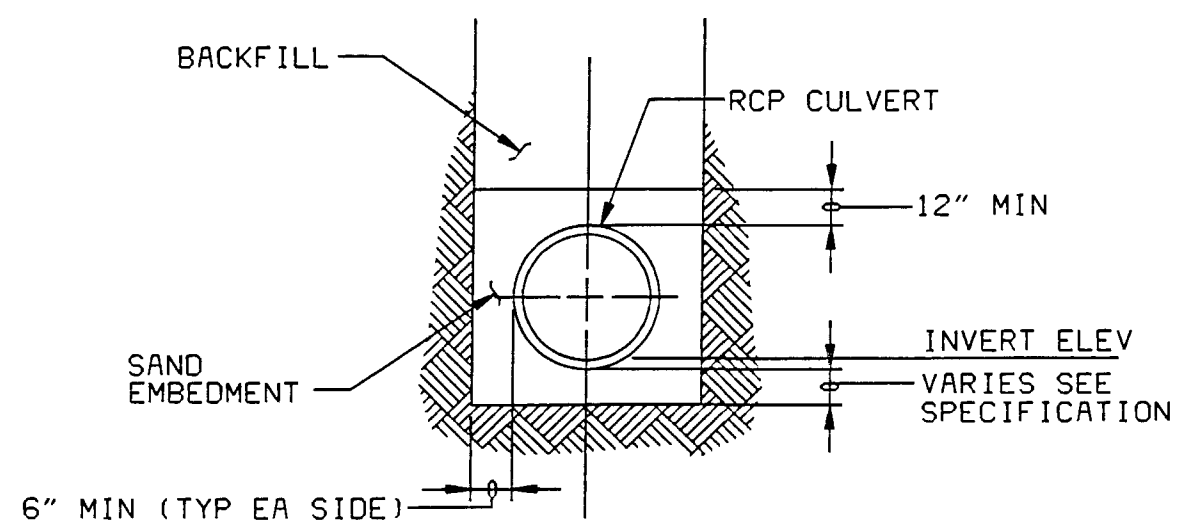
CULVERT LIST											
NO.	LOCATION COORDINATES		ANGLE (DEG.)	SIZE	TYPE	LENGTH	INVERT ELEVATIONS				REMARKS
	NORTH	EAST					NORTH	SOUTH	EAST	WEST	
C-1	N1202030.00	E512666.00	0°	30"	RCP	60'	124.2	124.0			
C-2	N1201740.00	E512668.73	0°	30"	RCP	63'	123.0	122.8			
C-3	N1201685.01	E512574.00	0°	24"	RCP	57'	122.5	122.3			
C-4	N1201678.80	E512305.00	0°	24"	RCP	75'	122.3	122.0			
C-5	N1201659.50	E512117.00	68°	2-48"	RCP	89'			120.3	120.0	
C-6	N1202217.50	E512420.40	90°	24"	RCP	90'			124.2	124.0	
C-7	N1202216.08	E512328.00	90°	24"	RCP	90'			123.9	123.7	
C-8	N1202215.46	E512233.20	90°	30"	RCP	46'			123.5	123.3	
C-9	N12022207.00	E512152.50	72°	2-30"	RCP	58'			123.2	122.9	
C-10	N1202009.60	E512040.50	0°	2-36"	RCP	91'	120.7	120.5			
C-11	N1202204.70	E513098.10	148°	12"	RCP	43'	125.8	125.5			
C-12	N1202250.00	E513533.85	0°	15"	RCP	59'	129.5	129.4			
C-13	N1202878.55	E513533.85	0°	15"	RCP	73'	129.8	129.7			
C-14	N1201578.70	E511237.00	51°	2-24"	RCP	33'					
C-15	N1202219.82	E512535.60	90°	18"	RCP	45'			124.7	124.5	

CULVERT NOTES

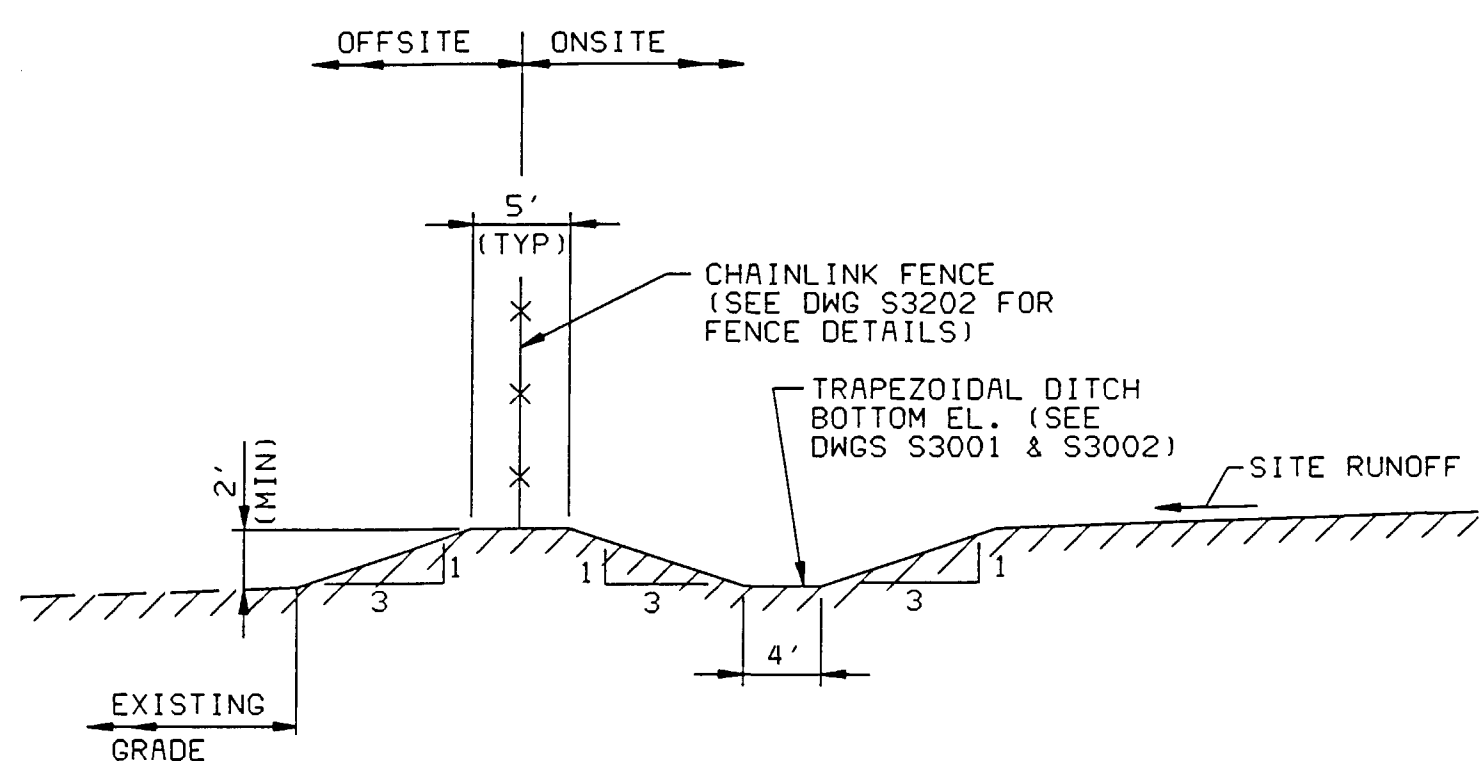
- CULVERTS SHALL BE PROVIDED WITH FLARED END SECTIONS UNLESS OTHERWISE INDICATED.
 - SKEN ANGLE IS MEASURED CLOCKWISE FROM PLANT NORTH TO THE CULVERT CENTERLINE.
 - CULVERT LENGTH INCLUDES TOTAL LENGTH OF CULVERT PIPE AND FLARED END SECTIONS UNLESS OTHERWISE NOTED.
 - PIPE SHALL BE LAID WITH THE TONGUE END POINTING IN THE DIRECTION OF FLOW.
 - CLASS V PIPE SHALL BE USED FOR ALL CULVERTS.
 - PLACE 4 SQUARE YARDS OF EUKAMAT EROSION CONTROL FABRIC OR APPROVED EQUAL AT ALL CULVERT OUTLETS WHERE RIPRAP EROSION PROTECTION IS NOT SHOWN.
- * = LENGTHS ARE APPROXIMATE



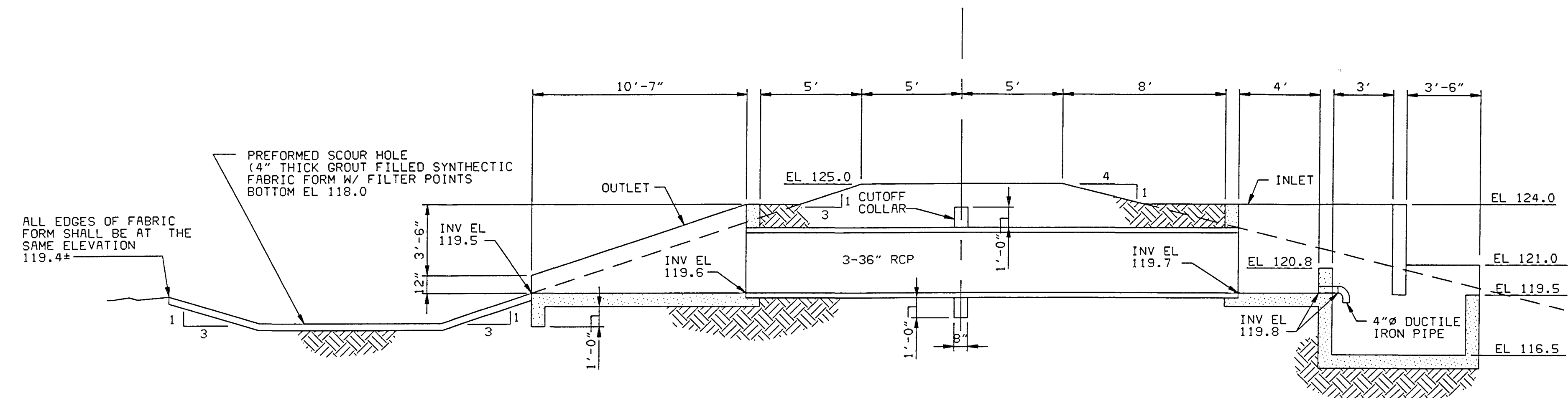
ELEVATION
TYPICAL FLARED END SECTION
NO SCALE



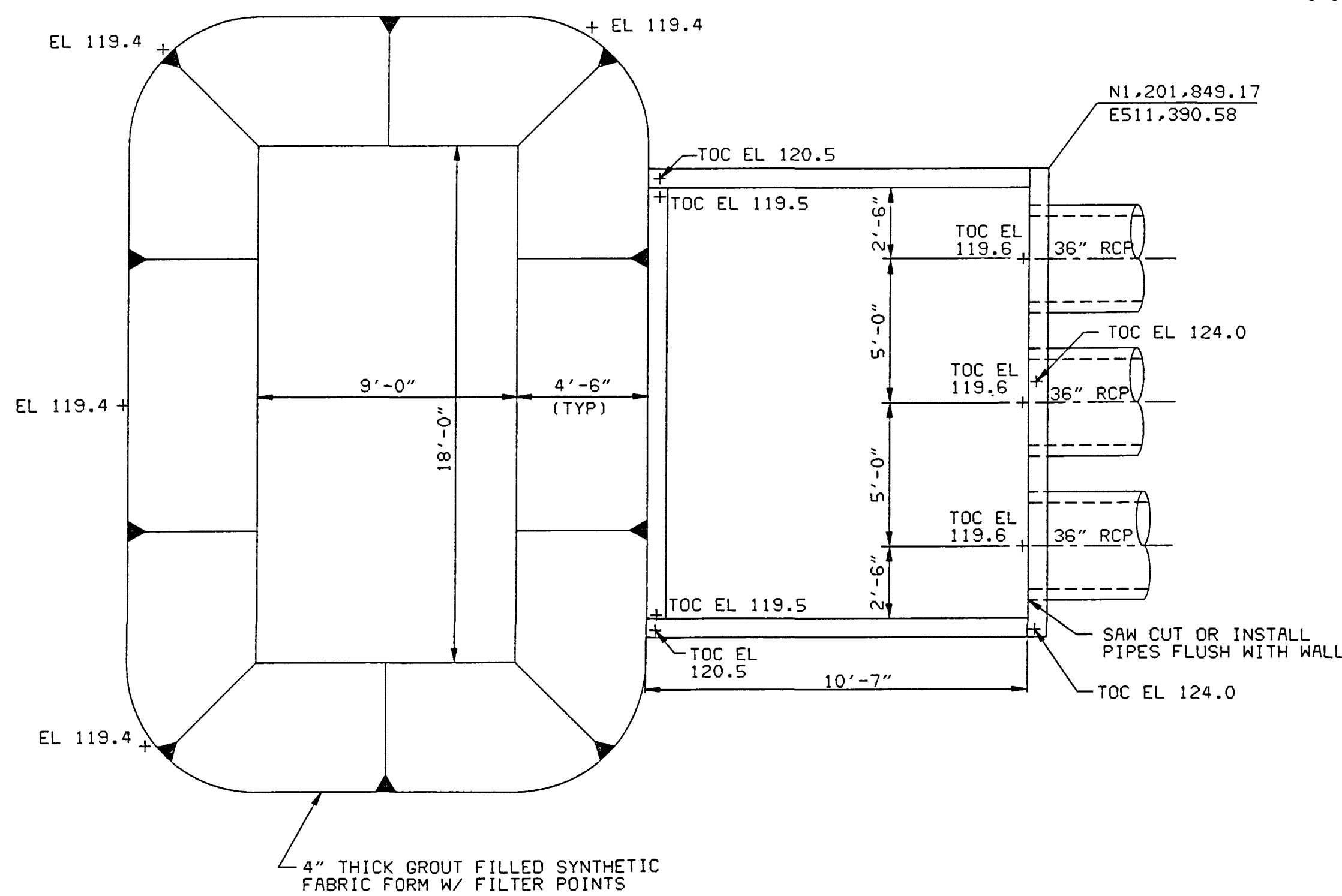
SECTION
SECOND CLASS BEDDING
NO SCALE
SEE CULVERT LIST, THIS DWG



