United States
Environmental Protection
Agency

Region IV
345 Courtland Street NE
Atlanta, GA 30365

EPA 904/9-94-002(a)
June 1994

EPA

FINAL

Environmental Impact Statement

Volume I: Report

Tampa Electric Company - Polk Power Station

PUBLIC NOTICE

June 10, 1994

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV
345 COURTLAND STREET, NE
ATLANTA, GEORGIA 30365

Availability of the U.S. Environmental Protection Agency's (EPA) final environmental impact statement (FEIS) entitled "Tampa Electric Company - Polk Power Station" was noticed by EPA Region IV as a Notice of Availability (NOA) in the *Federal Register* on June 10, 1994. EPA published the NOA for the draft environmental impact statement (DEIS) in the Federal Register at 59 FR 9211 on February 25, 1994. EPA has tentatively made an NPDES new source determination for the proposed project. This EIS provides EPA's National Environmental Policy Act (NEPA) documentation for the NPDES permitting decision for a new source. Pending successful completion of this EIS process, EPA's preferred permit action is to issue the NPDES permit with conditions.

Through license and permit applications, Tampa Electric Company is proposing to construct and operate a new power plant and associated facilities on an approximately 4,348-acre site in southwestern Polk County, Florida. The proposed facilities would be known as the "Tampa Electric Company Polk Power Station." The proposed total net generating capacity at full build-out of the units at the site would be approximately 1,150 megawatts (MW: EIS references to MW capacities of power generating units are understood to be "nominal net" capacities). The generating units planned for the Polk Power Station would be developed at the site according to a phased schedule that matches Tampa Electric Company's forecasted growth in electricity demands beginning in 1996 and continuing into the year 2010. The first generating facility at the Polk Power Station site is proposed to be an integrated gasification combined cycle (IGCC) unit. This IGCC unit would be known as "Polk Unit 1." Cost-shared financial assistance for the IGCC unit would be provided by the U.S. Department of Energy (DOE) through the DOE Clean Coal Technology (CCT) Demonstration Program, pending successful completion of this environmental impact statement (EIS) process. The 260 MW IGCC unit would consist of a 150-MW advanced combustion turbine (CT), heat recovery steam generator (HRSG), steam turbine (ST), and coal gasification (CG) facilities. The IGCC unit would be fueled by coal-derived gas called coal gas or syngas, which is produced in the CG facilities with low-sulfur No. 2 fuel oil as a backup fuel. Tampa Electric Company's current Power Resource Plan indicates that later facilities would consist of two combined cycle (CC) generating units and six simple-cycle CTs fueled by natural gas with low-sulfur No. 2 fuel oil as the backup fuel.

Received written comments on this FEIS and/or draft NPDES permit will be accepted by EPA if postmarked by the close of the NEPA 30-day public comment period on:

JULY 11, 1994

Comments should be addressed to Ms. Lena Scott; Public Notice Coordinator; U.S. Environmental Protection Agency, Region IV; 345 Courtland Street, NE; Atlanta, Georgia 30365; Telephone: (404) 347-3004. Facsimile transmittals may be sent to EPA at (404) 347-5206. EPA will prepare an EIS Record of Decision (ROD) after the 30-day public comment period. Any substantive comment letters received by EPA will be addressed in the ROD and all letters will be appended to the ROD. Comments must be timely in order to be considered in the EPA ROD.

Both DOE and U.S. Army Corps of Engineers (USACOE) are Cooperating Agencies to EPA for this EIS. DOE is primarily concerned with its CCT Demonstration Program. Pending successful completion of this EIS process, DOE's preferred action is to provide cost-shared financial assistance to Tampa Electric Company for the IGCC Polk Unit 1. USACOE is primarily concerned with its dredge-and-fill permitting decision under Section 404 of the Clean Water Act. Pending successful completion

(MORE ON BACK)

of this EIS process, it is expected that both DOE and USACOE would, at their discretion, adopt this EIS as NEPA documentation for their agency actions. As appropriate, DOE and USACOE would also prepare their respective agency EIS RODs separate from EPA's EIS ROD. DOE and USACOE final action decisions are pending.

During the NEPA public comment period for the DEIS, EPA held a Public Hearing near the project site proposed by Tampa Electric Company. This Public Hearing was held on the evening of March 31, 1994, at the Polk County Commission Board Room located at 330 West Church Street, Administrative Building, First Floor, in Bartow, Florida 33830. The hearing was a joint Public Hearing for both the EIS (including DOE's CCT action) and the NPDES permit, and was announced in the *Polk County Democrat* and the *Tampa Tribune* newspapers on February 24, 1994. The FEIS includes a copy of the draft EPA NPDES permit (dated March 31, 1994) and a copy of the EPA Public Hearing transcript as appendices.

The preferred alternative for the EIS is "Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)." Other reasonable project alternatives and subalternatives to the proposed project including the "No-Action Alternative" were also considered in the EIS.

This EIS generally considered environmental impacts for the full build-out capacity to 1,150 MW proposed by Tampa Electric Company by the year 2010 for the Polk Power Station. Impacts addressed included: air quality, groundwater, surface water, geological, terrestrial (including wetlands), aquatic, socio-economic, land use, transportation, cultural, noise, human health, environmental justice, and cumulative impacts. Minimization/mitigation of some of the project impacts was also addressed.

The Florida Department of Environmental Regulation (FDEP) has approved the Prevention of Significant Deterioration (PSD) permit as part of its Final PSD Determination. Approval is for the 260-MW Polk Unit 1 increment. The Florida Public Service Commission (FPSC) has approved the need for a 220-MW capacity (not 260 MW as stated in DEIS) proposed in Tampa Electric Company's need petition. Based on EPA coordination with FPSC, the FPSC is aware of Tampa Electric Company's proposed 260-MW capacity for Polk Unit 1 and that Tampa Electric Company is including it in its future plans. Although the FPSC has at this time only approved a 220-MW capacity for Polk Unit 1, Polk Unit 1 is nevertheless referred to in this EIS as a "260-MW" facility since it is proposed to have such a design capacity based on a Tampa Electric Company engineering study.

One or two copies of this FEIS are available for public review at:

Bartow Public Library
315 East Parker Street
Bartow, Florida 33830
ATTN: Ms. Linda Chancey
(813) 534-0131

Lakeland Public Library
100 Lake Morton Drive
Lakeland, Florida 33801
ATTN: Ms. Betty Boyd
(813) 499-8242

Ft. Meade Public Library
75 East Broadway
Ft. Meade, Florida 33841
ATTN: Ms. Kay Jackson
(813) 285-8287

Tampa Electric Company
Mulberry Customer Service
101 2nd Street, NW
Mulberry, Florida 33860
ATTN: Mr. Al Dorsett
(813) 425-4988

Bruton Memorial Library
302 McLandon Street
Plant City, Florida 33566
ATTN: Mr. Tim Pasden
(813) 757-9215

It may also be noted that in addition to the requested 12 FEIS copies mailed to the U.S. Department of the Interior (Ms. Lillian Stone) and the 10 FEIS copies to State of Florida (Ms. Janice Hatter) for their internal distribution, additional copies were also mailed to selected offices within these agencies.

Upon request, a limited number of copies of this FEIS is also available from EPA (Mr. Chris Hoberg (FAB-4), Federal Activities Branch, Environmental Policy Section; 345 Courtland Street, NE; Atlanta, GA 30365; Telephone: 404/347-3776;

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FINAL
Environmental Impact Statement

Volume I: Report

Tampa Electric Company - Polk Power Station

FINAL
ENVIRONMENTAL IMPACT STATEMENT

POLK POWER STATION
TAMPA ELECTRIC COMPANY

PROPOSED EPA ISSUANCE OF A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT FOR A NEW SOURCE

PROPOSED DOE CLEAN COAL COST-SHARED FINANCIAL ASSISTANCE UNDER THE DOE CLEAN COAL TECHNOLOGY DEMONSTRATION PROGRAM

Prepared by:

U.S. ENVIRONMENTAL PROTECTION AGENCY

in cooperation with:

U.S. DEPARTMENT OF ENERGY
U.S. ARMY CORPS OF ENGINEERS

ABSTRACT

Tampa Electric Company proposes to construct and operate a 1,150-MW power station in southwestern Polk County, Florida. The proposed Polk Power Station would require an EPA NPDES permit for a new source and would include a 260-MW IGCC unit as a DOE Clean Coal Technology demonstration project. This EIS document assesses the proposed project and alternatives with respect to environmental impacts. Mitigative measures are also evaluated for the preferred alternative.

Comments or inquiries should be directed to:

Heinz J. Mueller, Chief
Environmental Policy Section
U.S. Environmental Protection Agency, Region IV
345 Courtland Street, Northeast / Atlanta, Georgia 30365
(404) 347-3776 / FAX (404) 347-5206

Approved by:

Patrick M Tobin (signature)   May 26, 1994

for John H. Hankinson, Jr.
Regional Administrator
U.S. Environmental Protection Agency
Region IV

Date

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ACRONYMS AND ABBREVIATIONS

°C	Degrees Celsius
°F	Degrees Fahrenheit
μg/g	Micrograms Per Gram
μg/kg	Micrograms Per Kilogram
μg/L	Micrograms Per Liter
$\mu g/m^2/yr$	Micrograms Per Square Meter Per Year
$\mu g/m^3$	Micrograms Per Cubic Meter
μm	Micrometer (micron)
μmhos/cm	Micromhos Per Centimeter
7Q10	Minimum 7-day Average with a 10-year Recurrence
AADT	Average Annual Daily Trips
AAQS	Ambient Air Quality Standards
AGL	Above Ground Level
AMSL	Above Mean Sea Level
ANSI	American National Standards Institute
API	American Petroleum Institute
AQRV	Air-Quality—Related Value
A/RR	Agricultural/Residential Rural
BACT	Best Available Control Technology
BCF	Bioconcentration Factor
BEBR	Bureau of Economic and Business Research
BLIS	BACT/LAER Information System
bls	Below Land Surface
BMP	Best Management Practices
BOCC	Board of County Commissioners
BOD	Biochemical Oxygen Demand
BOD_5	5-Day Biochemical Oxygen Demand
Btu	British Thermal Unit
Btu/gal	British Thermal Units Per Gallon
Btu/lb	British Thermal Units Per Pound
Btu/scf	British Thermal Units Per Standard Cubic (Foot) Feet
CAA	Clean Air Act
$CaCO_3$	Calcium Carbonate
CC	Combined Cycle
CCT	Clean Coal Technology

ACRONYMS AND ABBREVIATIONS

CCT	Clean Coal Technology
CDBG	Community Development Block Grant
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act, 1980
CFC	Chlorofluorocarbons
CFR	Code of Federal Regulations
CFRPC	Central Florida Regional Planning Council
cfs	Cubic Foot (Feet) Per Second
CG	Coal Gasification
CGCU	Cold Gas Cleanup
cm/sec	Centimeters Per Second
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
COS	Carbonyl Sulfide
CPC	Clean Power Cogeneration
CR	County Road
CSM	Cubic Foot (Feet) Per Second Per Square Mile
CT	Combustion Turbine
CTC	Control Technology Center
CUP	Conditional Use Permit or Consumptive Use Permit
CWA	Clean Water Act
$\bar{d}$	Shannon Diversity Index
DAF	Dissolved Air Floatation
dB	Decibel
DEIS	Draft Environmental Impact Statement
DNL	Day-Night Average Sound Levels
DO	Dissolved Oxygen
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DRI	Development of Regional Impact
DSM	Demand-Side Management
ECT	Environmental Consulting & Technology, Inc.
*E*Hg	Expected Mercury Concentrations
EIS	Environmental Impact Statement

ACRONYMS AND ABBREVIATIONS

EMF	Electromagnetic Fields
EMS	Emergency Medical Services
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ESA	Endangered Species Act
ESP	Electrostatic Precipitator
FAA	Federal Aviation Administration
FAC	Florida Administrative Code
FCG	Florida Electric Power Coordinating Group
FCREPA	Florida Committee on Rare and Endangered Plants and Animals
FDACS	Florida Department of Agriculture and Consumer Services
FDCA	Florida Department of Community Affairs
FDEP	Florida Department of Environmental Protection
FDER	Florida Department of Environmental Regulation
FDHR	Florida Division of Historical Resources
FDLES	Florida Department of Labor and Employment Security
FDNR	Florida Department of Natural Resources
FDOT	Florida Department of Transportation
FEECA	Florida Energy Efficiency and Conservation Act
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FFPI	Florida First Processing, Inc.
FGD	Flue Gas Desulfurization
FGFWFC	Florida Game and Fresh Water Fish Commission
FGT	Florida Gas Transmission
FHWA	Federal Highway Administration
FICON	Federal Interagency Committee on Noise
FICUN	Federal Interagency Committee on Urban Noise
FIPR	Florida Institute for Phosphate Research
FLM	Federal Land Manager
FLUCCS	Florida Land Use and Cover Classification System
FNAI	Florida Natural Areas Inventory
FPC	Florida Power Corporation
FPSC	Florida Public Service Commission
FR	Federal Register

ACRONYMS AND ABBREVIATIONS

FRG	Floridians for Responsible Utility Growth
F.S.	Florida Statutes
FSRI	Florida Sinkhole Research Institute
ft	Foot (Feet)
ft-bls	Foot (Feet) Below Land Surface
ft/day	Foot (Feet) Per Day
ft/ft	Foot (Feet) Per Foot
ft-msl	Foot (Feet) Above Mean Sea Level
ft-NGVD	Foot (Feet) Above National Geodetic Vertical Datum of 1928
ft^2/day	Square Foot (Feet) Per Day
ft^3/day	Cubic Foot (Feet) Per Day
ft^3/day/ft^3	Cubic Foot (Feet) Per Day Per Cubic Foot
ft^3/hr	Cubic Foot (Feet) Per Hour
FTE	Full-Time Equivalent
FWS	U.S. Fish and Wildlife Service
g	Gram
g/m^2	Grams Per Square Meter
g/m^2/yr	Grams Per Square Meter Per Year
g/sec	Grams Per Second
GATX	General American Transportation Corporation
GC-MS	Gas Chromatograph-Mass Spectrometer
GE	General Electric
GEESI	General Electric Environmental Systems, Inc.
gpd	Gallons Per Day
gpm	Gallons Per Minute
gpm/ft	Gallons Per Minute Per Foot (Feet)
gpm/ft^2	Gallons Per Minute Per Square Foot
gr	Grains
gr/scf	Grains Per Standard Cubic Feet
GWH	Gigawatt Hours
H_2S	Hydrogen Sulfide
H_2SO_4	Sulfuric Acid
HCC	Hillsborough Community College
HEAST	Health Effects Assessment Summary Tables
HEC	Hydrologic Engineering Center
HEP	Habitat Evaluation Procedure

ACRONYMS AND ABBREVIATIONS

HGCU	Hot Gas Cleanup
HHV	Higher Heating Value
HRS	Health and Rehabilitative Services
HRSG	Heat Recovery Steam Generator
HSH	Highest–Second Highest
HUD	U.S. Department of Housing and Urban Development
Hz	Hertz (cycles per second)
I-75	Interstate 75
IAF	Induced Air Floatation
ICC	Interstate Commerce Commission
IGCC	Integrated Gasification Combined Cycle
IRIS	Integrated Risk Information System
ISC	Industrial Source Complex Model
ISC2	Industrial Source Complex Model 2
ISCLT2	Industrial Source Complex Long-Term Model
ISCST2	Industrial Source Complex Short-Term Model
IWT	Industrial Wastewater Treatment
KBN	KBN Engineering and Applied Science, Inc.
kg	Kilograms
kg/km^2	Kilograms Per Square Kilometer
km	Kilometers
km^2	Square Kilometers
kV/m	Kilovolts Per Meter
kV	Kilovolts
kWh	Kilowatt-hour
LAER	Lowest Achievable Emission Rate
lb/ft^3	Pound Per Cubic Foot
lb/gal	Pounds Per Gallon
lb/hr	Pounds Per Hour
lbs	Pounds
lb/yr	Pounds Per Year
LEAF	Legal Environmental Assistance Foundation
L_{eq}	Equivalent Sound Level
$L_{eq(1)}$	Equivalent Sound Level for a 1-hour Period
$L_{eq(24)}$	Equivalent Sound Level for a 24-hour Period
LHV	Lower Heating Value

ACRONYMS AND ABBREVIATIONS

L_{max}	Maximum Level (of Noise)
LOLP	Loss of Load Probability
LOS	Level of Service
m	Meter
m^2	Square Meter
m^3/yr	Cubic Meters Per Year
M-1	Code for Industrial Land Use
MCL	Maximum Contaminant Level
MCR	Maximum Current Rating
MDL	Method Detection Limit
mG	Milligausses
mg	Milligrams
mgd	Million Gallons Per Day
mg/kg	Milligrams Per Kilogram
mg/L	Milligrams Per Liter
mg/m^2	Milligrams Per Square Meter
$mg/m^2/yr$	Milligrams Per Square Meter Per Year
mi^2	Square Miles
MIR	Maximum Individual Risk
MIT	Mechanical Integrity Test
mL	Milliliters
MMBtu	Million British Thermal Units
MMcf	Million Cubic Feet
MODFLOW	Modular Three-Dimensional Finite Difference Groundwater Flow Model
MOU	Memorandum of Understanding
mph	Miles Per Hour
MPN	Most Probable Number
MSA	Metropolitan Statistical Area
msl	Mean Sea level
MSW	Municipal Solid Waste
Mton	Thousand Tons
MW	Megawatts
N_2O	Nitrous Oxide
NAACP	National Association for Advancement of Colored People
NAAQS	National Ambient Air Quality Standards

ACRONYMS AND ABBREVIATIONS

$NaHCO_3$	Sodium Bicarbonate
NAS	National Audubon Society
NCA	Noise Control Act
NEC	National Electric Code
NEPA	National Environmental Policy Act
NESC	National Electrical Safety Code
NESHAPS	National Emission Standard for Hazardous Air Pollutants
NFPA	National Fire Protection Association
ng	Nanogram(s)
NGVD	National Geodetic Vertical Datum of 1928
NH_3	Ammonia
NOA	Notice of Availability
NOI	Notice of Intent
NO_x	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NSPS	New Source Performance Standards
NSR	New Source Review
NTU	Nephelometric Turbidity Units
NWA	National Wilderness Area
NWI	National Wetlands Inventory
NWS	National Weather Service
O_3	Ozone
OSHA	Occupational Safety and Health Administration
PAH	Polynuclear Aromatic Hydrocarbon
PC	Pulverized Coal
PCB	Polychlorinated Biphenyls
pCi/L	Pico Curies Per Liter
PhM	Phosphate Mining
PHX	Primary Heat Exchanger
PM	Particulate Matter
PM_{10}	Particulate Matter less than or equal to 10 micrometers in diameter
POM	Polycyclic Organic Matter
PON	Program Opportunity Notice
POTW	Publicly-Owned Treatment Works
PPA	Pollution Prevention Act

ACRONYMS AND ABBREVIATIONS

ppb	Parts Per Billion
ppm	Parts Per Million
PPP	Pollution Prevention Plan
PPSA	Florida Power Plant Siting Act
ppt	Parts Per Trillion
PSD	Prevention of Significant Deterioration
PSES	Point-Source Evaluation Section
psig	Pounds Per Square Inch Gauge
Pt-Co	Platinum Cobalt
PVC	Polyvinyl Chloride
PWRR	Present Worth Revenue Requirements
QUAL2E	Enhanced Stream Water Quality Model
R-1	Code for Residential Land Use
Ra	Radium
RC	Rural Conservation
RCC	Rural-Cluster Center
RCRA	Resource Conservation and Recovery Act
RMS	Root Mean Square
RO	Reverse Osmosis
ROD	Record of Decision
ROW	Right-of-Way
RSC	Radiant Syngas Cooler
SAR	Staff Analysis Report
SARA	Superfund Amendments and Reauthorization Act
SCA	Site Certification Application
scf	Standard Cubic Feet
SCR	Selective Catalytic Reduction
SCS	Soil Conservation Service
SEL	Sound Exposure Level
SF-1M	Single Family-Mixed
SHPO	State Historic Preservation Officer
SIA	Significant Impact Areas
SIC	Standard Industrial Classification
SMSA	Standard Metropolitan Statistical Area
SNCR	Selective Noncatalytic Reduction
SO_2	Sulfur Dioxide

ACRONYMS AND ABBREVIATIONS

SO_3	Sulfur Trioxide
SO_x	Sulfur Oxides
SPCC	Spill Prevention Control and Countermeasure Plan
SR	State Road
ST	Steam Turbine
STORET	Storage and Retrieval of Parametric Data
stpd	Short Tons Per Day
SU	Standard Units
SUS	Saybolt Universal Seconds
SWCFGWB	South West-Central Florida Ground-Water Basin
SWFWMD	Southwest Florida Water Management District
SWUCA	Southern Water Use Caution Area
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TEC (or TECO)	Tampa Electric Company
TIA	Tampa International Airport
TN	Total Nitrogen
TP	Total Phosphorous
tpd	Tons Per Day
TPR	Total Population Risk
TPS	TECO Power Services
tpy	Tons Per Year
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
UE&C	United Engineers & Constructors, Inc.
UIC	Underground Injection Control
URF	Unit Risk Factor
USACOE	U.S. Army Corps of Engineers
USC	U.S. Code
USGS	U.S. Geological Survey
VISCREEN	Visual Impact Screening
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound
WAR	Water and Air Research, Inc.
WET	Wetland Evaluation Technique
WUCA	Water Use Caution Area
WUP	Water Use Permit
WWF	World Wildlife Fund

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

FINAL
ENVIRONMENTAL IMPACT STATEMENT
TAMPA ELECTRIC COMPANY
POLK POWER STATION

( ) Draft
(X) Final

U.S. Environmental Protection Agency, Region IV
345 Courtland Street, Northeast
Atlanta, Georgia 30365

1. Type of Action Administrative (X) Legislative ( )

2. Description of Action

Tampa Electric Company proposes to expand its electric generating capacity by establishing a 1,150-megawatt (MW: note that EIS references to MW capacities of power generating units are understood to be "nominal net" capacities) power station on an approximately 4,348-acre site in southwestern Polk County, Florida (see Figure E-1). The proposed power station would be known as the "Tampa Electric Company Polk Power Station." At full build-out to a 1,150-MW generating capacity, the proposed power station would consist of two combined cycle (CC) generating units, six combustion turbine (CT) generating units, and one integrated gasification combined cycle (IGCC) generating unit. The proposed IGCC unit would be capable of firing either coal-derived gas known as syngas produced by an on-site coal gasification (CG) facility or low-sulfur fuel oil and operated in a CC mode. The proposed Polk Power Station project would include on-site material handling and storage facilities for fuel oil, coal, and the by-products of CG and syngas treatment (slag and sulfuric acid [H_2SO_4]); water supply and wastewater treatment systems; solid waste disposal areas; a cooling reservoir; a substation; and storm water management facilities. The project would also include on-site and off-site transmission lines, rail spur, and ultimately a natural gas pipeline and a possible fuel oil pipeline.