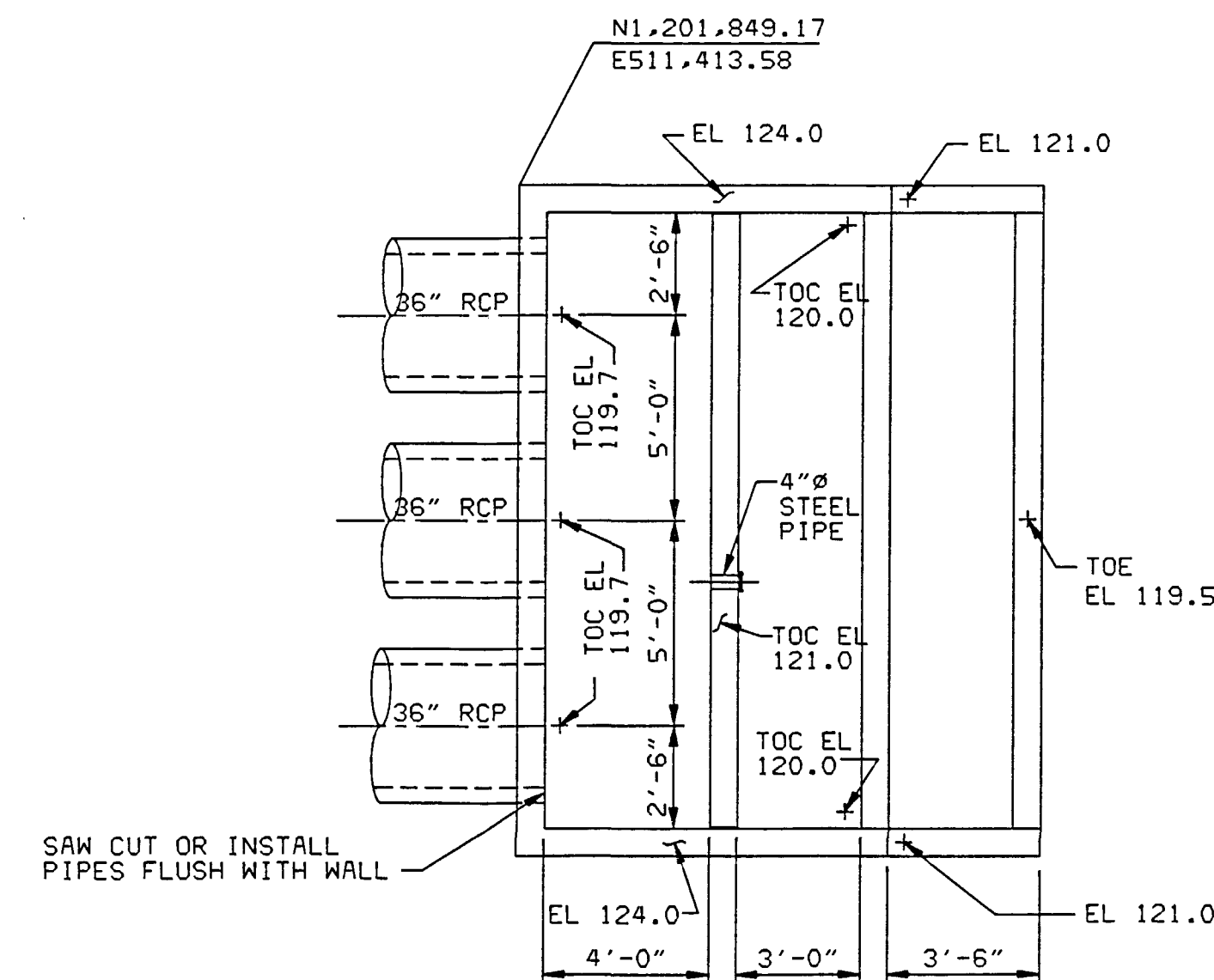
SECTION 3
PERIMETER DITCH AND CHAINLINK FENCE
NO SCALE



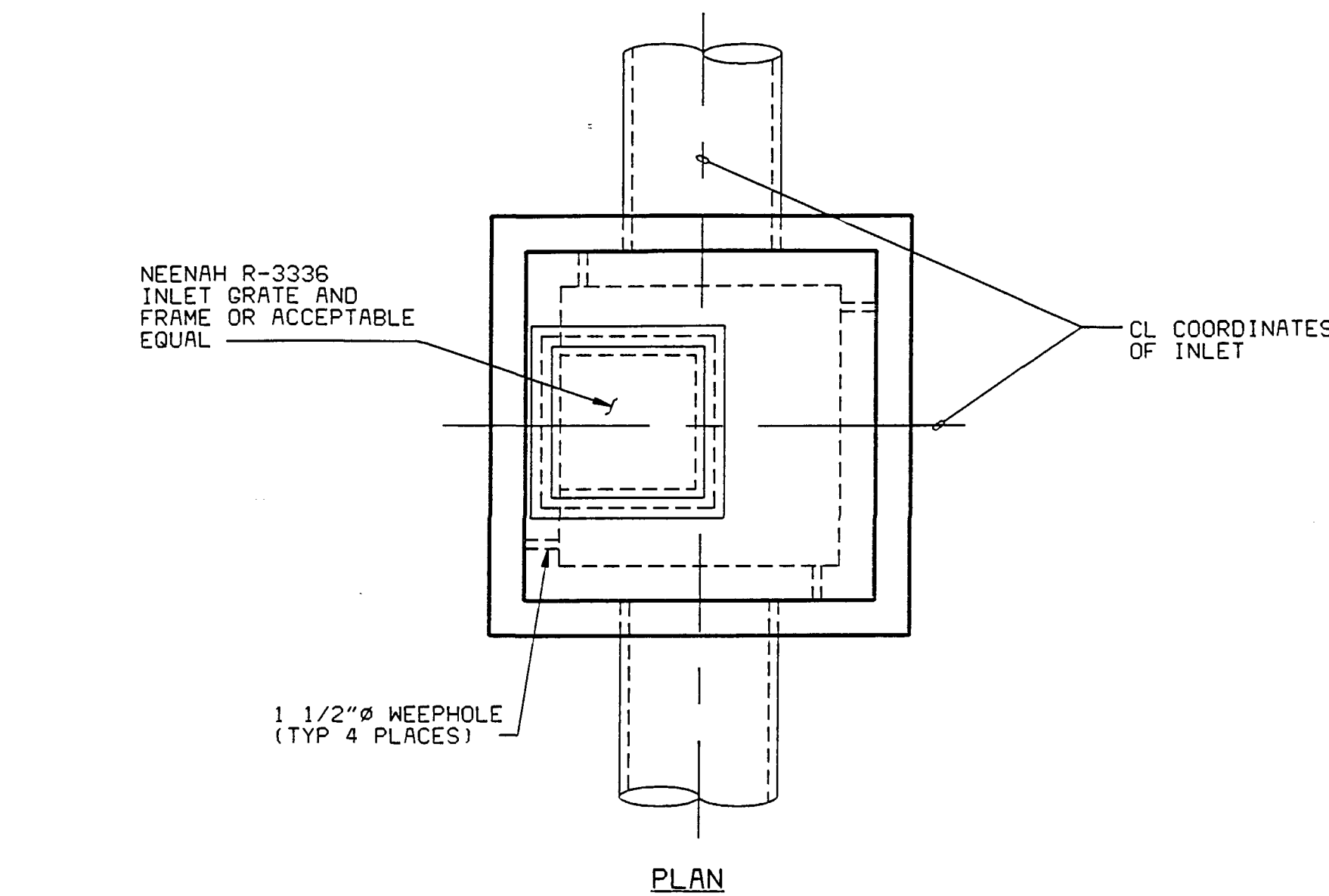
SECTION 1
DISCHARGE STRUCTURE
NO SCALE



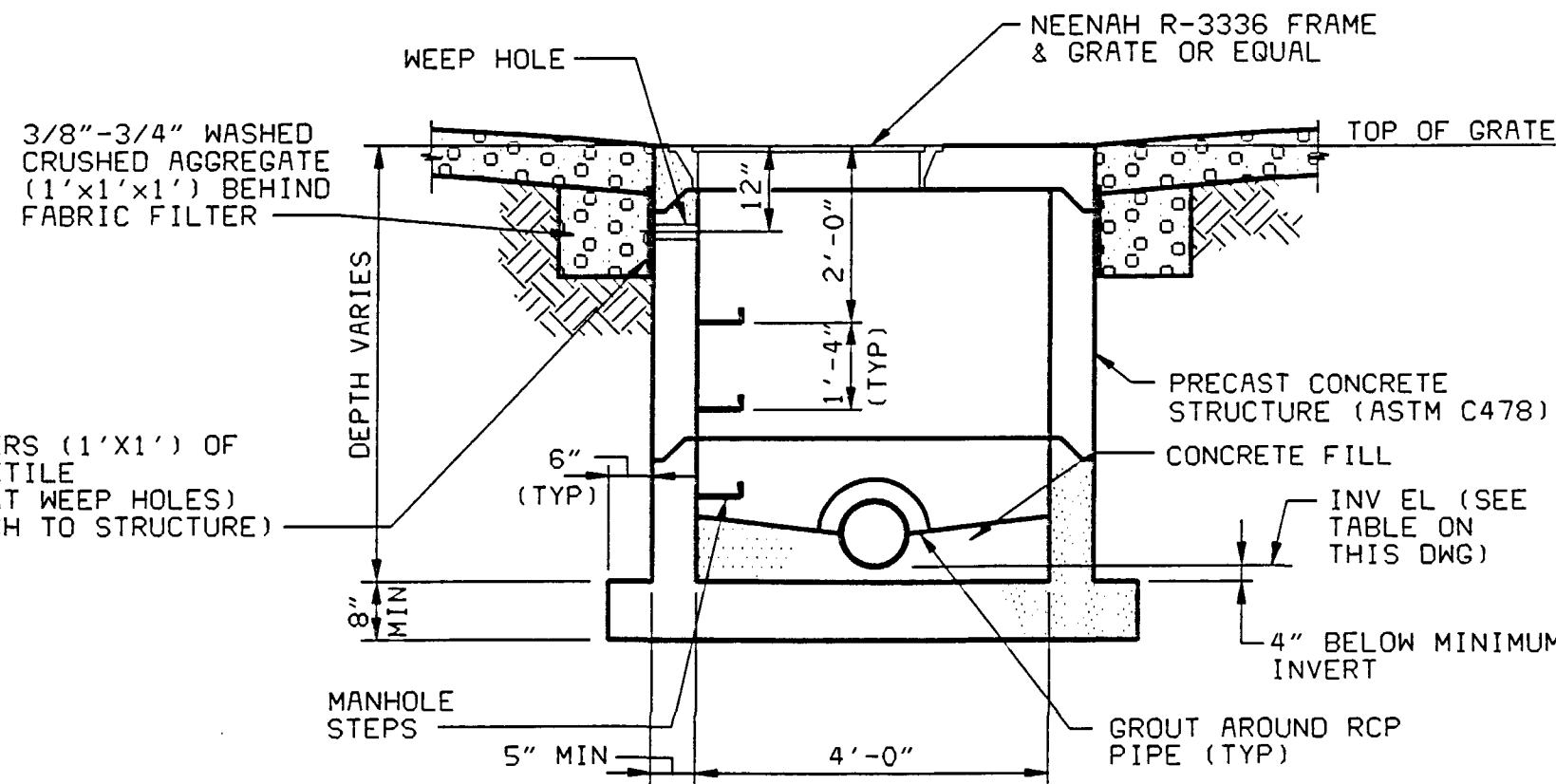
PLAN
DISCHARGE STRUCTURE OUTLET
PREFORMED SCOUR HOLE AND SPREADER SWALE
NO SCALE