Development of the proposed Polk Power Station would occur in three phases. The initial phase would involve the construction of a 260-MW IGCC unit, which would be known as "Polk Unit 1," centered on a 150-MW advanced CT unit, with attendant on-site and off-site support facilities. Phase I would also include overall site development/reclamation activities. Phase II would consist of the construction of two 220-MW CC units and a 75-MW CT unit. These units would burn natural gas as primary fuel and fuel oil as backup fuel. Phase III would involve the construction of five more 75-MW CT units. According to Tampa Electric Company's proposed plans, the IGCC Polk Unit 1 would be in service in mid-1996. The full build-out of the proposed Polk Power Station to its ultimate capacity of 1,150 MW is planned to be completed in 2010.

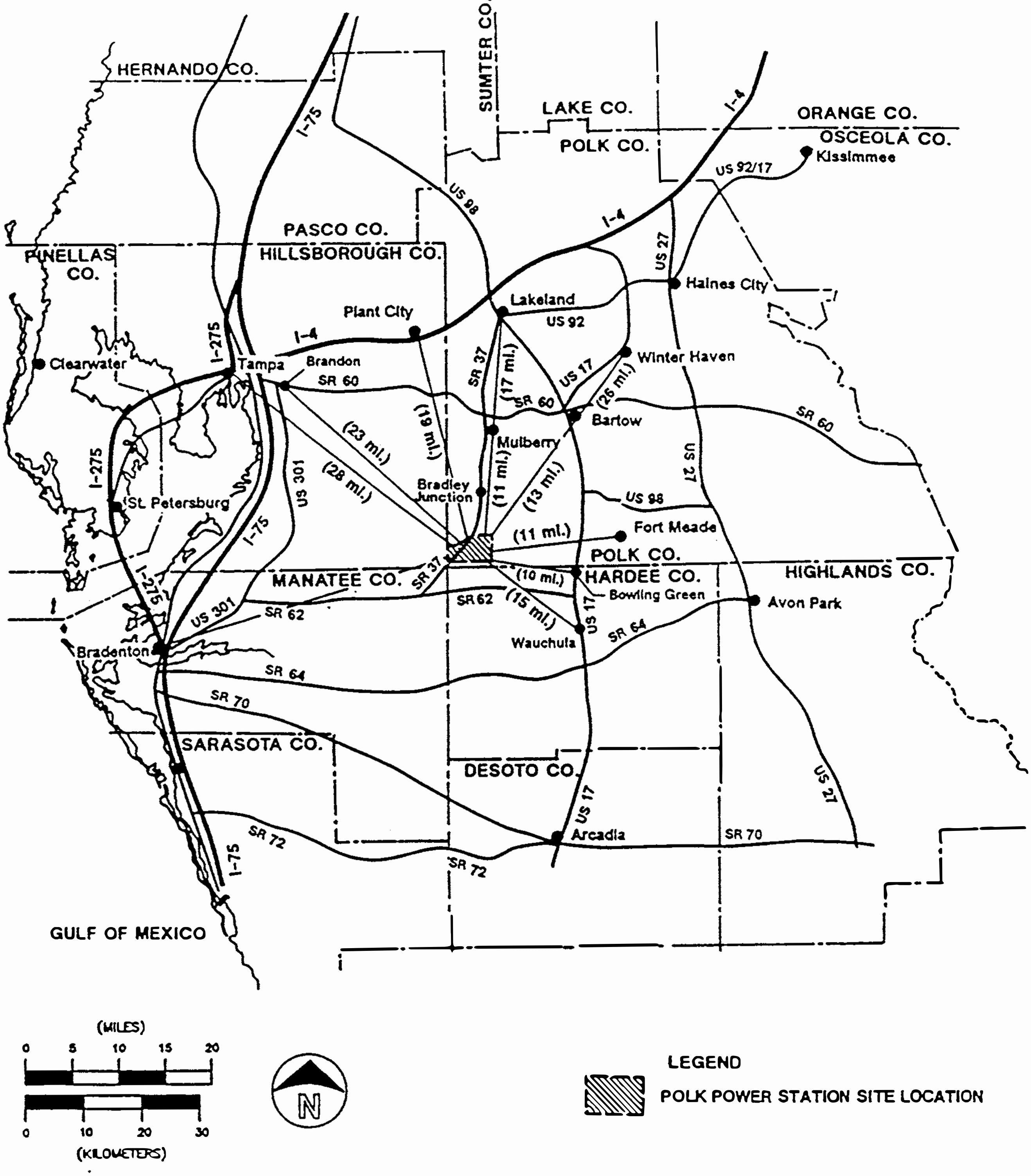

FIGURE E-1.
Regional Location of the Polk Power Station Site.

SOURCES: ECT 1992; TEC, 1992a.

U.S. Environmental Prote tion Agency, Region IV

Environmental Impact Statement

Polk Power Station
Polk Count , Florida

The proposed project requires major federal actions on the part of the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE), each action requiring National Environmental Policy Act (NEPA) documentation. As such, this environmental impact statement (EIS) was considered the appropriate NEPA documentation for the proposed EPA and DOE major federal actions. Through a memorandum of understanding (MOU) (March 1993) between these two agencies as well as the U.S. Army Corps of Engineers (USACOE), EPA was designated the federal Lead Agency for the preparation of this EIS. The EPA notice of intent (NOI) for this EIS was published in the *Federal Register* at 58 FR 29577 on May 21, 1993.

DOE is a Cooperating Agency to EPA for the preparation of this EIS primarily due to DOE's project involvement through the DOE Clean Coal Technology (CCT) Demonstration Program. Specifically, the proposed 260-MW IGCC Polk Unit 1 is being considered by DOE for approximately $130 million (amended from $120 million because of additional costs of design changes and improvements) of cost-shared financial assistance to Tampa Electric Company under the DOE CCT Demonstration Program. The decision to provide cost-shared financial assistance for the IGCC demonstration project is considered a major federal action subject to NEPA. The DOE "EIS Action Alternatives" are to provide cost-shared financial assistance for the proposed demonstration project or to deny such financial assistance. DOE's preferred action alternative for this proposed project is to provide the cost-shared financial assistance, pending successful completion of this EIS process.

USACOE is also a Cooperating Agency to EPA for this EIS, largely due to the proposed dredge-and-fill permitting issues associated with the project and the USACOE permitting responsibilities for dredge-and-fill activities in waters of the United States pursuant to Section 404 of the Clean Water Act (CWA). USACOE has received a Section 404 permit application (original and updated) from Tampa Electric Company to fill approximately 253 acres of wetlands on Tampa Electric Company's preferred site (site "PLK-A"). These 253 acres have been determined by USACOE to be jurisdictional wetlands with formal notification of this determination provided to Tampa Electric Company on November 4, 1992. USACOE's permitting alternatives are to issue, issue with conditions, or deny the requested Section 404 dredge-and-fill permit. Since Section 404 permitting is also subject to NEPA, USACOE, as the permitting agency, expects to adopt this EPA EIS, as appropriate, to comply with its NEPA review responsibilities associated with appropriate NEPA documentation for any Section 404 permits USACOE may choose to issue.

Tampa Electric Company has submitted a National Pollutant Discharge Elimination System (NPDES) permit application to EPA seeking approval for discharge of water from the proposed power station cooling reservoir to waters of the United States, in accordance with the provisions of the CWA as amended (33 United States Code [USC] 1251 *et seq.*; EPA, 1989a). Tampa Electric Company also requested EPA to provide an NPDES "new source determination." By a letter dated January 11, 1994, to Tampa Electric Company, EPA tentatively determined the proposed Polk Power Station to be a "new source" requiring an NPDES permit based on New Source Performance Standards (NSPS).

EPA's "EIS Action Alternatives" are to issue, issue with conditions, or deny the NPDES permit for Tampa Electric Company's proposed project. EPA's preferred permitting action for this proposed project is to issue the permit with conditions, pending successful completion of this EIS process.

In July 1992, Tampa Electric Company submitted to the Florida Department of Environmental Protection (FDEP) and other appropriate agencies a site certification application (SCA) for the construction and operation of the proposed Polk Power Station project pursuant to the Florida Power Plant Siting Act (PPSA). The Florida PPSA provides for the coordination of all applicable state, regional, and local regulatory requirements, permits, and approvals for steam electric generating facilities with capacities greater than 75 MW under the SCA review and certification process. PPSA also requires that two administrative hearings be held: a land-use hearing to determine the consistency of the proposed project with local land-use plans and zoning ordinances, and a site certification hearing to determine the compliance of the project with all other state, regional, and local applicable environmental regulatory requirements. FDEP is responsible for the central coordination and administration of the site certification process, including coordination efforts to notify, consult, and obtain appropriate inputs and reports from affected agencies, governmental entities, and other public parties. Based on the findings from the land-use and site certification hearings and the FDEP staff analysis report (SAR), including recommendations from other agencies, the hearing officer prepares recommended orders for consideration and final decision-making by the Florida Governor and Cabinet (sitting as the Power Plant Siting Board) regarding approval of the project.

In accordance with the State of Florida PPSA process, the land-use hearing for the proposed Polk Power Station was held in Bartow, Florida, on October 29, 1992, and the Power Plant Siting Board approved the hearing officer recommended order that the proposed project was consistent with state, regional, and local land-use plans on January 26, 1993. The site certification hearing for the project was held in Bartow, Florida, on October 13, 1993, and the Power Plant Siting Board concurred with the recommended order granting certification for the proposed Polk Power Station project subject to specific conditions of certification on January 25, 1994.

Tampa Electric Company Need for Additional Power Supply

Based on its long-range integrated resource planning process, Tampa Electric Company has determined the need for additional resources of approximately 800 MW beginning in 1995 through the year 2001, and approximately 1,300 MW from 2002 through 2010. Thus, over the future 15-year period, Tampa Electric Company has determined the need for a total of approximately 2,100 MW in additional resources to meet its customer electric power demands. The need for these additional resources is primarily based on the projected continued growth of population and resulting electricity demands in the Tampa Electric Company service area. Based on this forecasted population growth and despite Tampa Electric Company's existing conservation efforts, load management, and cogeneration programs to reduce energy demands, Tampa Electric Company currently has determined the need for a total of approximately 1,150 MW in new generating capacity from 1996 to 2010.

Based on this forecasted growth, Tampa Electric Company would not meet its dual system reliability criteria in this future timeframe without the additional resources. These reliability criteria are a minimum 20-percent winter generation reserve margin and an assisted loss of load probability (LOLP) of less than 0.1 day per year. This latter criterion is accepted by the Florida Public Service Commission (FPSC) in determining the peninsular Florida power capacity needs. The former criterion has been adopted by Tampa Electric Company and determined to be appropriate by FPSC to meet intrastate transmission constraints or extreme weather conditions.

FPSC Need Determination for the IGCC Unit

Under the Florida PPSA, the determination of need for new electric generating capacity in Florida is the exclusive responsibility of FPSC. On September 5, 1991, Tampa Electric Company filed a "Petition to Determine Need for Electrical Power Plant" with FPSC pursuant to Section 403.519, Florida Statutes (F.S.) of PPSA. In conjunction with this filing, Tampa Electric Company submitted to FPSC a document entitled "Polk Unit One Need Determination Study" to support the need determination petition.

In the petition to determine need and the supporting study, Tampa Electric Company provided FPSC with information from its integrated resource plan that demonstrated the need for an additional 440 MW of new generating capacity during the period of 1995 through 2000. The information also showed that Tampa Electric Company's total resource needs to meet customer demands for the 5-year period were almost 800 MW, of which more than 40 percent would be met through the Tampa Electric Company's existing conservation and load management programs and power purchases from cogenerators. According to Tampa Electric Company's integrated resource plan, the remaining resource needs would be most cost-effectively and reliably met by the construction of the proposed IGCC unit with a scheduled commercial operation date of July 1996, followed by the phased construction of a 220-MW CC unit with a planned in-service date of 1999 for the first 75-MW CT unit comprising the CC unit and ultimate build-out and operation of the CC unit in 2001.

At a Special Commission Conference held by FPSC on January 31, 1992, FPSC voted to approve and issue a certification of need order for the IGCC unit (Polk Unit 1) of the proposed power station. The order determining the need for Polk Unit 1 was issued on March 2, 1992. In its order, FPSC determined that the proposed Polk Unit 1 was needed to maintain electric system reliability and integrity of the Tampa Electric Company electric system and is also needed to contribute to the reliability and integrity of the electric system of the state as a whole. FPSC also concluded that the proposed IGCC unit is the most cost-effective alternative to provide the additional needed capacity for Tampa Electric Company and peninsular Florida. Further, FPSC concluded that Tampa Electric Company had adequately explored power purchases from cogeneration and other utilities to provide the required generating capacity. Finally, FPSC concluded that Tampa Electric Company's existing residential conservation programs were reasonable in saturating the eligible market and that no additional conservation measures were reasonably available to Tampa Electric Company to avoid the need for the proposed IGCC unit. Based on these findings, FPSC approved and issued Tampa Electric Company an order (March 2, 1992) determining the need for 220 MW (Note: not 260 MW as stated in the draft EIS [DEIS]) for a proposed electrical power plant at the proposed Polk Power Station site. However, FPSC's approval was limited to 220 MW for Polk Unit 1. As such, Tampa Electric Company would need to make additional need determination application to FPSC for the proposed future capacity beyond the approved 220 MW and up to the proposed 1,150-MW build-out capacity. (Note: EPA understands from Tampa Electric Company that results from a Tampa Electric Company engineering study completed before the FPSC's March 2, 1992 order showed that the actual expected capacity from the IGCC unit would be 260 MW. Based on EPA coordination with FPSC [1994], the FPSC is aware of Tampa Electric Company's proposed 260-MW capacity for Polk Unit 1 and that Tampa Electric Company is including it in its future plans. However, at this time, FPSC has only approved a 220-MW capacity for Polk Unit 1. In this EIS, Polk Unit 1 is nevertheless referred to as a "260-MW" facility since it is proposed to have such a design capacity. Furthermore, Tampa Electric Company projects that future demands will exceed the approved 220-MW capacity or the expected 260-MW capacity of Polk Unit 1. Also, the environmental impacts of 260-MW generation are expected to be nominally the same as for 220-MW generation.)

DOE Need for the IGCC Unit

In December 1985, Congress made funds available to DOE to administer cost-shared financial assistance for proposed projects under the DOE CCT Demonstration Program. The CCT Demonstration Program is designed to address a wide range of issues associated with the use of coal as an energy resource including acid rain, global climate change, improved energy efficiency, energy security, and environmental quality. Under this program, advanced coal technologies are being demonstrated at or near commercial scale, and are incorporating new power generation and pollution control concepts. Congress has appropriated a total budget of nearly $2.75 billion for the CCT Demonstration Program. These funds are being committed to demonstration projects through five competitive solicitations. The first four solicitations have resulted in a combined commitment by the federal government and the private sector of about $4.7 billion. DOE's cost share for these projects would be some $1.8 billion, or approximately 38 percent of the total. Upon final DOE approval, project sponsors (such as Tampa Electric Company) would provide the remainder of more than $2.9 billion, or approximately 62 percent of the total estimated cost. The response to DOE's fifth solicitation would bring the combined commitment by the federal government and the private sector to approximately $6.9 billion, thereby increasing the average industry cost share to approximately 66 percent, which far exceeds the 50 percent share of non-DOE funding mandated by Congress.

Under terms of Public Law No. 100-446, Congress provided approximately $575 million to DOE to support the construction and operation of demonstration facilities selected for cost-shared financial assistance as part of the third round of DOE CCT Demonstration Program. The CCT projects cover a broad spectrum of technologies having the following in common:

- All are intended to increase the use of coal in an environmentally acceptable manner
- All are ready to be proven at the demonstration scale

The electricity-producing industry largely depends on coal as its primary fuel. In 1989, 86 percent of total coal consumption in the United States was for the generation of electricity. Coal use in the electricity production industry is projected to increase at least 50 percent by 2010 and double by 2030, even with optimistic estimates of contributions from conservation, renewable resources, and nuclear energy to reduce electricity demands. However, the existing available technologies for coal-fired power plants would have difficulty in satisfying the rapidly changing environmental, economic, and technical performance requirements.

The coal-fueled power plant of the future must be capable of meeting stringent siting and environmental requirements, while, with a high level of reliability, efficiently produce power. Further, the ability to rapidly add generation capacity, in modules, that closely matches load growth will be an important factor in keeping future electricity costs reasonable. Hence, over the next 10 years, it will be critical to bring new technology options into the marketplace to satisfy not only the requirements of the traditional utility industry, but also the requirements of independent power producers and cogenerators that are producing an increasing share of power in the United States. Based on such consideration and pending successful completion of the NEPA process for this EIS, DOE is considering cost-shared financial assistance for the proposed IGCC unit at the Polk Power Station through the DOE CCT Demonstration Program under a cooperative agreement with Tampa Electric Company.

Under this cooperative agreement and if cost-shared financial assistance is provided by DOE for the proposed IGCC unit, Tampa Electric Company would demonstrate a hot gas cleanup (HGCU) system for removing sulfur compounds, particulates, and other potential pollutants from syngas produced in the CG facility prior to firing in the advanced CT. The demonstration HGCU system has the potential to achieve pollutant removal efficiencies equivalent to or greater than the conventional cold gas cleanup (CGCU) technology, while providing a more efficient power generation system. The proposed IGCC unit would also demonstrate the overall integration of CG and CC technologies for power production. These demonstration activities would occur over a two-year period after initiation of the IGCC unit operation.

Requirements for Ultimate Site Build-Out

Since Tampa Electric Company's application submitted to EPA for an NPDES permit was for the full build-out of the proposed power station to 1,150 MW, this EIS is written for a 1,150-MW facility (with the understanding that FPSC has only approved the need for 220 MWs for Polk Unit 1 at this time). Tampa Electric Company proposes a phased build-out for the Polk Power Station to 1,150 MW by 2010. Build-out of the proposed Polk Power Station to the ultimate generating capacity of

1,150 MW is proposed by Tampa Electric Company with DOE cost-shared financial assistance under the DOE CCT Demonstration Program or without such financial assistance. Accordingly, Tampa Electric Company's SCA submittal to FDEP was also for an ultimate 1,150-MW facility. Although Tampa Electric Company's application for a Prevention of Significant Deterioration (PSD) permit (i.e., air quality construction and operation permit), which was submitted to FDEP as part of the SCA process, included modeling analyses and potential impact assessments for the proposed 1,150-MW build-out of the power station, FDEP approval of the PSD permit was limited to the first 260-MW unit increment. Therefore, additional PSD permit application(s) approvals would need to be pursued by Tampa Electric Company for additional proposed units at the Polk Power Station to the 1,150-MW level. Similarly, Tampa Electric Company would need to make additional need determination application to FPSC for the proposed future capacity beyond the approved 220 MW and up to the proposed 1,150-MW build-out capacity.

Site Location and Land Use

Tampa Electric Company's selection of their preferred site (site "PLK-A") was based on a comprehensive, structural methodology that integrated multidisciplinary environmental, engineering, and economic siting factors in the evaluation of potential areas. The site selection assessment was structured into a phase I regional screening, a phase II intermediate screening, and a phase III detailed analysis screening. To this end, a site selection task force identified potential candidate sites within a six-county study region. Under the phase I screening analysis, 34 areas within the study region were considered for CC only, 23 areas for CC or baseload, and 21 areas for both CC and baseload plants on one site. Under the phase II analysis, 21 sites were screened; five of the most suitable sites were rated as suitable for the CC and baseload option. Under the phase III analysis, sites PLK-1, PLK-2, and PLK-A underwent detailed investigation. Based on guidance from the siting task force, site PLK-A was selected as the preferred site. The PLK-A site preferred by Tampa Electric Company has been selectively inspected by Tampa Electric Company, USACOE, U.S. Fish and Wildlife Service (FWS), EPA, DOE, Southwest Florida Water Management District (SWFWMD), and consulting contractors.

The proposed Tampa Electric Company Polk Power Station site is located in southwestern Polk County, Florida, approximately 17 miles south of the City of Lakeland, 11 miles south of the City of Mulberry, and 13 miles southwest of the City of Bartow (see Figure E-1). The site is bordered by the Hillsborough County line along the western boundary; Fort Green Road (County Road [CR] 663) on the east; CR 630, Bethlehem, and Albritton Roads along the north; and State Road (SR) 674 and several phosphate clay settling ponds on the south.

A majority of the land at the Polk Power Station project site has been mined to recover phosphate or disturbed due to mining-related activities. Mining of portions of the proposed site will continue into 1994. Approximately 94 percent of the 4,348-acre site would be mined or disturbed by mining activities prior to Tampa Electric Company's proposed use of the site for the Polk Power Station project.