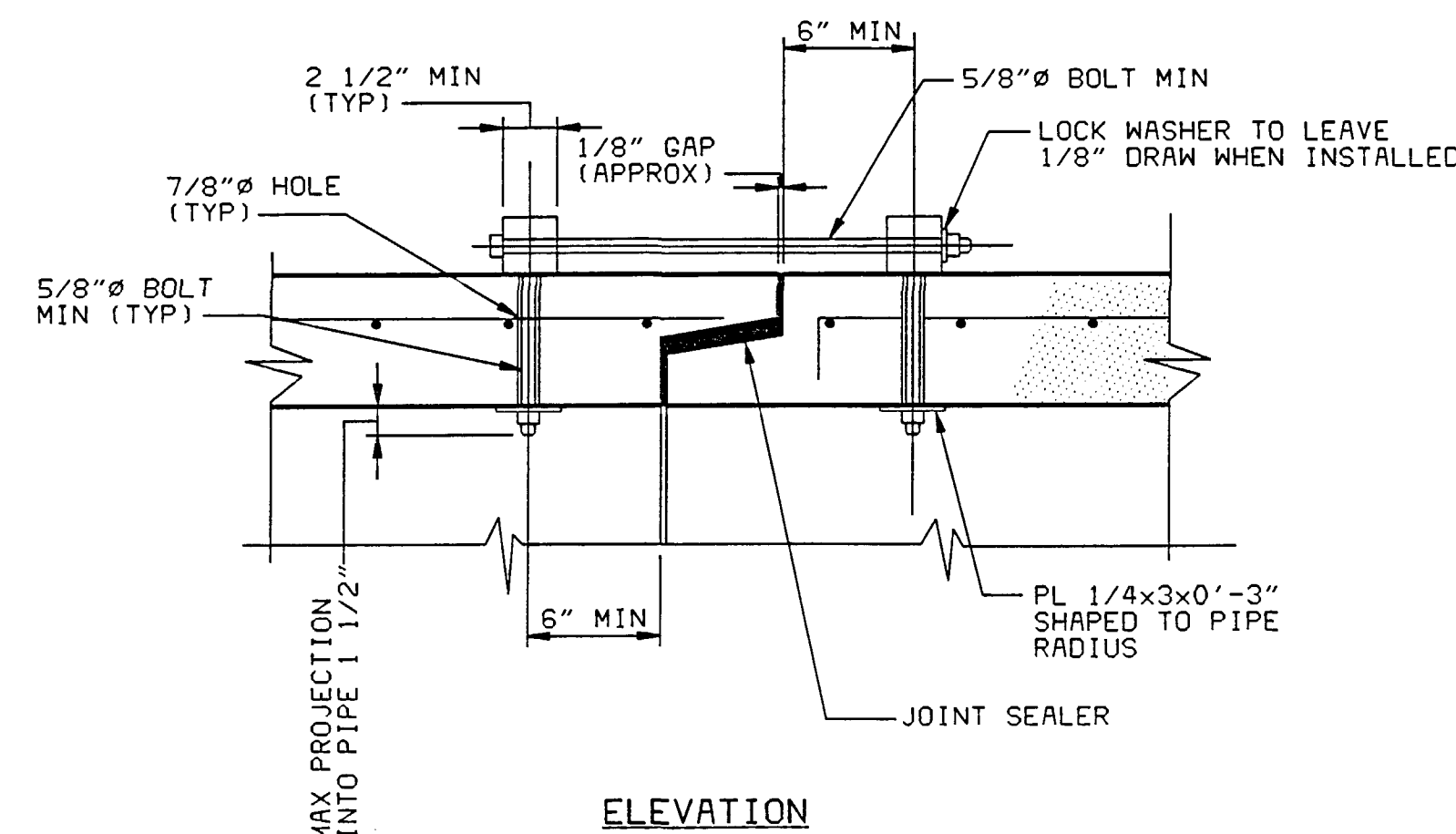
PLAN
DISCHARGE STRUCTURE INLET
NO SCALE



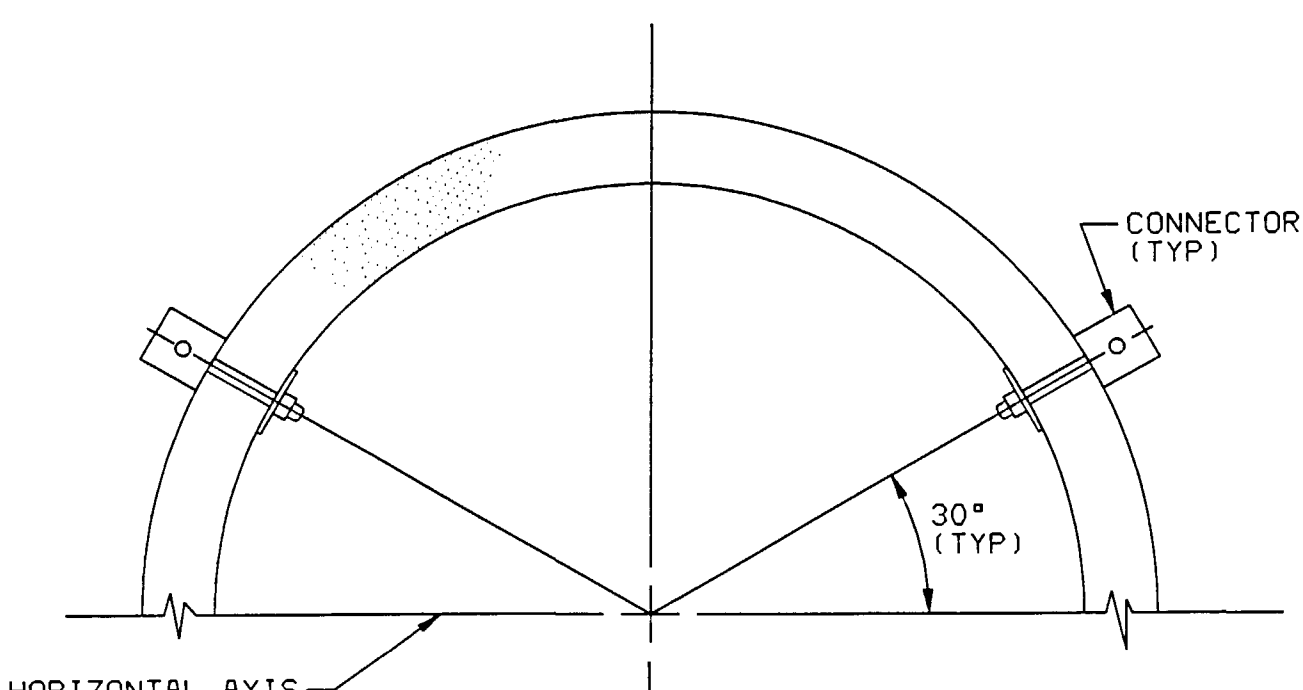
PLAN



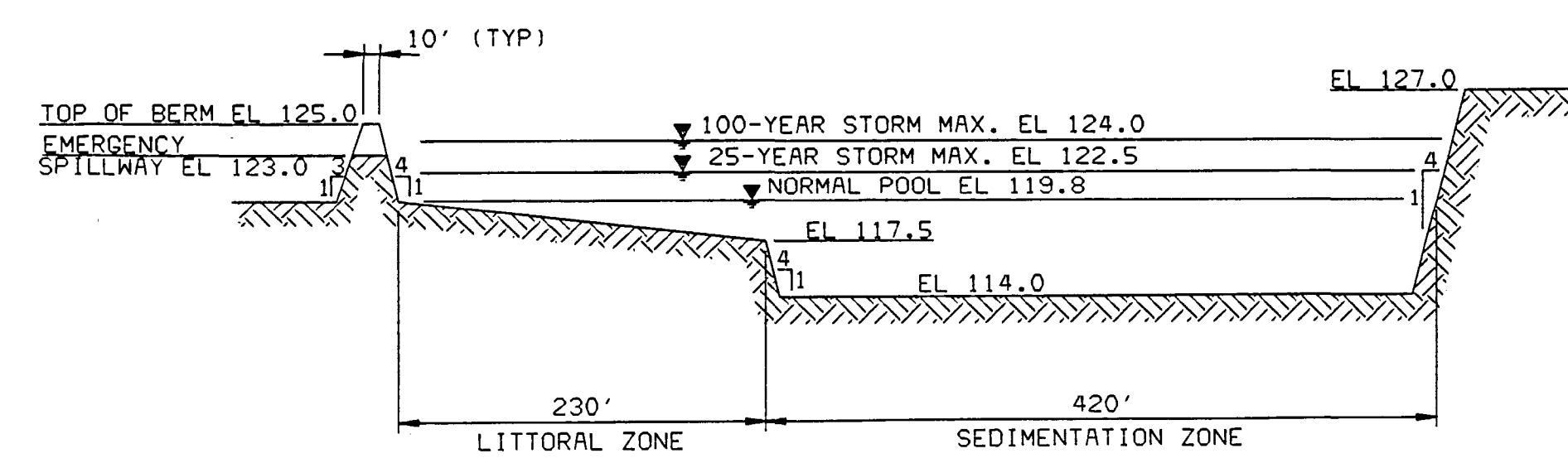
SECTION
TYPICAL SQUARE PRECAST STORM DRAIN INLET
NO SCALE



ELEVATION



SECTION
TYPICAL REINFORCED CONCRETE PIPE CONNECTOR
FOR END SECTION TIED JOINTS
NO SCALE



SECTION 2
DETENTION BASIN
NO SCALE

NOTES

- SEE DRAWING S3000 FOR GENERAL NOTES AND LEGEND.
- SEE DWG. S3002 FOR CULVERT LIST.
- SEE DRAWING S3001 & S3002 FOR GRADING AND DRAINAGE.

EXTENSIVE REVISIONS

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FOR CONSTRUCTION

DATE OF ISSUE 03-15-94

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BLACK & VEATCH
ENGINEER
DRAWN
NO
DATE

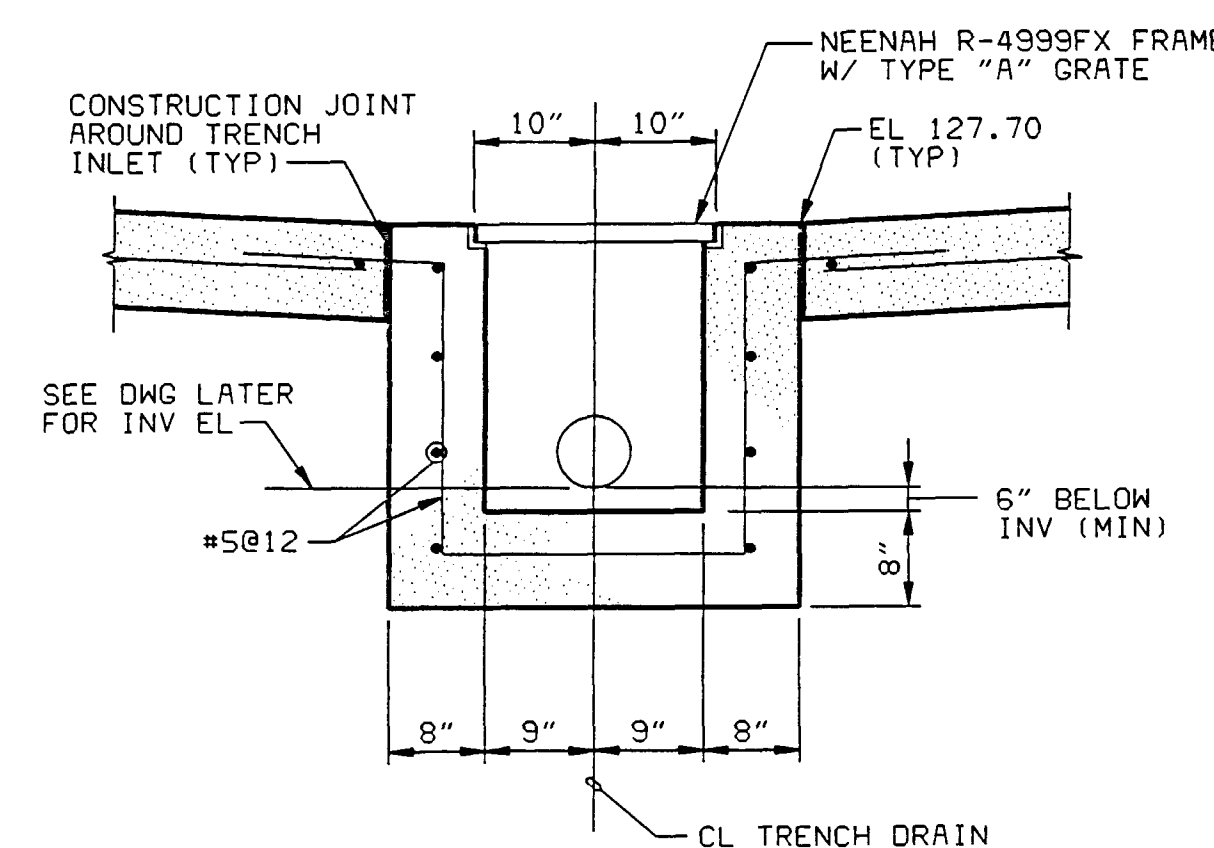
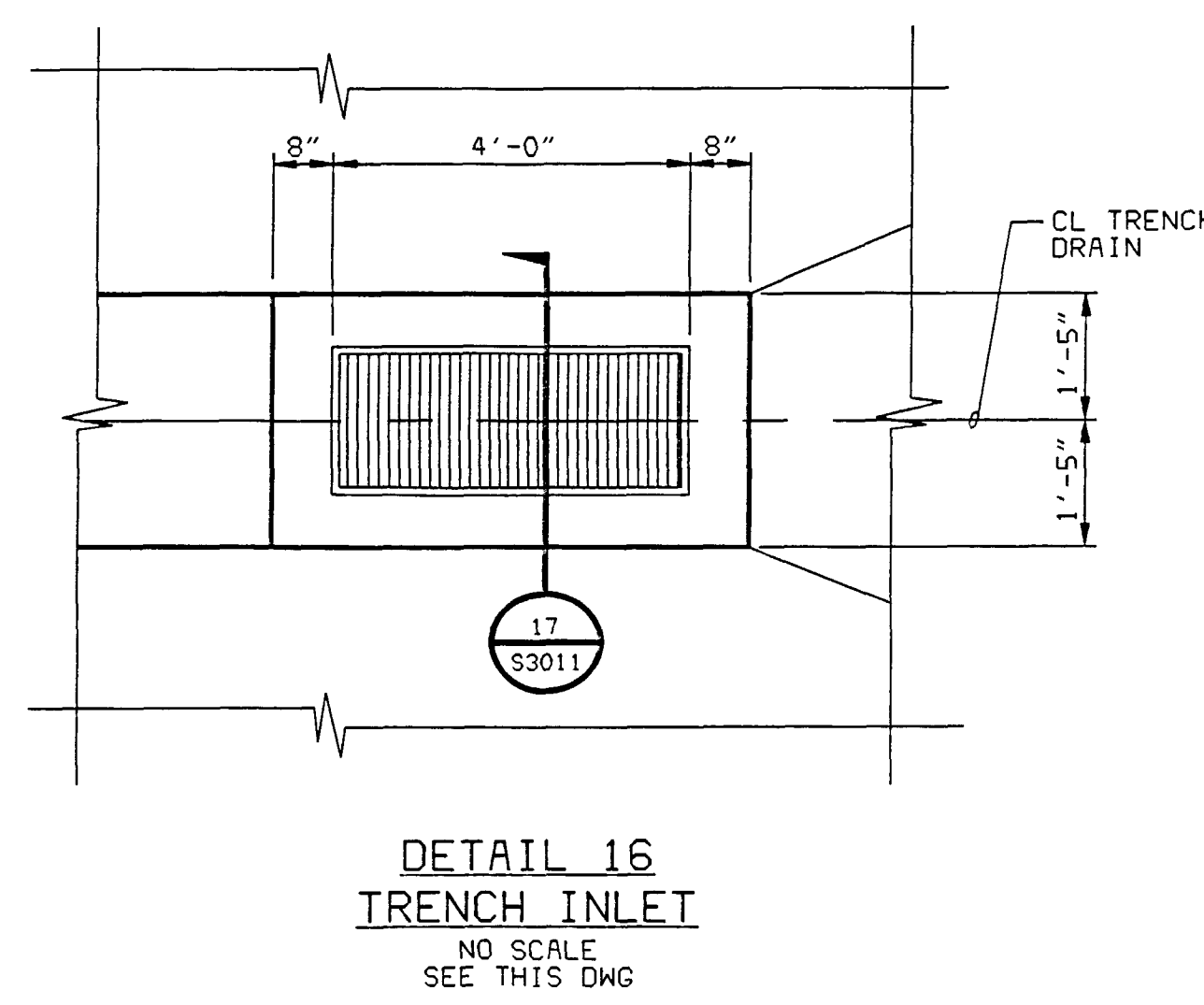
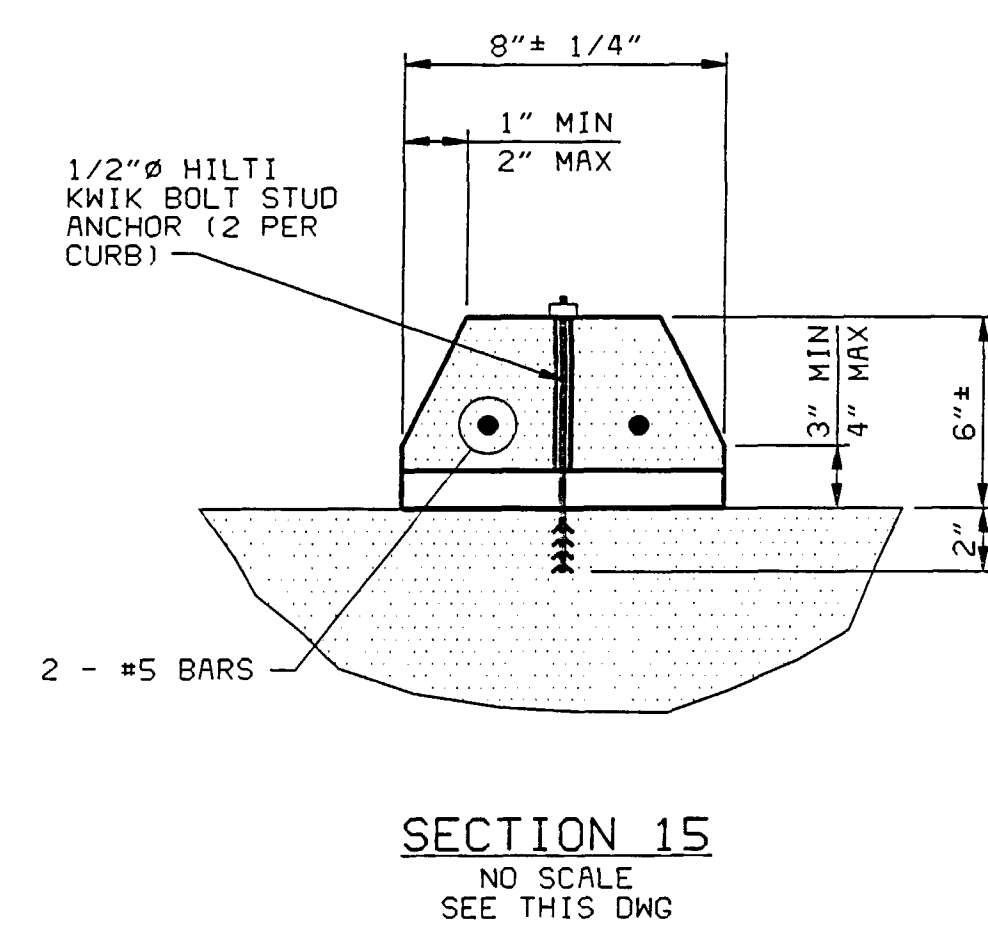
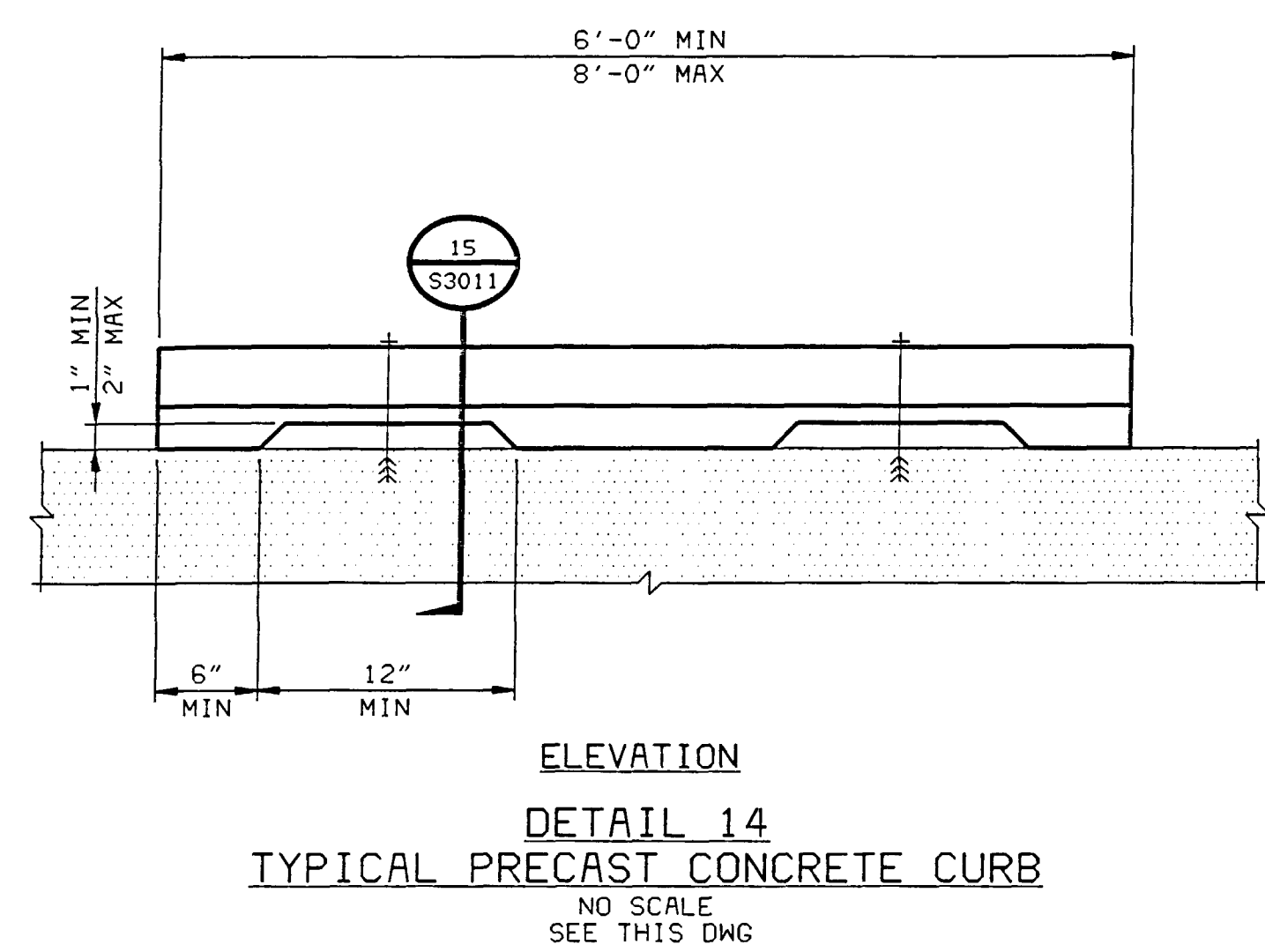
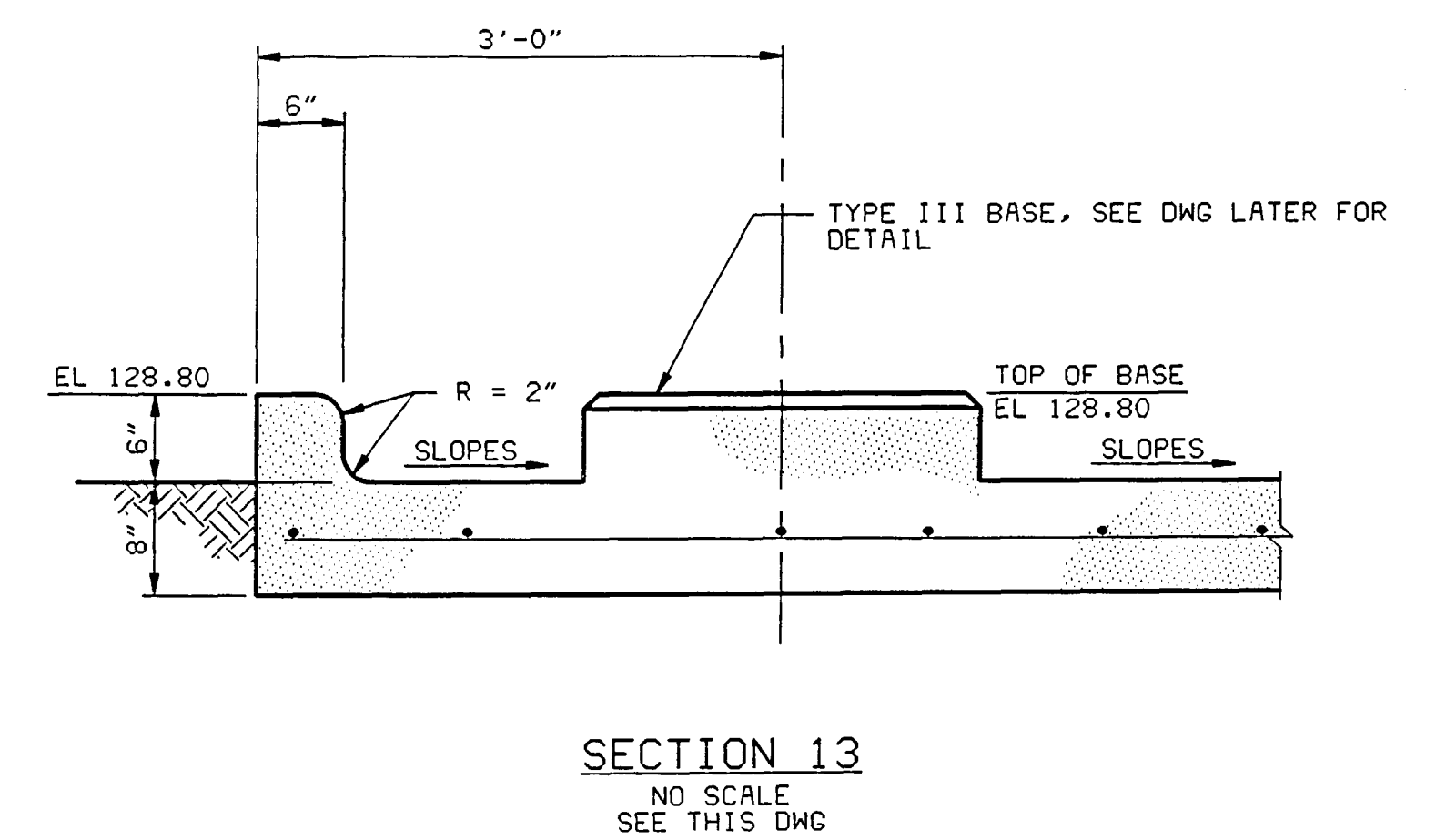
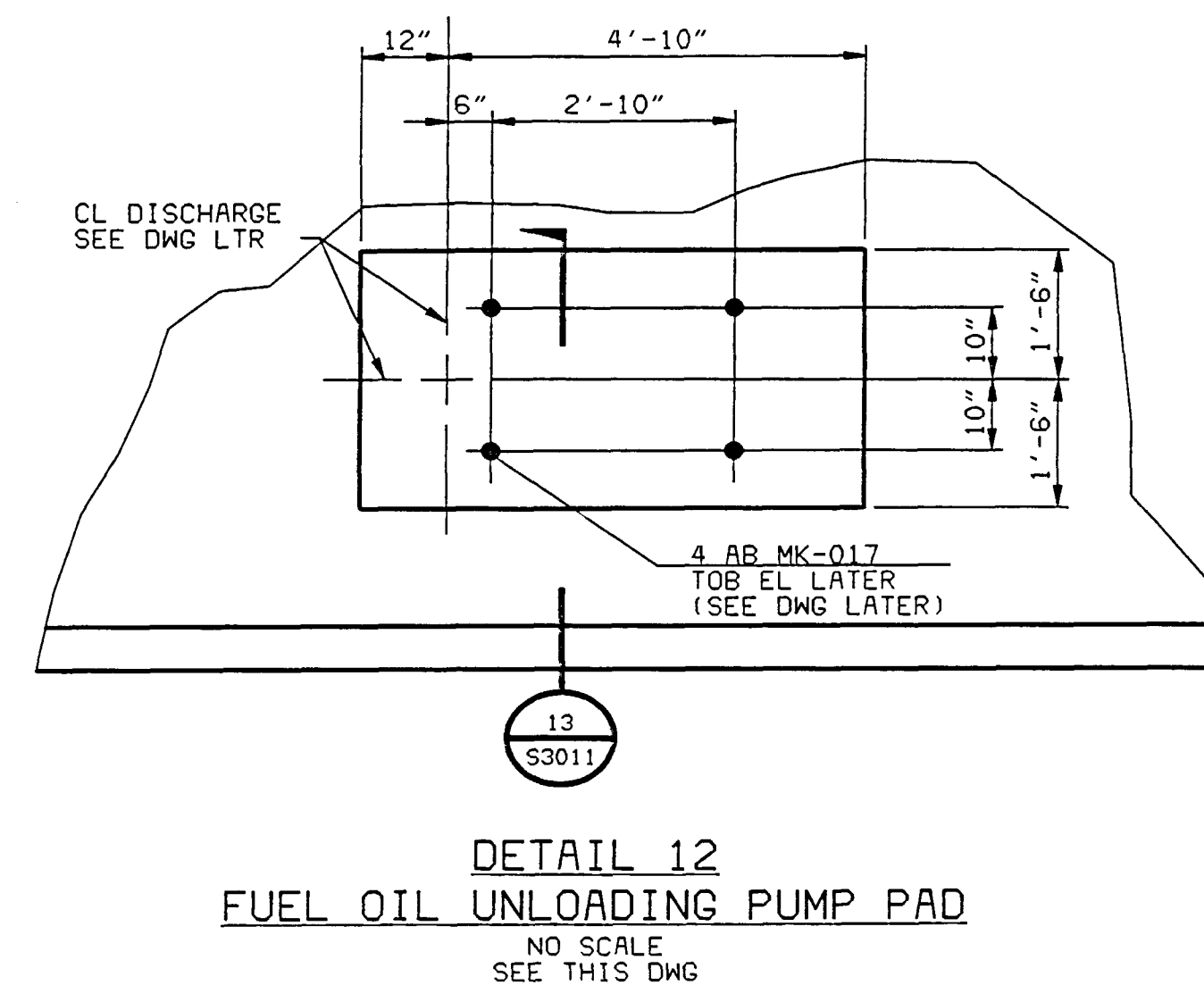
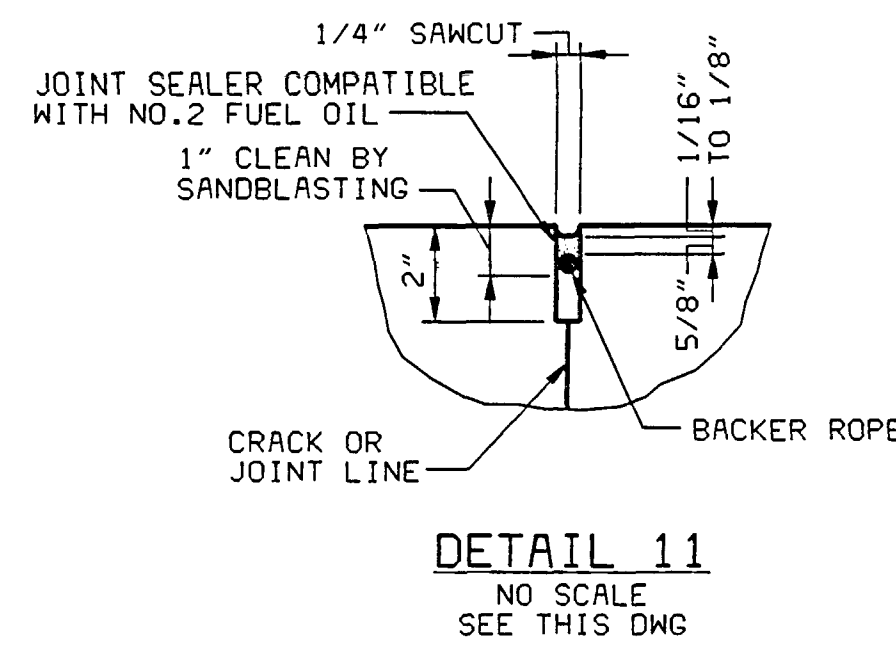
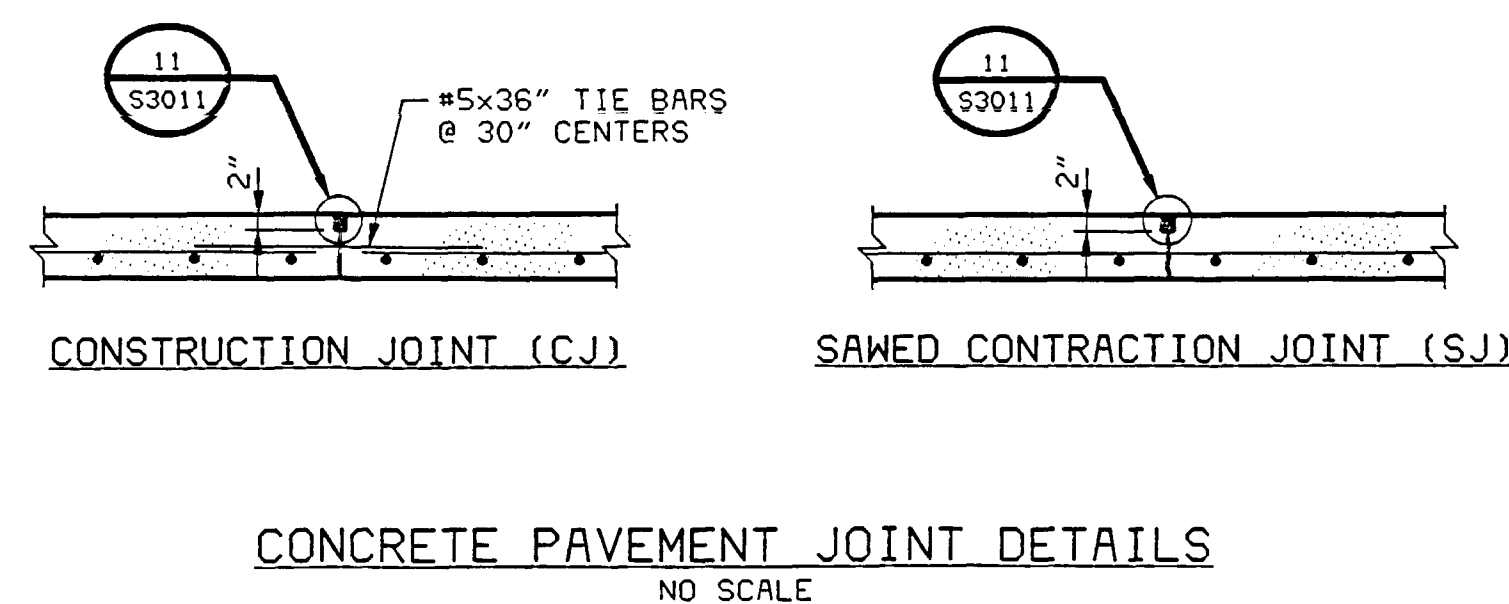
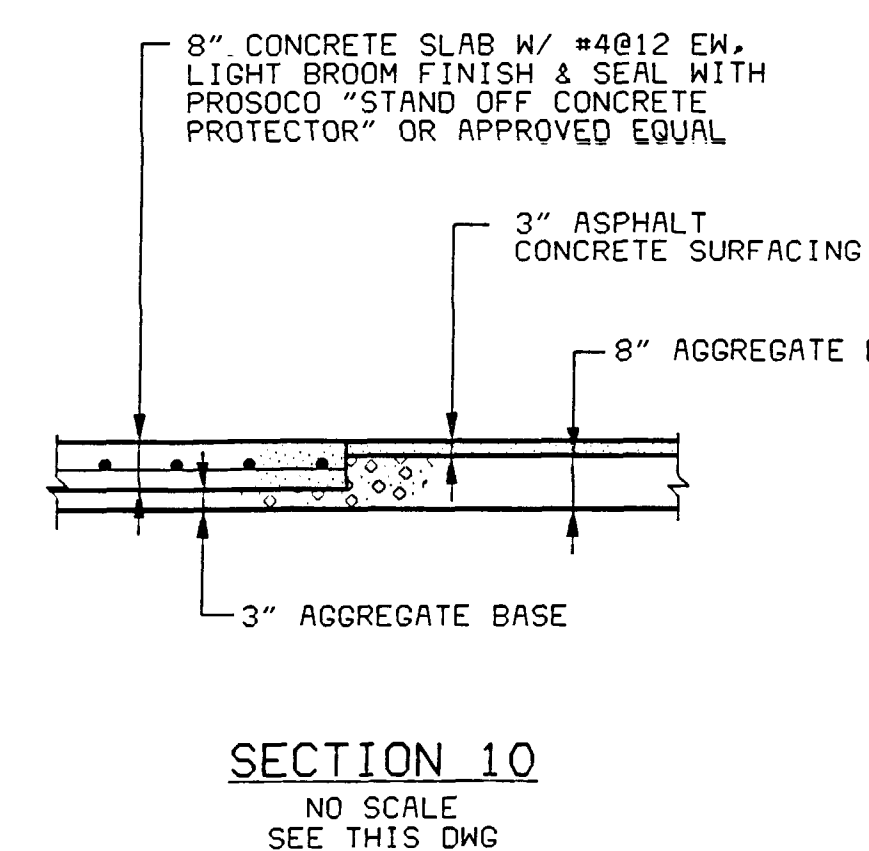