After proposed full build-out to 1,150 MW, electrical power plant facilities would occupy approximately 150 acres. or less than 4 percent of the overall site. Other areas classified for use as power plant facilities would total approximately 111 acres. A cooling reservoir would occupy approximately 860 acres. The remainder of the site would be predominantly used for pastureland (776 acres), shrub and brushland (544 acres), upland hardwood forest (55 acres), upland mixed forest (774 acres), lakes (264 acres), wetland hardwood forest (61 acres), wetland mixed forest (310 acres), and herbaceous wetland (428 acres). The 1,511-acre portion of the site to the west of SR 37 would be reclaimed to an integrated system of forested and nonforested wetlands and uplands and is intended to develop into a wildlife habitat/corridor area since no power plant facilities would be located on this tract. Project wetland mitigation (168.41 acres) would be provided in several on-site areas east of SR 37.

Within a 5-mile radius of the site, which includes the community of Bradley Junction, land use is dominated by activities associated with the mining and processing of phosphate ore. These uses include mined areas, spoil banks, sand tailing areas, settling ponds, and reclaimed areas. Facilities associated with phosphate mining and processing in the area include IMC Fertilizer Haynsworth Mine, Mobil Chemical Company Big Four Mine, and the Agrico Chemical Company Fort Green and Payne Creek Mines. Other electrical generating facilities in the area include the Hardee Power Station located 4 miles south of the site and the proposed Florida Power Corporation 3,000-MW power plant to be located approximately 5 miles east of the site. Excluding the community of Bradley Junction, which is located approximately 4.5 miles north of the site, residential areas within a 5-mile radius of the site include approximately 85 homes located west of SR 37 (1.5 miles), an area of 14 homes located southeast of the site along Mills Road (1.5 miles), and an area of approximately 30 homes located west of the site adjacent to SR 674 in Hillsborough County.

Generating Units

The proposed generating units include Polk Unit 1, a 260-MW IGCC unit, two 220-MW CC units, and six stand-alone 75-MW CT units. The proposed construction and operation of these units would provide a total, ultimate generating capacity of 1,150 MW at the Polk Power Station site.

For the proposed 260-MW IGCC generating unit, a pressurized, oxygen-blown, entrained-flow gasifier would be used to produce a medium-British thermal unit (Btu) syngas for firing in the advanced 150-MW CT. In the gasifier, coal/water slurry would be combined with oxygen at high temperature and pressure to produce the syngas. When fired on the syngas and operated with the addition of nitrogen gas from the air separation unit, the advanced CT unit would have a generating capacity of 190 MW. The unit would have the capability to fire low-sulfur fuel oil as backup fuel and to operate in a CC mode to provide required flexibility in the event of unanticipated disruptions in the delivery of coal or unplanned unavailability of CG facilities.

The proposed operation of the IGCC unit would involve a number of major associated systems and processes including the following: coal grinding and slurry preparation; air separation unit; CG facilities; slag handling and storage; syngas scrubbing and cooling systems; gasification process black water handling and brine concentration system; acid gas removal unit; demonstration HGCU system; H_2SO_4 by-product plant and storage facilities; heat recovery steam generator (HRSG); and steam turbine (ST) generator.

Operation of the proposed IGCC unit offers environmental and economic advantages over current conventional systems. Emissions of toxic air pollutants such as sulfur dioxide (SO_2) and nitrogen oxides (NO_x) would be reduced and an HRSG would increase efficiency compared to conventional power generating facilities. The proposed IGCC unit would produce up to 25 percent more electricity from burning the same amount of coal than a conventional plant. According to DOE calculations, overall plant output would increase 50 to 150 percent. Less carbon dioxide (CO_2) would be released to the atmosphere, thereby lowering the contribution to the "greenhouse" effect. From an economic perspective, the operation of the proposed IGCC unit would save Tampa Electric Company ratepayers $195 million over the life of the unit.

The proposed Polk Power Station would also include two 220-MW CC units. Each of the CC units is expected to be comprised of two 75-MW CTs, two HRSGs, and one ST generator. Natural gas would be used as the primary fuel for the units with low-sulfur fuel oil as a backup fuel. The CTs would also be designed with by-pass exhaust stacks capable of operating in both CC and simple-cycle modes.

The six stand-alone, simple-cycle CT units would have a generating capacity of 75 MW for each CT. The proposed primary fuel for the CT units would be natural gas with low-sulfur fuel oil as backup fuel.

Fuel Delivery, Storage, Handling, and Usage

The proposed IGCC unit would require nearly 2,325 tons (dry) of coal per day, when operating at full load. Proposed coal delivery to the site would initially be by trucks, with delivery by unit train railcars as a potential future delivery option. Two unit trains per week would be needed to meet the IGCC's fuel requirements if all coal were delivered by train. Use of the back-haul availability of trains that currently transport phosphate from Polk County to terminals on Tampa Bay is another rail delivery option. For the proposed coal delivery by truck only, 80 to 100 loads per day would be required, using specially designed 28-ton payload capacity trucks with bottom dumps and aluminum covers.

Coal would be stored in two silos. The planned aggregate capacity in the coal storage silos is approximately 10,000 tons, which is the coal fuel supply needed to operate the proposed IGCC unit at full generating capacity for approximately five days. To prevent leachate and storm water runoff from entering the surficial aquifer, runoff from the coal unloading and silo storage areas would be collected in concrete sumps and pumped to the coal grinding/slurry preparation facilities for use as makeup water in the plant operations. No direct discharges to groundwater or surface waters would occur.

Natural gas usage for the stand-alone CT and CC units is estimated to be about 11 million cubic feet per hour (ft^3/hr) of natural gas fuel with all units operating at full load. Because natural gas would be delivered directly to the site via pipelines from the natural gas transmission system in the region, no on-site natural gas storage would be needed. Tampa Electric Company is currently evaluating various alternatives for the natural gas supply and no specific interconnection points to the existing or planned future gas transmission system has been determined. Permitting issues associated with the natural gas pipeline route to the site would be evaluated when the route is finalized and if permission to build these units is received from FPSC and FDEP. Thus, the pipeline route and its potential impacts on the environment are unknown at this time and are not addressed in this EIS. Tampa Electric Company anticipates the need for natural gas by 1999.

Fuel oil would be delivered to the site by tanker truck and/or railcar. Fuel oil would serve primarily as a backup fuel for the stand-alone CT and CC units as well as for the advanced CT component of the IGCC unit when operated in CC mode. An estimated total of 77,000 gallons per hour of fuel oil would be consumed by the stand-alone CC and CT units if all units were operated at full load, and an additional 13,500 gallons per hour of fuel oil would be needed for the IGCC unit if syngas was not available from the CG facilities.

Fuel oil, following proposed full build-out, would be stored in three on-site aboveground steel tanks, each with a storage capacity of 3 million gallons. The tank storage area would be furnished with an impervious secondary containment system around and under the tank containment area. An earthen berm sealed with asphalt or other comparable materials would surround the storage area to contain any unexpected oil spills. Appropriate safeguards and systems to prevent, control, and recover any accidental spills would also be built or installed in accordance with federal and state regulatory requirements for above-ground storage tanks. Storm water runoff from the fuel oil storage tank area would be collected and routed to an oil/water separation system designed to reduce any potential oil and grease content in water to a level not exceeding 15 milligrams per liter (mg/L). The oil/grease and other solid sediments then would be collected and hauled off site by a licensed contractor for appropriate recycling or disposal. Effluent from the oil/water separation system would be routed into the wastewater equalization basin for further treatment.

Air Emissions and Controls

Air emissions associated with the proposed project operations fall into three categories: combustion emissions, process emissions, and fugitive emissions. The combustion-related air emission sources would be: the advanced CT integral to the IGCC unit; the HGCU thermal oxidizer; the IGCC unit flare; an auxiliary boiler associated with the IGCC unit; the four CTs associated with the two CC units; and the six stand-alone, simple-cycle CTs. Process emission sources would include the H_2SO_4

plant and minor, intermittent emissions of gaseous pollutants that may be generated in the gasification plant. Fugitive particulate emissions would be potentially generated by material handling and storage, principally coal and slag.

Controls for particulate matter (PM) and heavy metal emissions from the IGCC unit would include water scrubbing, use of fuels with low PM content, and good operational practices to achieve efficient combustion. Controls for PM emissions from coal and slag handling and storage systems would include railcar and truck coal unloading in an enclosed building, storage of coal in silos, baghouse particulate control at transfer points, enclosure of certain coal conveyors, wet grinding in the rod mills, and the paving of roads within the Polk Power Station site. Slag would be transported wet to minimize or eliminate fugitive dust emissions.

Carbon monoxide (CO) and volatile organic compounds (VOC) emissions from the IGCC unit and stand-alone CCs and CTs would be controlled by the use of advanced combustion equipment and operational practices to obtain efficient combustion, which in turn would result in low CO and VOC emission rates.

Control of SO_2 and H_2SO_4 mist emissions is integrated in the IGCC unit. With the conventional CGCU technology, hydrogen sulfide (H_2S) and carbonyl sulfide (COS), present as the syngas exits the gasifier, are removed using a promoted amine process in the acid gas removal unit. With the demonstration HGCU technology, H_2S present in the syngas stream would be reacted with zinc titanate sorbent in a moving bed absorber. Regeneration of the absorber would yield a concentrated SO_2 stream that would then be converted to H_2SO_4 in an H_2SO_4 production plant. The expected efficiency of sulfur removal with the demonstration HGCU technology would meet or exceed that of conventional CGCU technology (i.e., 95.6 percent).

H_2SO_4 mist emissions from the IGCC combustion sources would be controlled by the use of low-sulfur fuels. Sulfur content of treated syngas and fuel oil would be 0.07 and 0.05 weight percent, respectively. SO_2 emissions from the stand-alone CC and CT units would also be controlled by the use of low-sulfur natural gas and fuel oil. Sulfur content in the natural gas would be less than 10 grains (gr)/100 standard cubic feet (scf). Fuel oil would contain less than 0.05 weight percent sulfur.

The advanced CT in the IGCC unit would use nitrogen produced from the air separation unit to control NO_x emissions during syngas firing. Water injection would be employed when backup fuel oil is used. NO_x emissions from the remaining IGCC facility combustion sources would be controlled by using low-NO_x burners and/or good combustion practices that reduce NO_x formation. The stand-alone CC and CT units would be equipped with dry low-NO_x burners when fired on natural gas to control NO_x emissions. Water injection would be used when the CC and CT units are fired on backup fuel oil.

Water Supply and Usage

Water to supply the potable, process, and cooling reservoir makeup needs for operations of the proposed power station would be provided by pumping groundwater from the Floridan aquifer through on-site wells. According to current engineering designs and analyses, groundwater from the Floridan aquifer would be withdrawn and provided directly to the cooling reservoir at an estimated annual average rate of 5.0 million gallons per day (mgd) and a peak rate of 6.5 mgd to maintain normal operational water levels. Total groundwater withdrawals for potable, process, and cooling water makeup use is estimated to be about 9.3 mgd on a maximum month daily basis and approximately 6.6 mgd on an annual average basis. If the CC and CT units are fired with natural gas, water injection for NO_x control is no longer needed and the daily groundwater withdrawals should be lower than these values. To minimize groundwater withdrawals for makeup purposes, water lost from the cooling reservoir would also be replenished from rainfall directly to the reservoir surface, runoff from the surrounding and internal berms, treated wastewater, treated runoff, and groundwater seepage from the surficial aquifer.

Surface water discharges from the reservoir, estimated to be 3.1 mgd on an annual average basis, would be routed to an unnamed, reclaimed lake on the eastern edge of the site and then off site to the Little Payne Creek system. Based on the results of water quality modeling analyses, the quality of water discharges from the reservoir is predicted to meet all applicable State of Florida Class III surface water quality standards except the thermal standard, which would be met within a 250-foot (ft) mixing zone within the reclaimed lake. Groundwater seepage discharges from the reservoir are expected to meet all Florida primary and secondary drinking water standards with the exception of iron and color, which are secondary drinking water parameters. The secondary drinking water standards for iron (0.3 mg/L) and color (15 color units) would be exceeded by the predicted concentrations in the reservoir (0.627 mg/L and 50.49 color units). Even with these exceedances, seepage from the cooling reservoir is not predicted to cause adverse impacts on the groundwater quality in the area since the iron and color concentrations are below ambient levels in the surficial aquifer.

Wastewater Treatment System

Construction of an on-site industrial wastewater treatment (IWT) system is planned to collect and appropriately treat the process and service wastewater, storm water runoff, and washdown from the materials storage areas. The proposed treatment strategy would be to collect wastewater at its source, pretreat it if necessary, and direct it to the wastewater equalization basin prior to filtration and discharge to the cooling reservoir. The proposed IWT system would include the following basins and units: oil/water separation; neutralization tank; diversion box; slag runoff retention basin; clarification; and filtration.

All oil-bearing equipment would be segregated using a combination of curbed and sloped concrete areas with drains directing washdown, runoff, minor leaks, and spills to the oil/water separation system through an oily sewer. The oil/water separation system is designed to remove oil, grease, and sludge from wastewater prior to discharge to the IWT equalization basin. Potentially oil-contaminated streams would be collected using segregated diked areas and sumps. Oil-contaminated wastewater would be directed to an oil/water separator. Skimmed oil and froth from the separator would be collected in a skimmed oil tank for further separation and either recycling or disposal off site by an approved contractor. Treated wastewater would be pumped to the equalization basin with an effluent having an oil and grease level not exceeding 15 mg/L.

Low-volume wastewaters would be treated according to the nature of the waste. Boiler blowdowns, laboratory wastes, and reverse osmosis (RO) concentrate stream would be combined in the neutralization tank where pH would be adjusted to a range of 6 to 9 before being discharged to the cooling reservoir. Filter backwash water from the makeup water treatment unit would be directed to the equalization basin and subsequently filtered. The nonchemical cleaning wastes associated with CT and compressor washing could be generated up to six times per year and would be routed to the equalization basin for subsequent filtration treatment. Spent chemicals and metal cleaning wastes would be disposed off site by a licensed contractor.

Black water removed from the slag and the syngas scrubber would be directed to a vacuum flash drum and gravity settler, which together would remove nearly all suspended solids in the black water. The resulting grey water would be routed to the grey-water treatment system that would include the grey-water tank, grey-water evaporator, evaporator condensate tank, and concentrated brine storage tank. Most of the grey water would be reused in the gasification plant for syngas scrubbing or slag flushing, and the remainder would be processed and concentrated to a brine solid waste. No liquid discharges would occur from the black water processing system associated with the CG facilities.

Storm water runoff and wash water from the coal unloading structure and silo storage area would be collected in a sump for each area and would be directed to the coal grinding sump to be used for makeup water in the coal grinding/slurry preparation operation. Slag pile runoff would be collected in a lined retention basin and pumped to the filtration system prior to discharge to the cooling reservoir. The slag pile storage area would also be lined with a synthetic material or other low-permeability materials.

Discharges from showers, wash basins, bathrooms, and other facilities are expected to result in 10,500 gallons per day (gpd) of combined sanitary wastewater flow. After treatment in an on-site package plant, effluent would be discharged into the cooling reservoir for reuse.

Solid Wastes Handling and Disposal Systems

Nonhazardous solid wastes generated by the Polk Power Station would include the following: sanitary wastewater treatment sludge, IWT solids, CG wastewater treatment brine solids, water treatment media, HGCU system wastes, and general solid wastes. The resultant wastes would be removed and transported off site according to approved practices (e.g., reclamation and licensed contractor transportation for storage at landfills). The H_2SO_4 and slag by-products would be marketed for off-site uses. Unmarketable slag by-products would be temporarily stored on site in a lined storage area.

Sludge from the sewage treatment package plant would be periodically transported off site for disposal. Used water treatment media, filter media (such as sand), activated carbon, and RO cartridge filters would be disposed at an off-site permitted landfill. Solids from the IWT equalization basin systems and filtration would be periodically removed and transported off site for disposal.

The CG wastewater treatment brine solids would be discharged from the brine concentrator at a rate of approximately 26.5 ft^3/hr. Ammonium chloride, sodium chloride, and ammonium formate are expected to represent 99 percent of the total brine solids makeup. The remaining 1 percent would consist of trace elements present in the feed coal ash, such as aluminum, barium, cobalt, copper, vanadium, and zinc. The brine concentrator solids would be stored in an on-site disposal area consisting of storage cells with runoff collection and leachate collection systems and an impermeable liner in accordance with Chapter 17-701, Florida Administrative Code (FAC).

The demonstration HGCU system is expected to generate salt from the barrier filter, sorbent fines from the regenerator, and solids from the cyclone unit at the approximate rate of 125, 25, and 25 pounds per hour (lb/hr), respectively. Salt from the barrier filter would be disposed in the brine storage area. The sorbent fines would be reclaimed off site. The nonhazardous cyclone solids would be transported off site to a permitted landfill.

Transmission Line Corridors

To link the proposed Polk Power Station with the Tampa Electric Company and the Florida electric transmission grids, an on-site substation and four 230-kilovolt (kV) transmission line circuits would be needed. Two of the 230-kV circuits from the substation would be constructed within a corridor located entirely within the Polk Power Station property. These two 230-kV circuits would interconnect with the existing Tampa Electric Company 230-kV Hardee-Pebbledale transmission line that runs along the eastern border of the site. Two additional circuits would be built within an on-site corridor running west from the substation to SR 37, then off site north along SR 37 approximately five miles, and to interconnect with Tampa Electric Company's existing Mines-Pebbledale 230-kV transmission line at a point to the west of the community of Bradley Junction. The proposed transmission line would be routed to avoid residential areas in the community of Bradley Junction.

Although Tampa Electric Company has selected a proposed corridor for the off-site portion of this northern transmission line, a specific alignment has not been finalized. Although FWS inspected the proposed corridor on December 23, 1993, additional coordination with other appropriate resource agencies by Tampa Electric Company regarding potential alignment impacts is pending.

3. **Alternatives Analysis**

Under NEPA regulations, preparation of an EIS requires identification and assessment of reasonable alternatives to the proposed project that could avoid or minimize potentially adverse effects on the quality of the human environment. The proposed project for this EIS is "Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)." Reasonable project alternatives and subalternatives to the proposed project were considered in this EIS. In addition to "Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance)" and the "No-Action Alternative," alternatives/subalternatives considered were: alternatives to constructing new generating facilities, alternative generation technologies, alternative sites, and alternative processes and facilities. Table E-1 summarizes the alternatives/subalternatives considered in this EIS.

4. **Summary of the Major Environmental Impacts of Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)**

Construction-Related Impacts

Physical Environment--Small quantities of fugitive dust, vehicle emissions, and combustion products would be generated during construction, site preparation, vehicle movement, and open burning of debris. While on-site air quality may be slightly affected, no violations of applicable ambient air quality standards are expected.

No significant construction-related impacts to surface water resources are anticipated as a result of the proposed project. Existing surface waters within the proposed site primarily consist of open water in mine cuts that were artificially created through phosphate mining operations, reclaimed and unreclaimed mine cut lakes, and remnant unmined areas of disturbed and hydrologically isolated wetlands. The proposed project construction, including the 860-acre cooling reservoir, would result in the loss of approximately 253 acres of USACOE jurisdictional wetlands (approximately 212 acres of surface water in mine cuts and approximately 41 acres of highly stressed wetlands). The unmined areas have been highly altered through surface water drainage, groundwater drawdowns, and other disturbances associated with mining activities.

The proposed project would have minor potential effects on the reclaimed hydrology and water quality on and in the vicinity of the site. Construction activities that disturb five acres or more require an NPDES permit for storm water discharges from the site to ensure the implementation of Best Management Practices (BMPs) and minimize impacts to off-site surface waters. Tampa Electric Company has filed a notice of intent for coverage under the General Permit for "Storm Water Discharges Associated with Construction Activities" and is currently (as of August 25, 1993) covered under that General Permit. As a part of the General Permit, Tampa Electric Company has prepared a Pollution Prevention Plan (PPP), including BMPs to control erosion and hydrologic and water quality

Table E-1. Summary of Alternatives/Subalternatives Considered in this EIS (Page 1 of 3)

1. Alternatives to Constructing New Generating Facilities

- Construct all 2,100 MW of needed capacity
- Conservation (TEC's proposed project)
- Interruptible load (TEC's proposed project)
- Residential load control (TEC's proposed project)
- Cogeneration power purchases (TEC's proposed project)
- Other purchased power (TEC's proposed project)

2. Alternative Generation Technologies

- TEC's proposed resource plan (TEC's proposed project)
- Three CC without CG facilities
- Three IGCC units
- PC with FGD unit (TEC's alternative power resource proposal)

3. Alternative Sites

- PLK-A site (TEC's proposed site)
- PLK-1 site
- PLK-2 site

4. Site Layout Alternatives

- Reversing locations of coal unloading and storage and slag by-product storage areas
- Proposed site layout (TEC's proposed project)

5. Fuel Handling and Storage Alternatives

- Coal delivery by rail or truck, bottom-dump rail car or truck, coal storage in silos, above-ground fuel oil storage tanks (TEC's proposed project)
- Lined storage pile with fugitive emission, leachate, and runoff controls and mobile equipment reclamation
- Rotary dumper unloading and stacker-reclaimer
- Unlined storage area and covered coal storage area
- Below-ground oil storage tank.