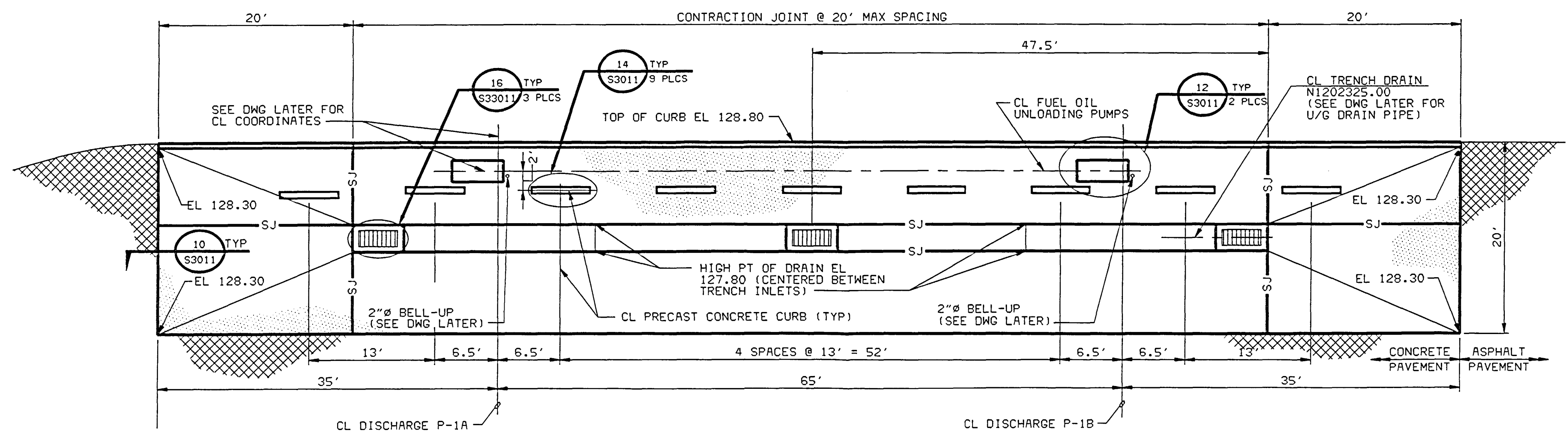
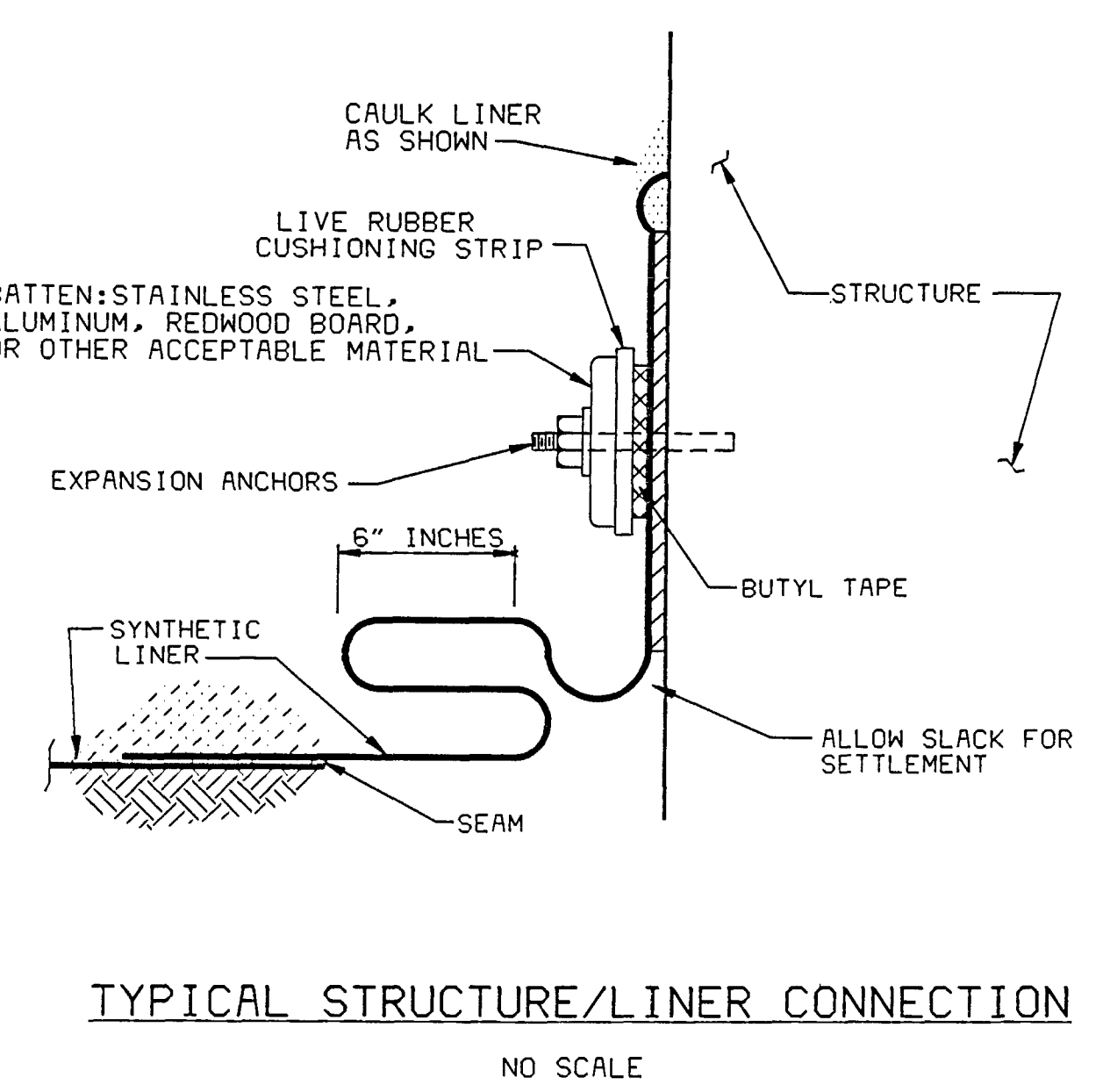
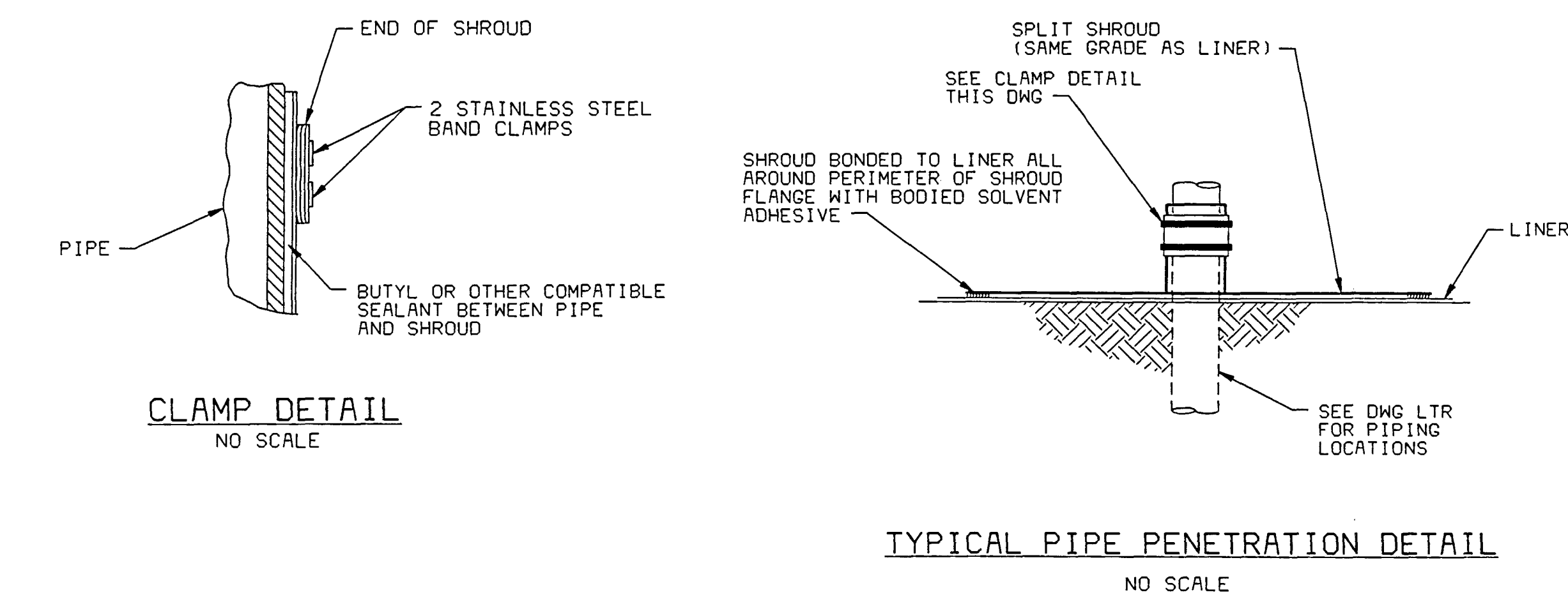
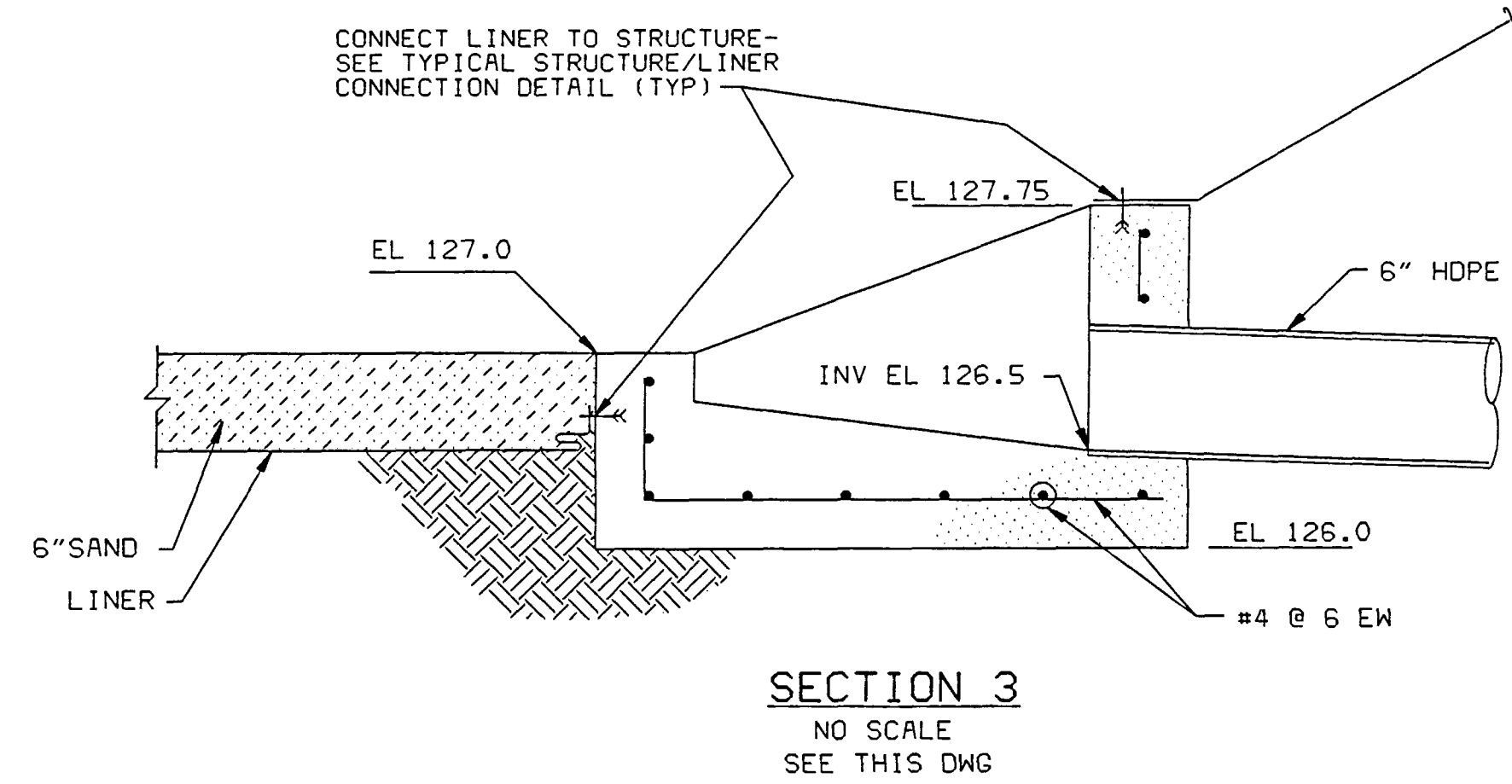
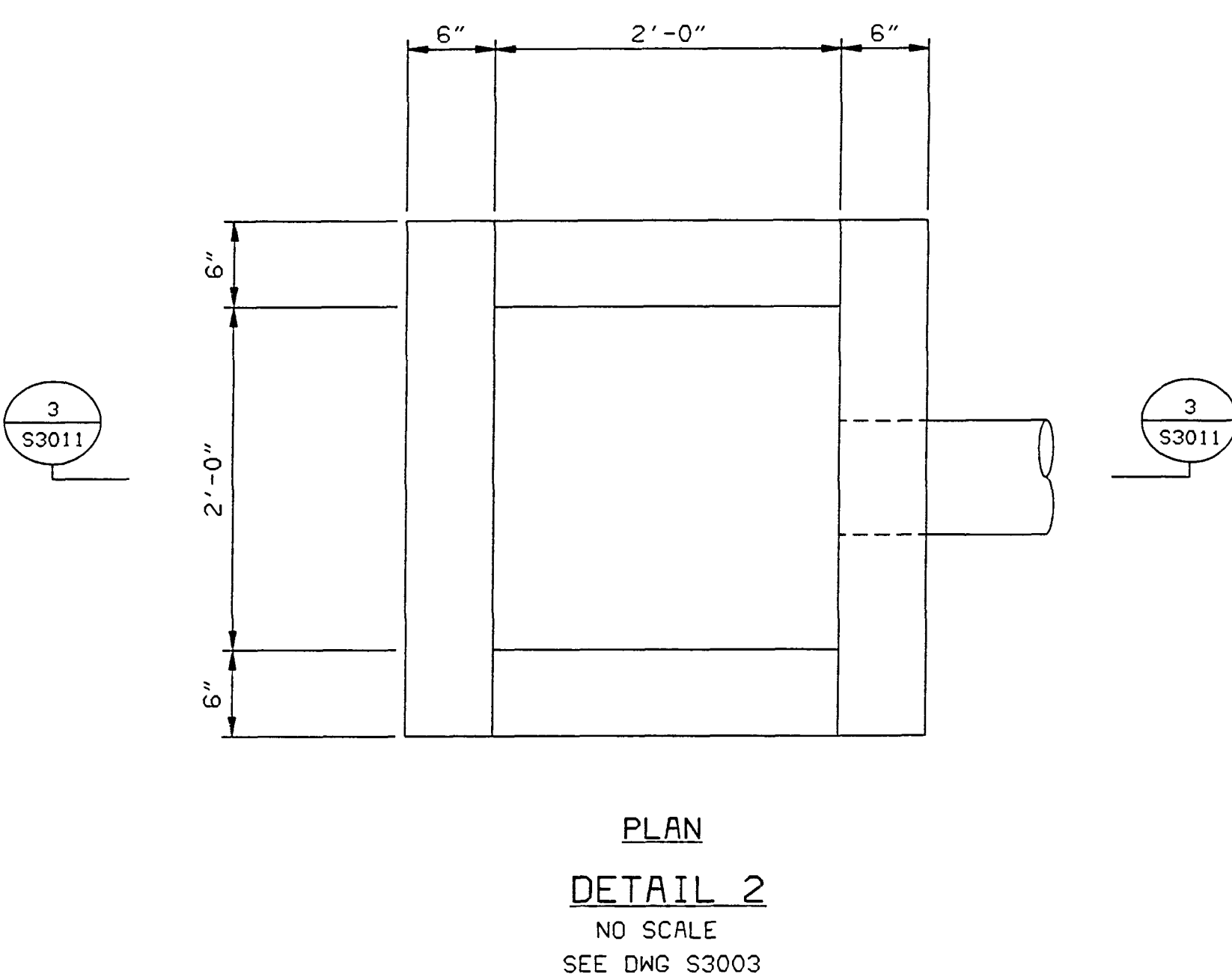
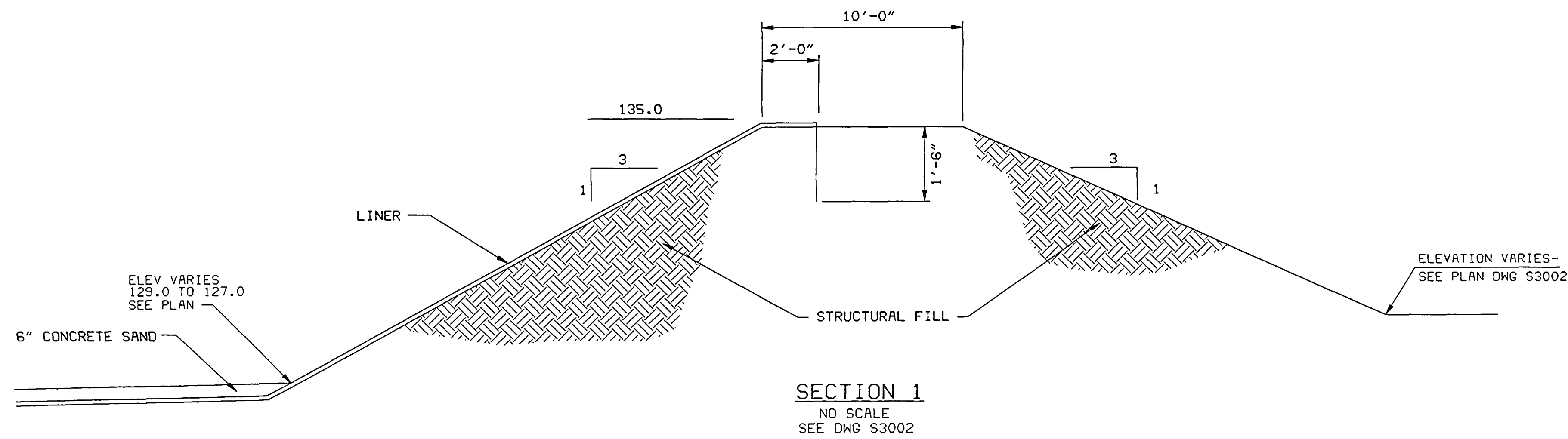
SEMINOLE ELECTRIC COOP, INC.
HARDEE POWER STATION UNIT 3
SITE - GRADING AND DRAINAGE
SECTIONS & DETAILS - SHEET 1

PROJECT
DRAWING NUMBER
23930-CSTF-S3010
CODE
AREA

REV
B

NO	DATE	REVISIONS AND RECORD OF ISSUE	BY
B	03-15-94	REVIEW ISSUE	
A	01-28-94	REVIEW ISSUE	
NO			

BY CHK/APPL/PLM



NOTES

- SEE DRAWING S3000 FOR GENERAL NOTES AND LEGEND.
- CONCRETE SHALL BE REINFORCED WITH FIBERMESH AT THE RATE OF 1 1/2 LBS OF FIBERMESH PER CUBIC YARD OF CONCRETE. FIBERMESH SHALL BE HANDLED, STORED AND MIXED IN ACCORDANCE WITH FIBERMESH RECOMMENDATIONS (FIBERMESH CO., 4019 INDUSTRY DRIVE, CHATTANOOGA, TN 37416).

EXTENSIVE REVISIONS

NOT TO BE USED FOR CONSTRUCTION

DATE OF ISSUE 03-15-94

BLACK & VEATCH

ENGINEER DRAWN WG
CHECKED DATE

SEMINOLE ELECTRIC COOP, INC.
HARDEE POWER STATION UNIT 3

PROJECT DRAWING NUMBER
23930-CSTF-S3011

SITE - GRADING AND DRAINAGE
FUEL UNLOADING & STORAGE AREA DETAILS

CODE
AREA

REV
B

REVISIONS AND RECORD OF ISSUE

NO	DATE	REVISIONS AND RECORD OF ISSUE
B	03-15-94	REVIEW ISSUE
A	01-28-94	REVIEW ISSUE

BY: CH/AP/FLM

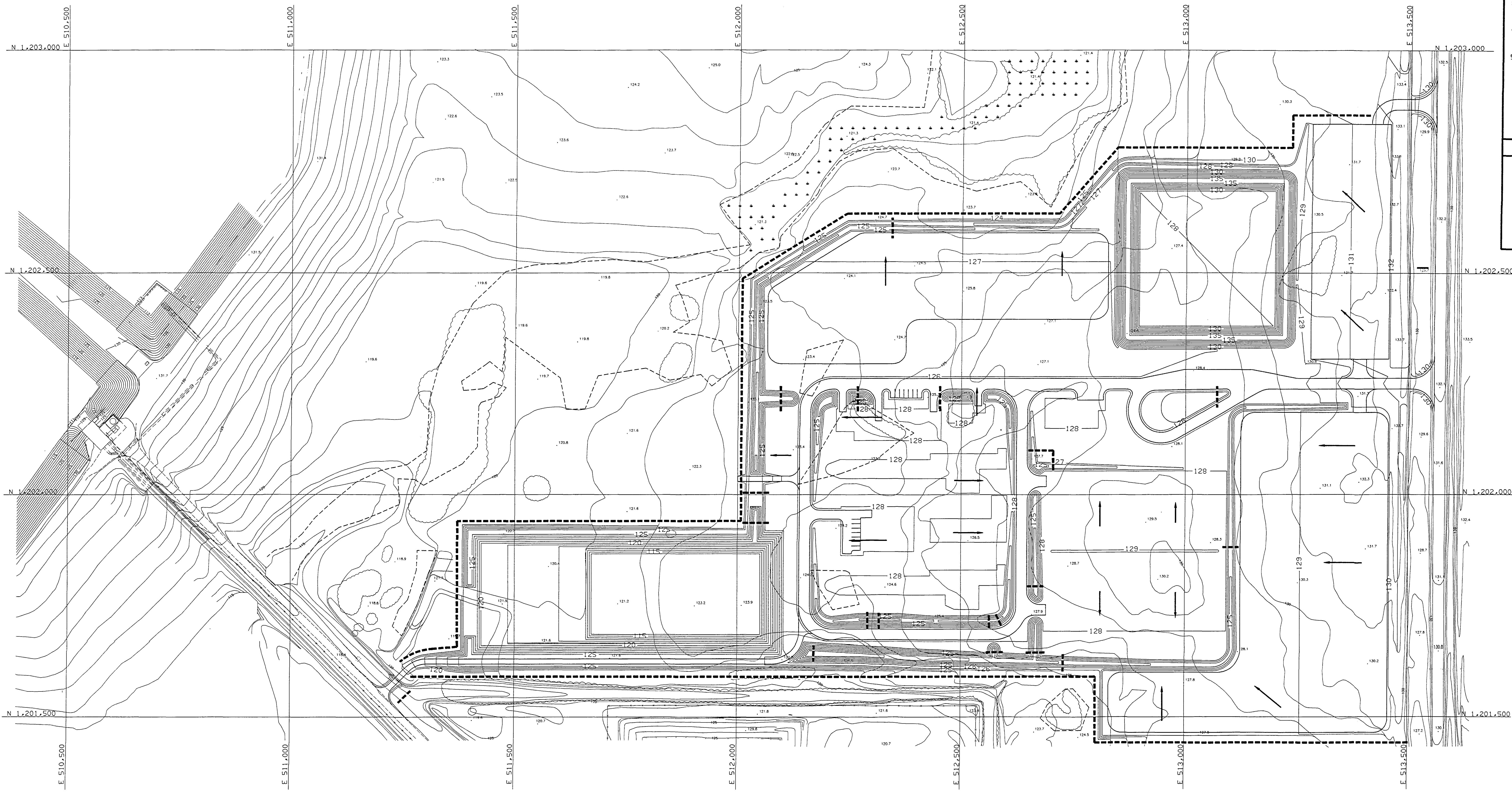
I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF FLORIDA.

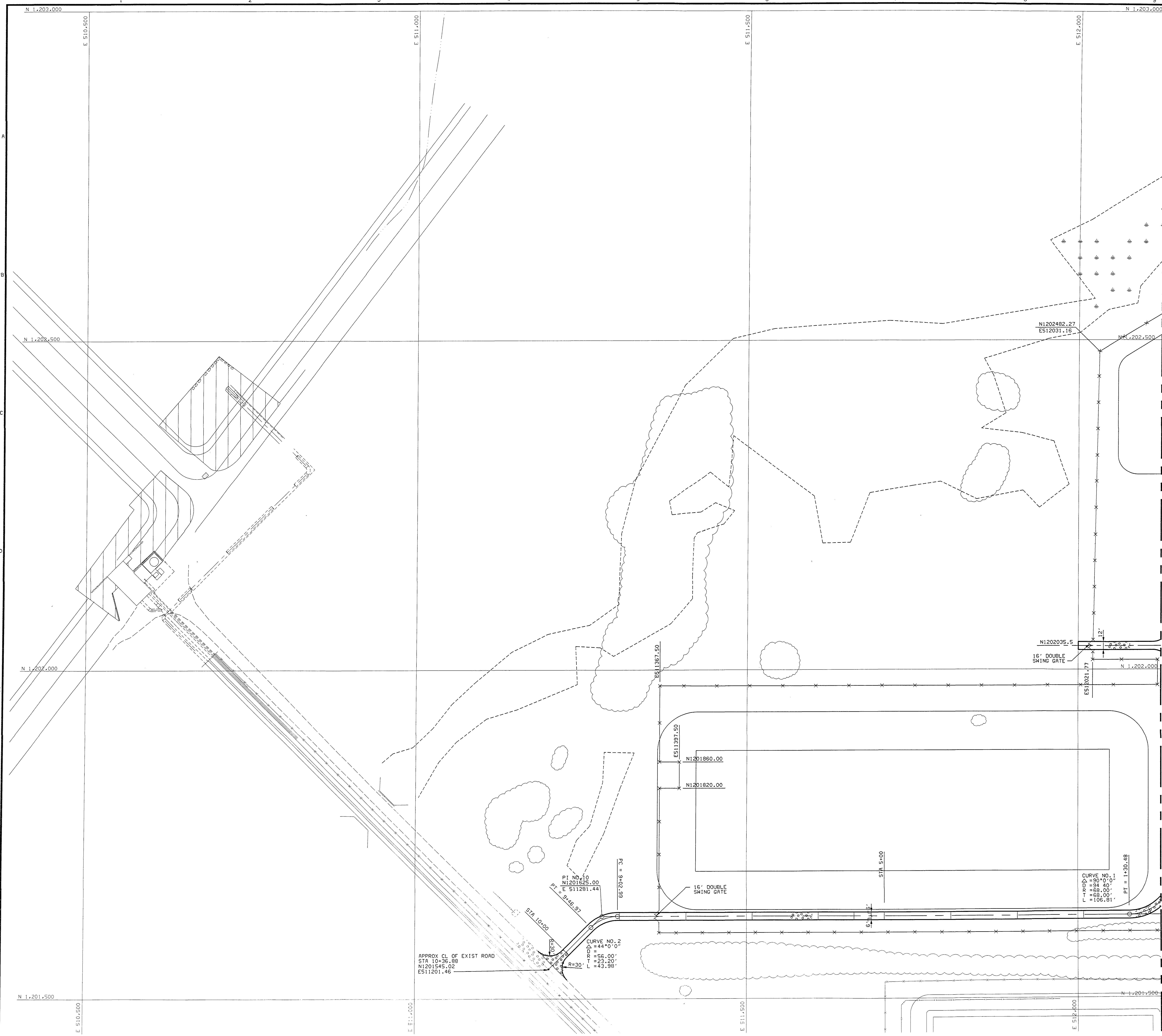
SIGNED
DATE REG. NO.