6. Cooling System Alternatives

- Cooling reservoir (TEC's proposed project)
- Cooling towers: mechanical draft
- Once-through cooling

7. Cooling Water Makeup Source Alternatives

- Groundwater from upper Floridan aquifer, treated wastewater, storm water runoff (TEC's proposed project)
- Groundwater from intermediate aquifer
- Groundwater from deep lower Floridan aquifer (highly mineralized)
- Storm water from all or large portion of the site
- Surface water from streams
- Public water supply/wastewater treatment system

Table E-1. Summary of Alternatives/Subalternatives Considered in this EIS (Page 2 of 3)

8. Cooling Reservoir Discharge Alternatives

- Discharge to Little Payne Creek (TEC's proposed project)
- Discharge to Payne Creek or South Prong Alafia River
- Deep well injection
- Zero discharge

9. Sanitary Wastewater Alternatives

- On-site package plant (TEC's proposed project)
- Septic tank system
- Off-site publicly-owned treatment works

10. CC Process Wastewater Treatment/Disposal Alternatives

- Discharge of treated wastewater to reservoir (TEC's proposed project)
- Discharge of treated wastewater directly off site
- Disposal by deep well injection
- Zero liquid discharge

11. CG Process Water Handling Alternatives

- Treat and reuse of water with zero off-site discharge (TEC's proposed project)
- Treat discharge to cooling reservoir
- Treat and discharge off-site

12. Air Emission Control Alternatives

• PM and trace heavy metals alternatives	a) Use natural gas, syngas, and distillate fuel oil (TEC's proposed project) b) Post-combustion controls: electrostatic precipitators, centrifugal collector, baghouse, or wet scrubber
• SO_2 alternatives	a) CGCU and HGCU systems and low-sulfur fuels (TEC's proposed project) b) Lower sulfur fuel oil c) Post-combustion controls: FGD
• NO_x alternatives	a) Nitrogen and water injection, and dry low-NO_x burners (TEC's proposed project) b) Steam injection c) Selective catalytic reduction d) Selective noncatalytic reduction
• CO and VOCs alternatives	a) Efficient combustion practices (TEC's proposed project) b) Oxidation catalyst
• Fugitive alternatives	a) Coal storage in silos, equipment enclosures, filters, application of dust suppression materials, and use of paved roads (TEC's proposed project) b) Covered coal storage areas

Table E-1. Summary of Alternatives/Subalternatives Considered in this EIS (Page 3 of 3)

13. Solid Waste Storage/Disposal Alternatives

- Combination of on-site and off-site storage and disposal (TEC's proposed project)
- All on-site storage and disposal
- All off-site disposal

14. By-product Storage and Management Alternatives

- Sale for off-site commercial use with temporary storage on site (TEC's proposed project)
- Permanent disposal on site
- Permanent disposal off site

15. Transmission Line Corridor Alternatives

- North on SR 37 and west of Bradley Junction to Mines-Pebbledale transmission line (TEC's proposed project)
- South on SR 37 to SR 674 and west to Polk/Hillsborough county line, then north to Mines-Pebbledale transmission line

16. Other Linear Facility Alternatives

- Natural gas pipeline, alternatives to be determined
- Fuel oil pipeline, alternatives to be determined
- TEC proposed rail spur location (TEC's proposed project)
- Adjacent rail spur location

17. EPA and DOE "EIS Action Alternatives"

- EPA approves NPDES permit and DOE provides financial assistance (TEC's proposed project)
- EPA approves NPDES permit and DOE denies financial assistance (TEC's alternative power resource proposal)
- EPA approves NPDES permit with conditions and DOE provides financial assistance (TEC's proposed project)
- EPA approves NPDES permit with conditions and DOE denies financial assistance (TEC's alternative power resource proposal)
- EPA denies NPDES permit and DOE provides financial assistance
- EPA denies NPDES permit and DOE denies financial assistance

18. No-Action Alternative

- EPA denies NPDES permit
- FDEP denies site certification
- TEC withdraws permit/certification applications

Note: "TEC" refers to Tampa Electric Company.

effects from storm water runoff during proposed construction. Both structural and nonstructural (vegetative) measures would be designed, implemented, and properly maintained in accordance with BMPs.

Overall site reclamation (which is required by FDEP with or without implementation of the proposed project, and is a State of Florida process separate from the EIS process) would be performed to restore the approximate premining hydrologic boundaries between the South Prong Alafia River, Payne Creek, and Little Payne Creek watersheds. The post-reclamation on-site acreages within these watersheds would be within 1.8 percent of premining acreages. No structures would be constructed either within streambeds or floodplains of the existing off-site drainage systems of Little Payne Creek, Payne Creek, or South Prong Alafia River. Construction of the cooling reservoir, plant facilities, and overall site reclamation activities would have a minor effect on surface hydrology based on long-term modeling predictions. Approximately 1,100 acres of the site would have runoff controlled by the proposed cooling reservoir and other water retention areas instead of more natural runoff patterns planned for other reclaimed areas on the site.

Site preparation and facility construction activities would have short-term effects on groundwater in the surficial aquifer within and adjacent to the site due to temporary dewatering activities. Dewatering would last for approximately one year and is not expected to adversely impact on-site and off-site groundwater resources. Drawdown in off-site areas directly adjacent to dewatering activities would be 5 feet (ft) or less for all land uses, except for under the clay settling ponds south of the site that would experience approximately 10-ft drawdowns (permission has been obtained from landowner in accordance with SWFWMD requirements). Essentially no water from the surficial aquifer would be lost since dewatering water would be retained on site in subareas not actively under construction. Potential dewatering effects on the surficial aquifer would be generally offset by the increased infiltration from adjacent storage areas.

The proposed main power plant facilities would be primarily constructed on lands disturbed by associated mining activities. Existing soils would likely be converted to Arents-Urban Land Complex soil association as a result of the proposed construction. The existing soils are not considered prime farmland. No adverse impacts to on-site topography is anticipated since the re-establishment of premining watershed divides would occur.

Biological Environment--Consideration of any impacts to the biological components of the environment due to construction of the proposed project would be tempered by the fact that the majority of the site currently consists as a damaged ecosystem due to the mining of phosphate ore. The proposed main power plant facilities, including the cooling reservoir, would occupy approximately 1,090 acres of land within the eastern portion of the property. This area includes 253 acres of USACOE jurisdictional wetlands. Compensation for this projected wetland loss would be made by Tampa Electric Company by the proposed implementation of project mitigative measures (wetland enhancement/creation) that together with site reclamation measures would result in an overall net increase in open water/wetland habitats compared to premining and existing conditions and would help restore site biodiversity.

Construction activities such as clearing of vegetation from the power block area and the transmission line corridor would have impacts on resident wildlife. Species that are mobile may be able to relocate to other suitable nearby habitats if ecological carrying capacities permit. Those species that are not mobile would be lost. Noise from construction equipment is expected to have only transitory effects on wildlife.

No threatened or endangered species or species of special concern are expected to be significantly impacted by the proposed construction activities. Wetland species such as herons, egrets, ibis, wood stork, sandhill crane, limpkin, and round-tailed muskrat can be expected to experience temporary displacement during construction. Although Tampa Electric Company's preferred project site is within the range of the gopher tortoise and potential commensals such as indigo snake, pine snake, short tailed snake, and gopher frog, these species are generally not expected in areas scheduled for the proposed power plant development due to the general absence of favorable habitat.

Socioeconomic Environment--Construction of the proposed project should have positive socioeconomic impacts including increased employment opportunities, payrolls, and tax base. Increased demands on community services and housing should be minimal. Construction impacts to surrounding land use are expected to be minimal based on the predominance of phosphate mining activities in the area. The proposed northern transmission line corridor is not expected to have significant impacts on adjacent areas and land use. Analysis of construction-related transportation impacts indicates that impacts would be temporary and would not result in unacceptable level of service (LOS) ratings for roadway links and intersections in the vicinity of the site.

Proposed site preparation and construction activities would involve the use of heavy equipment producing continuous daytime noise. Construction-related noise can be divided into the following stages: (1) site preparation and excavation; (2) foundation preparation and pouring; (3) steel erection and equipment installation, and (4) site cleanup and plant start-up. Based on recent literature, the first two stages can be expected to produce noise levels up to 95 decibels (dB) at 50 ft. The highest noise levels (97 dB at 50 ft) are expected to be produced by diesel locomotives. Rail deliveries are estimated to range from 12 to 30 rail deliveries (or a total of 24 to 60 trips to and from the site) on an infrequent basis during the construction of the IGCC unit and less frequent during future construction phases. The site preparation and steel erection stages are expected to produce the highest levels of continuous daytime noise. Due to the distance (1.6 miles) between the plant site and the nearest residence, the construction noise levels would be attenuated to an average-hour equivalent $L_{eq(1)}$ (the averaged hourly noise measurements) of between 40 and 35 dB at the nearest residence. This project construction contribution would be below the existing $L_{eq(24)}$ level of 51.7 dB at this residence. Steam line blow-out activities during the plant start-up phase would produce a significant maximum instantaneous noise level of between 85 to 80 dB at the nearest residence, which represents a noticeable increase from background noise levels would likely create a "startle effect" to nearby human and wildlife receptors. Tampa Electric Company will publish advance notice of the steam line blow out activities in area local newspapers to minimize inconvenience due to these activities.

During the construction phase of the proposed facility, Tampa Electric Company would implement a health and safety plan to promote accident prevention through compliance with the Occupational Safety and Health Administration (OSHA) standards. The project safety and health plan would include key components which are designed to minimize accidents and to maximize workers health and safety during the construction phase.

Human health risk from radiation exposure during construction is negligible due to the absence of phosphogypsum on the site. Phosphogypsum is a waste by-product from the processing of phosphate ore into phosphoric acid and becomes enriched with radium-226 (Ra^{226}) and radium-228 (Ra^{228}). No phosphate ore was processed on the PLK-A site and the site was not used for disposal of phosphogypsum from any off-site processing facilities.

Operation-Related Impacts

Physical Environment--Air modeling results indicate that the operation of the proposed Polk Power Station would not cause or contribute to a violation of any air quality regulations including consumption of PSD increments or National and State of Florida Ambient Air Quality Standards (AAQS). Furthermore, the results of a No-Threat Level analysis indicate that public health in Polk County and adjacent counties would not be jeopardized with respect to direct human inhalation of air emissions from the proposed project operations. Based on the results of a human health analysis, the total cancer risk for individuals due to direct human inhalation of the proposed project air emissions is 1.8×10^{-6} (or 2 persons per one million persons).

Hydrologic impacts should be primarily beneficial due to a steady supply of water to headwaters of the Little Payne Creek from the cooling reservoir, and the storm water controls applied elsewhere within the site to reduce peak flood flows. The proposed continuous average discharge from the cooling reservoir would increase the average annual discharge of Little Payne Creek at Fort Green Road from an estimated premining discharge of 8.2 cubic feet per second (cfs) (5.3 mgd) to an average of 11.9 cfs (7.69 mgd). In order to protect water quality in the reservoir and receiving waters, all sanitary and industrial wastewater would be treated in accordance with applicable regulations before discharge to the cooling reservoir for reuse in the facility cooling systems. Water quality modeling results demonstrate that cooling reservoir discharges throughout the year would comply with State of Florida Class III surface water quality standards, except the thermal standard. A mixing zone of 250 ft from the point of discharge would be required to reduce the temperature to less than 3 degrees

Fahrenheit (°F) above the ambient temperature in the receiving unnamed reclaimed lake water body during winter conditions.

The annual average and annual maximum groundwater withdrawal rates for operation of the plant and associated facilities would be approximately 6.6 and 9.3 mgd, respectively. Regional modeling results show an average drawdown of approximately 4.5 ft would occur at the site boundaries, which is in compliance with the SWFWMD requirements of less than a 5-ft drawdown at property boundaries. Therefore, the proposed groundwater withdrawals and associated drawdowns are not expected to affect other water users in the site vicinity. Impacts to water quality in the Floridan or intermediate aquifers are not anticipated from the proposed project operations due to the presence of confining layers between these aquifers and the overlying surficial aquifer and the fact that water in the proposed cooling reservoir would meet applicable FDEP Class G-II standards, with only minor exceedances of secondary drinking water standards. Iron and color concentrations in the reservoir would exceed secondary drinking water standards; however, the concentrations are below ambient levels in the surficial aquifer.