1. SEE DRAWING S3000 FOR GENERAL NOTES AND LEGEND.
2. SILT FENCES SHALL BE INSTALLED AT ALL CULVERT INLETS AND AREA INLETS.
3. EROSION AND SEDIMENTATION CONTROL MEASURES INSTALLED UNDER CONTRACT 71.0201. THESE INSTALLATIONS SHALL BE REMOVED AT PROJECT COMPLETION.
4. CONTRACTOR SHALL INSTALL ADDITIONAL SILT FENCE, AS NECESSARY, OR AS DIRECTED BY THE CONSTRUCTION MANAGER, TO CONTROL EROSION AND SEDIMENTATION.
5. THE EROSION CONTROL SHOWN ON THIS DRAWING IS THE MINIMUM REQUIRED. HOWEVER, THE CONTRACTOR SHALL INSTALL ADDITIONAL MEASURES AS NEEDED TO CONTROL EROSION AND SEDIMENT FROM CONSTRUCTION OPERATIONS.

EROSION CONTROL LEGEND

- 125— EXISTING CONTOURS
- 125— NEW CONTOURS
- CONSTRUCTION SILT FENCE
- DIRECTION OF FLOW





- NOTES
1. SEE DRAWING S3000 FOR GENERAL NOTES AND LEGEND.
 2. SEE DRAWING S3001 AND S3002 FOR CONTOURS WHICH REPRESENT FINISH GRADE.
 3. SEE DRAWING S1001 FOR LOCATIONS OF STRUCTURES.
 4. SEE DRAWING S1001 FOR LOCATIONS OF STRUCTURES.
 5. AGGREGATE SURFACING SHALL BE 4 INCHES THICK.

SURFACING LEGEND

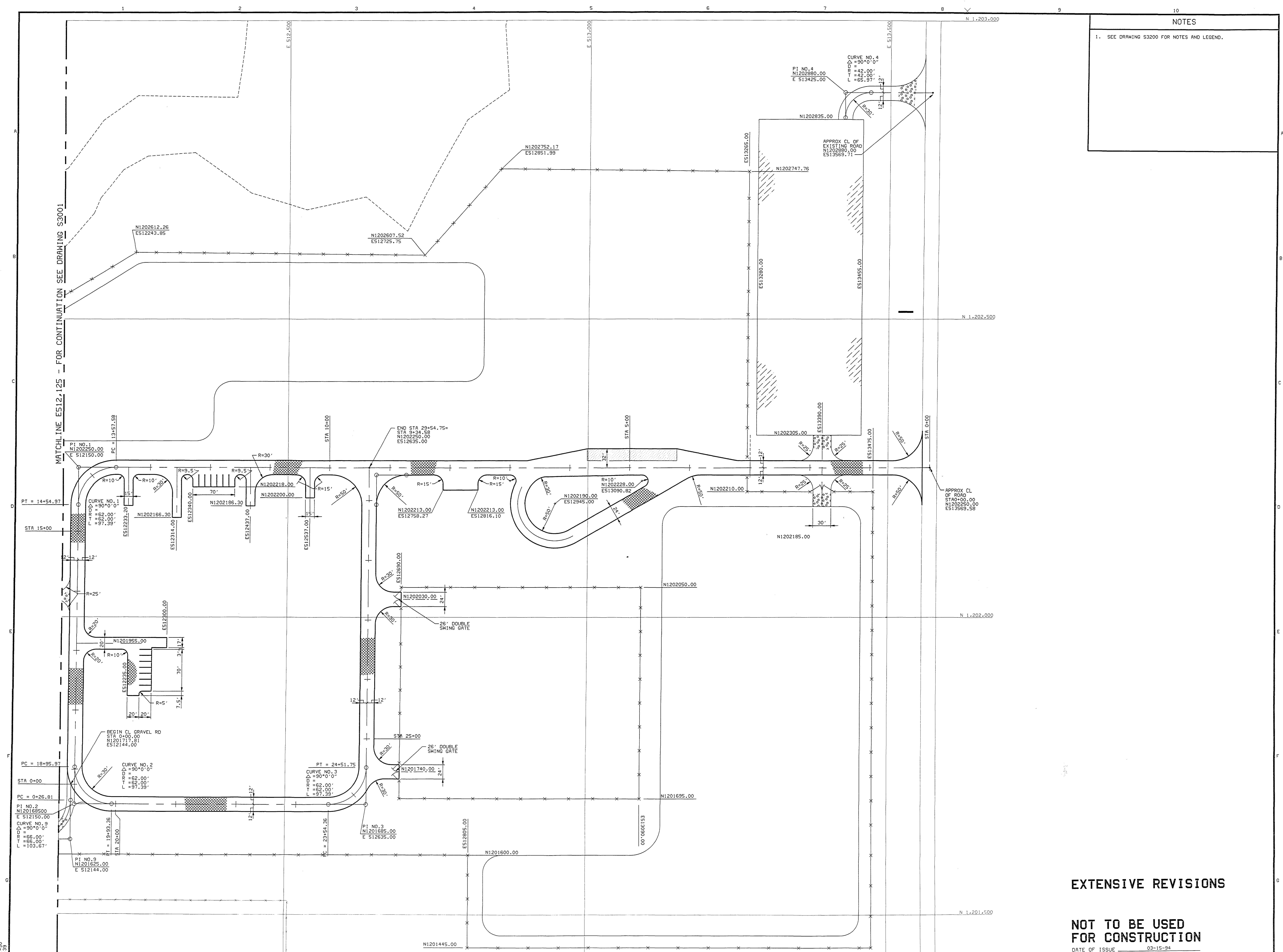
	ASPHALT PAVEMENT
	AGGREGATE SURFACING
	AGGREGATE BASE
	CONCRETE PAVEMENT

EXTENSIVE REVISIONS

NOT TO BE USED FOR CONSTRUCTION

DATE OF ISSUE 03-15-94

07/28/94 ACAD 12.cib		I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF FLORIDA		BLACK & VEATCH		SEMINOLE ELECTRIC COOP, INC. HARDEE POWER STATION UNIT 3		PROJECT 23930-CSTF-S3200		DRAWING NUMBER 1	
NO		DATE		REVISIONS AND RECORD OF ISSUE		BY CHK/APP/PLM		ENGINEER		DRAWN	
1		03-15-94		REVIEW ISSUE				CHECKED		DATE	
0		01-28-94		REVIEW ISSUE				DATE		DATE	
								SITE - ROADS		CODE	
								ROADS, FENCING, & SURFACING PLAN - AREA 1		AREA	



NOTES

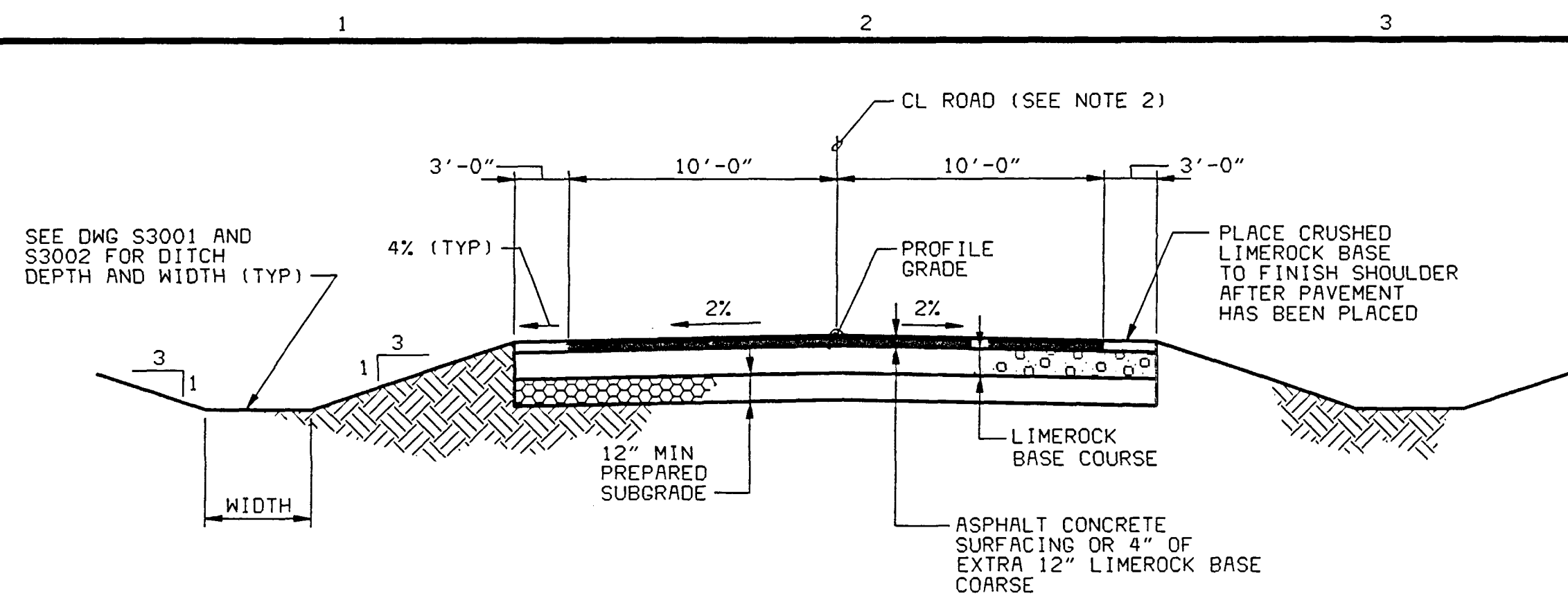
1. SEE DRAWING S3200 FOR NOTES AND LEGEND.

EXTENSIVE REVISIONS

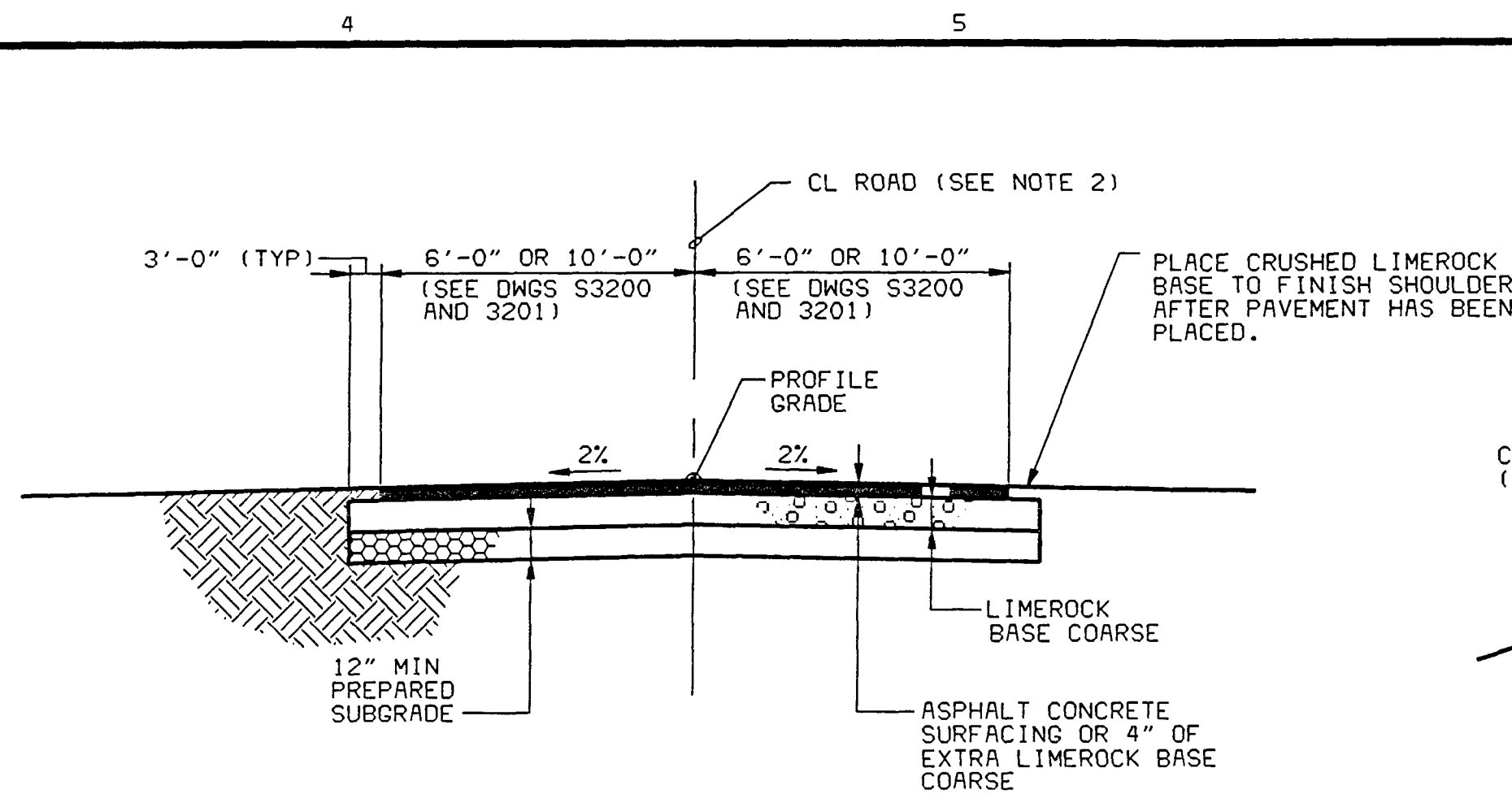
NOT TO BE USED
FOR CONSTRUCTION

DATE OF ISSUE 03-15-94

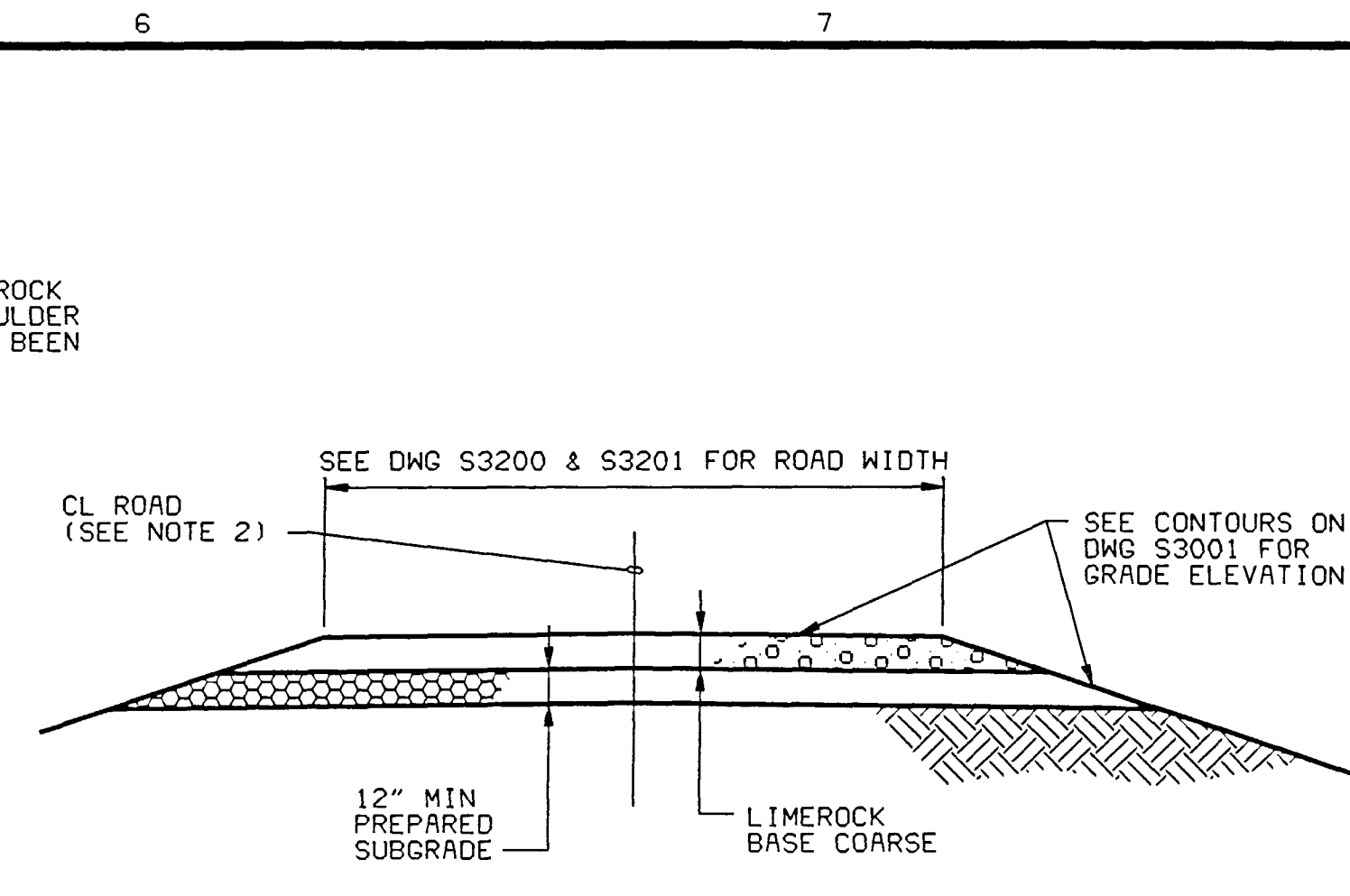
073600656 AC08 12-clb A105008 E1 03/17/94 13:40:39		1 03-15-94 REVIEW ISSUE		BY CHK/APP/FL		BLACK & VEATCH		SEMINOLE ELECTRIC COOP, INC HARDEE POWER STATION UNIT 3		PROJECT 23930-CSTA-S3201		DRAWING NUMBER 1	
NO		DATE		REVISIONS AND RECORD OF ISSUE		SIGNED		DATE		SITE - ROADS ROADS, FENCING, & SURFACING PLAN - AREA 2		AREA	



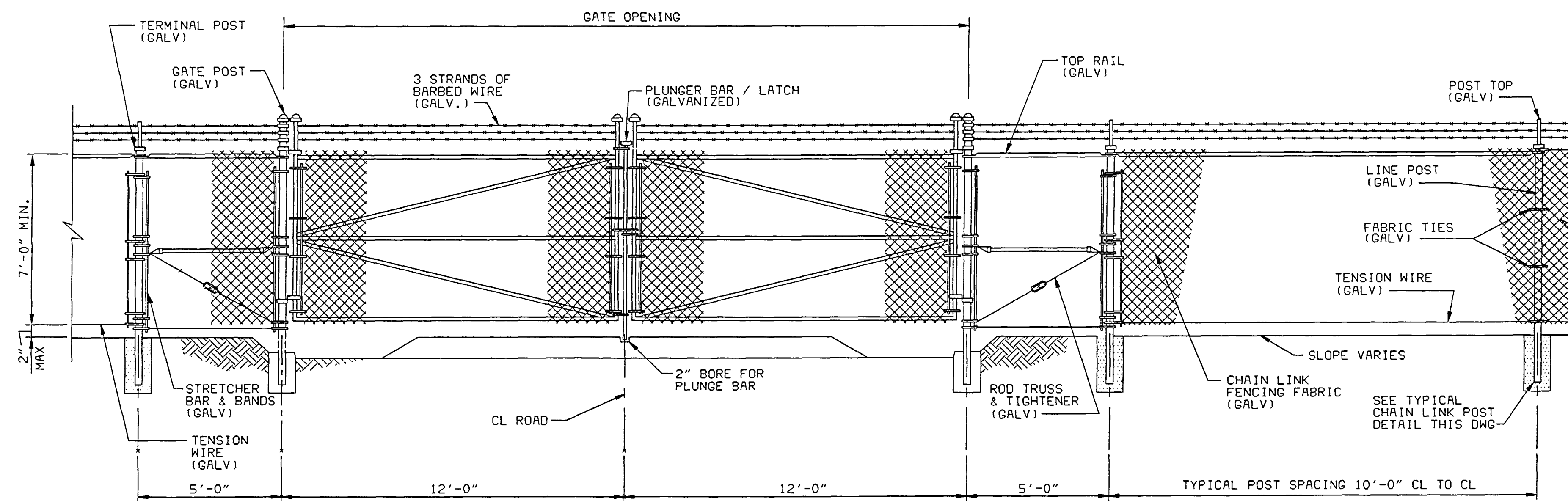
SECTION 1
PAVED SITE ACCESS ROAD
NO SCALE
SEE DWG S3201



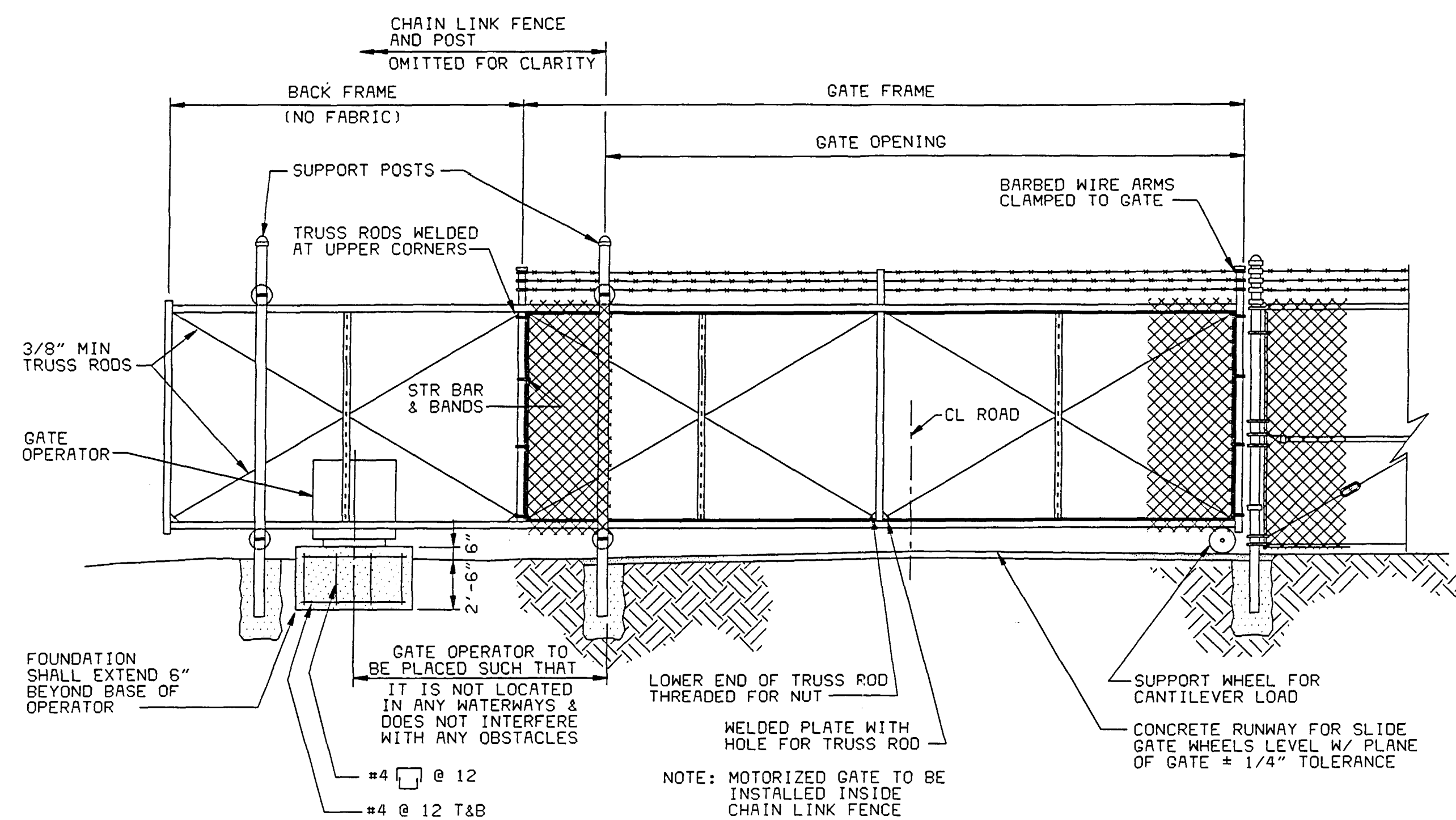
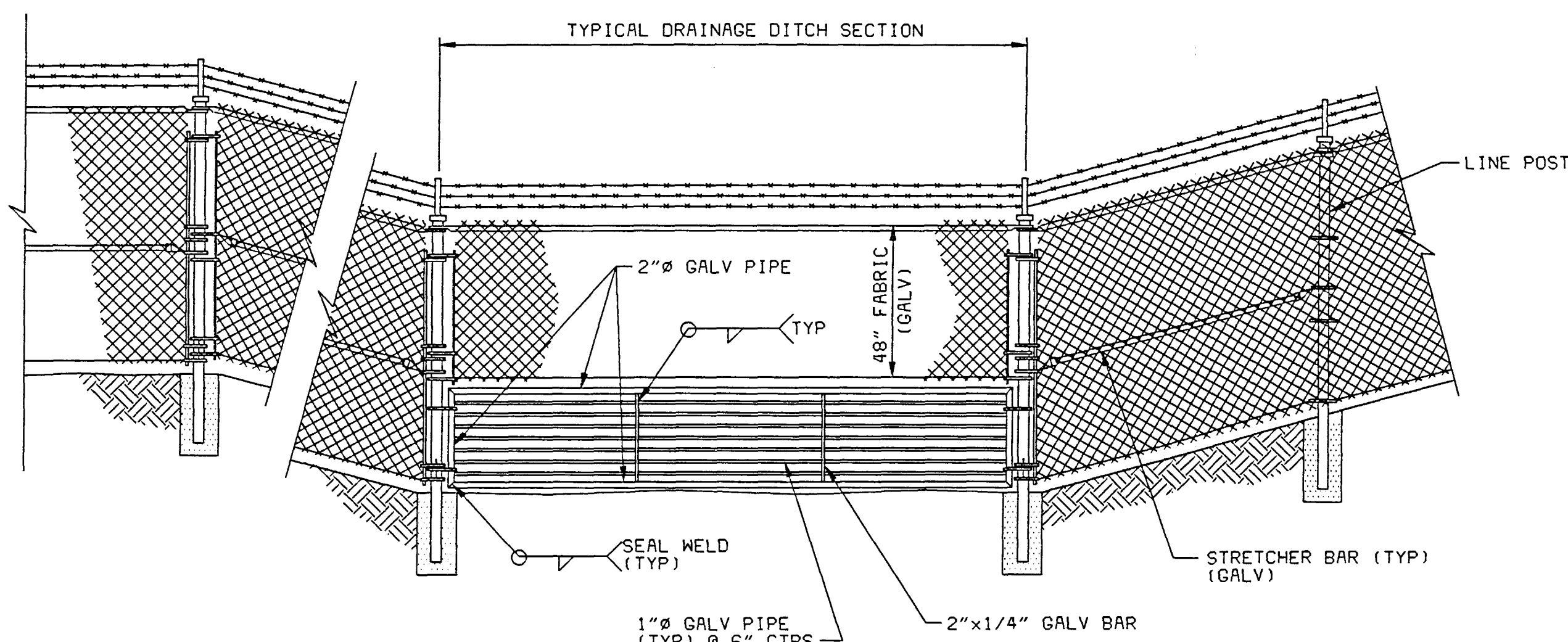
SECTION 2
PLANT ROADS
NO SCALE
SEE DWGS S3200 & S3201



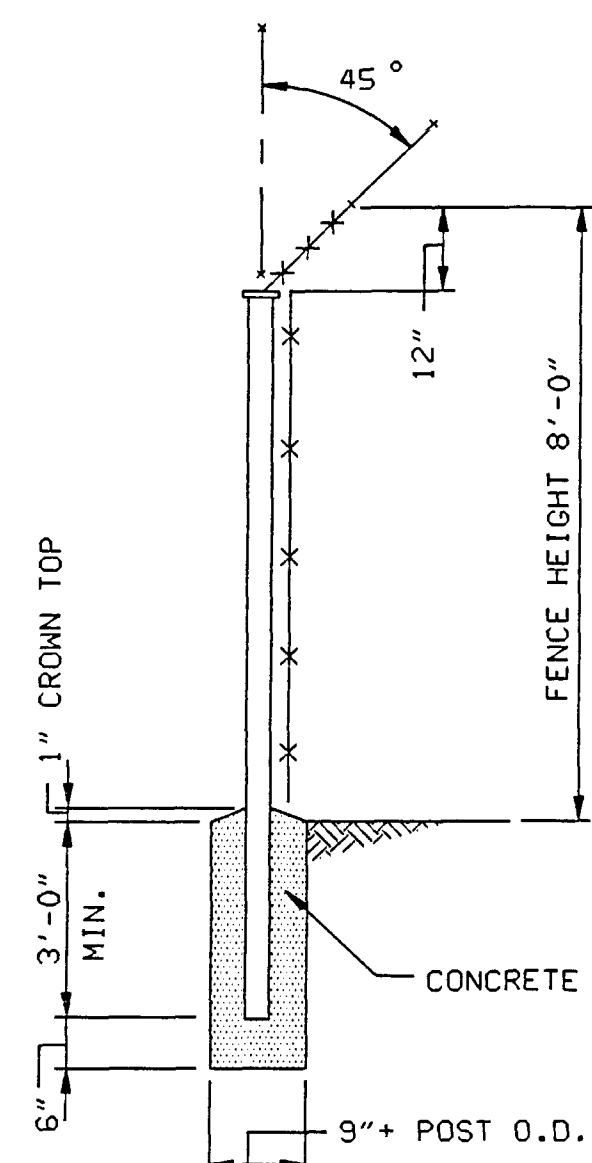
SECTION 3
MISC. AGGREGATE SURFACED ROADS
NO SCALE
SEE DWGS S3001, S3002, S3200 & S3201



TYPICAL CHAIN LINK FENCE WITH SWING GATE
NO SCALE



TYPICAL MOTOR OPERATED SLIDE GATE DETAIL
NO SCALE



TYPICAL CHAIN LINK POST
NO SCALE

NOTES

- SEE DRAWING S3000 FOR GENERAL NOTES AND LEGEND.
- SEE DRAWINGS S3200, S3201, S3001, & S3002 FOR HORIZONTAL AND VERTICAL ROAD ALIGNMENT.

EXTENSIVE REVISIONS

NOT TO BE USED
FOR CONSTRUCTION

DATE OF ISSUE 03-15-94

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BLACK & VEATCH
ENGINEER
DRAWN
HG
CHECKED
DATE

SEMINOLE ELECTRIC COOP, INC.
HARDEE POWER STATION UNIT 3

PROJECT
DRAWING NUMBER
23930-CSTA-S3202
REV
B
SITE - ROADS
SECTIONS & DETAILS

NO DATE REVISIONS AND RECORD OF ISSUE BY CHM/APPLM