Biological Environment--Potential adverse effects to local or regional terrestrial and wetland vegetation resulting from plant operation are not anticipated since air emissions and water discharges would be in compliance with applicable AAQS and water quality standards. Groundwater withdrawals from the Floridan aquifer are not expected to result in drawdown of the surficial aquifer and, therefore, would not cause changes to terrestrial or wetland habitats.

During operation of the proposed Polk Power Station, pollution prevention and Best Available Control Technology (BACT) procedures would be implemented to minimize air emissions deleterious to biota. Both SO_2 and NO_x emissions would be below threshold injury levels for native vegetation and agricultural crops reported in various scientific studies. Emissions of air toxics including metals within a 10-kilometer (km) radius would not cause significant risk to wildlife based on assessments using FWS contaminant hazard review information. Mercury deposition and entrance into the food chain has become an emerging environmental problem in Florida. Bioconcentration of this metal has been observed in aquatic ecosystems placing wildlife dependent on fish at risk from mercury toxicity. The proposed Polk Power Station is predicted to emit 0.000177 $\mu g/m^3$ of mercury as an annual maximum concentration. Using the ISCLT2 air quality/deposition model the mercury concentration in the unnamed, reclaimed lake east of the main power block is predicted to be 0.0045 $\mu g/L$, a concentration below the 0.012 $\mu g/L$ Florida Class III water quality standard. However, fish bioconcentrate mercury and wildlife foraging on contaminated species are at risk from metal toxicity. For this reason an ecological analysis was completed for this FEIS using the southern bald eagle as the receptor species to mercury exposure. The results of this analysis showed that uptake of this metal through foraging on fish to be within acceptable bioaccumulation levels. Data are insufficient to make a determination for other resident-at-risk species from mercury emissions.

The previously mentioned, unnamed reclaimed lake leading to Little Payne Creek would receive an average of 3.1 mgd of water discharged from the cooling reservoir. Based on water quality modeling results, the discharges from the cooling reservoir are predicted to meet State of Florida Class III surface water quality standards. Therefore, no adverse biological impacts are expected outside of the thermal mixing zone in the reclaimed lake or in any off-site waters.

Socioeconomic Environment--As with construction, the proposed project operations would have positive socioeconomic impacts. At the proposed project build-out, 210 persons would be employed, the majority of which are expected to be drawn from the local labor pool. The total cumulative annual operational payroll is estimated to be approximately $109 million (in 1992 dollars) from 1995 to 2010. Ad valorem taxes generated by the project for Polk County would increase from $1.9 million in 1996 to $19.6 million in 2011. Operation of the proposed project would not adversely impact any community services or facilities including community water or wastewater systems or local roads. Adequate buffering between the main operating facilities and surrounding land use has been incorporated into the design of the project.

The proposed project is not expected to have significant adverse effects on human health due to direct human inhalation of air emissions from the facilities under the proposed normal operating conditions, since the total individual cancer risk is at the 1.8×10^{-6} level (or two persons per one million persons) and the noncarcinogen exposure level is below the Florida No-Threat Level, given the protective assumptions and models used in this EIS. An estimate of the number of people in the entire affected population that would potentially suffer an increased incidence of cancer due to the proposed Polk Power Station emissions is one additional case every 4,000 years. Cooling reservoir discharge water quality is expected to meet all Class III surface water quality standards; therefore, impacts to human health are considered unlikely through this pathway. The rights-of-way for the proposed transmission lines and the existing transmission lines that would be interconnected would comply with the State of Florida EMF rule (Chapter 17-274, FAC). No adverse human health effects are expected from radiation on the mined land due to the absence of phosphogypsum.

Average noise levels contributed by the operation of the proposed Polk Power Station would be similar to existing noise levels and would be at relatively low noise levels for nearby residences. For example, at the residential area nearest to the power block (one residence at 1.6 miles away), the modeled $L_{eq(24)}$ noise level at full build-out operation is 51 dB $L_{eq(24)}$, which is essentially the same as the measured existing level (51.7 dB $L_{eq(24)}$) and as such would cause only a slight overall noise elevation at that receptor. The calculated $L_{eq(24)}$ levels of plant noise contributions at full build-out at the other nearest residential areas are 51 dB (45 residences at 1.9 miles away) and 40 dB for the most distant residential area considered (53 residences at 4.2 miles away).

Although average noise levels during plant operation are relatively low, the instantaneous maximum noise levels are significant during noise single events. Modeling for the maximum instantaneous levels for the operation of the plant flare stack showed significant noise levels for intermittent periods compared to the average measured ambient (e.g., 77 dB versus the existing level of 55.4 dB $L_{eq(24)}$ and 75 dB versus 51.7 dB $L_{eq(24)}$ for the existing level at the two nearest residential areas). Flare stack operation is expected to be relatively infrequent, occurring during start-up and shut-down of the CG facilities and during emergencies, totaling some 24 hours per year.

Peak-hour $L_{eq(1)}$ (noise level during peak traffic hour) noise traffic levels due to project coal trucks at full build-out at the residence nearest the edge of the route along SR 674 (85 ft away) is predicted to be 57.5 dB $L_{eq(1)}$ compared to a predicted peak-hour level of 64 dB $L_{eq(1)}$ from existing traffic. However, coal truck noise during pass-bys are calculated to be a significant 86 dB at the nearest residence and 77 dB at the most distant (250 ft away) residence considered. At full build-out, it is conservatively estimated that the proposed project operations would generate 302 total truck trips (i.e., 151 trips entering the site and 151 trips exiting the site) per day for coal and other project truck deliveries (excluding approximately 100 trips per year for general consumables) with approximately 30 total trips occurring during the peak traffic hour. The estimated existing truck traffic on the proposed SR 674 coal delivery route is 47 total trips during the peak traffic hour.

The maximum instantaneous noise levels for coal trains is not predicted to be significant for residences nearest the power block (e.g., 54 dB versus 51.7 dB $L_{eq(24)}$ for the existing level at the nearest receptor), although single events such as whistles could be intrusive. Based on the recent literature, diesel locomotives can be expected to generate noise levels of 97 dB at 50 ft during pass-bys. Train noise is not new to the project area due to phosphate mining activities.

5. Comparison of Environmental Impacts of Project Alternatives

Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance) was compared to Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance) relative to potential environmental impacts. Under the Alternative Power Resource Proposal, the proposed 260-MW IGCC unit and two 75-MW CTs would be replaced by a 500-MW pulverized coal (PC) with flue gas desulfurization (FGD) generating unit. Primarily due to the resource requirements and effectiveness of pollution control and minimization measures associated with the proposed IGCC unit, the proposed project is expected to create less potential environmental impacts than the alternative proposal with the PC unit. The No-Action Alternative would generate no project-related operational impacts, although FDEP-required reclamation activities would be needed for the proposed site even if the No-Action Alternative was selected.

Physical Environment

The Alternative Power Resource Proposal PC unit would result in higher SO_2 emissions and greater than two times higher NO_x emissions than an equivalent IGCC unit. Particulates would also be higher with the Alternative Power Resource Proposal. Therefore, the Alternative Power Resource Proposal would result in significantly greater potential air quality impacts than the proposed project, although the potential impacts could also comply with applicable air quality regulations with the use of appropriate BACT measures.

The larger coal, limestone and solid by-product storage areas and the larger main power plant area needed for the Alternative Power Resource Proposal would result in increased storm water runoff. Process water demands and the resulting water quality in the cooling reservoir are expected to be equivalent with the proposed project or alternative proposal. The Alternative Power Resource Proposal would result in greater cooling water needs and a significantly larger reservoir area, which would result in additional discharges to receiving waters; however, the increased discharges would not be expected to cause a significant hydrologic impact. The greater groundwater pumpage required for the Alternative Power Resource Proposal to provide for cooling reservoir makeup might result in unacceptable drawdowns at the property boundaries and a larger withdrawal in the SWFWMD Water Use Caution Area (WUCA).

Biological Environment

The Alternative Power Resource Proposal would result in greater impacts to terrestrial ecosystems than the proposed project, due to the increased land acreages required for coal and product storage, increased cooling water requirements, and increased air emissions. Compared to the proposed project, no significant increase in potential impacts to off-site aquatic systems are expected with the Alternative Power Resource Proposal.

Socioeconomic Environment

Demographic, economic, and community service impacts from the Alternate Power Resource Proposal would be equivalent to those resulting from the proposed project. Operational employment would parallel the proposed project; however, peak construction employment would be greater with the proposed project. Consistency with land-use plans and zoning ordinances would not change with the Alternative Power Resource Proposal. Intermittent noise from the flare stack would be eliminated with the Alternative Power Resource Proposal since the PC alternative would not require a flare stack. However, compared to the proposed project, there would be an increase in noise with the Alternative Power Resource Proposal due to increased truck or rail traffic to deliver coal and limestone and remove solid waste by-products.

In summary, Tampa Electric Company's Proposal Project (Preferred Alternative With DOE Financial Assistance) with the 260-MW IGCC unit would have several environmental advantages relative to Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance) which would include a 500-MW PC unit. The advantages of the proposed project include the need for less land area for the main plant facilities and coal and by-product storage; a smaller cooling reservoir area and lower groundwater makeup and surface water discharge requirements; lower SO_2, NO_x, and PM air emissions; and lower coal usage which in turn would require fewer truck/train deliveries.

Implementation of the No-Action Alternative would result in avoidance of environmental impacts resulting from the proposed project operations.

6. Cumulative Impacts

Cumulative impacts were assessed for construction and operation of the proposed Polk Power Station including other existing and proposed facilities in the site area. These assessments included cumulative consequences to the physical, biological, and socioeconomic resources of southwestern Polk County and the region. Based on the results of mathematical modeling and other analyses for full build-out of the proposed 1,150 MW facility, cumulative impact assessments were made for air quality, surface and groundwater quality, aquatic and terrestrial ecology, noise, land use, transportation and secondary induced impacts from construction and operation of the proposed facility. Cumulative impacts from air emissions relate to human health and ecological issues. The human health analysis based on maximum air emissions showed that the proposed Polk Power Station would account for two additional cases of cancer per one million persons per year from direct inhalation of air emission pollutants. No significant adverse impacts are expected to affect flora or fauna, including federally and state-listed species. Greenhouse gas emissions from the facility would represent approximately 0.041 percent of the total fossil fuel carbon emissions produced in 1985 for energy production in the United States. Tampa Electric Company has also instituted conservation efforts to reduce greenhouse effects through a mix of education, conservation, and load management programs designed to reduce both the customers' current energy usage and, over the long term, the customers' energy costs.

Other cumulative ecological impacts relate to surface and groundwater. The proposed loss of approximately 253 acres of USACOE jurisdictional wetlands would represent potential cumulative impacts that would be mitigated by the proposed wetland mitigation and by reclamation plans. The discharge of 3.1 mgd from the cooling reservoir ultimately into Little Payne Creek may be beneficial by supplementing low-flow conditions in Little Payne Creek. Potential cumulative effects from groundwater withdrawal would include the reversal of potentiometric gradients in coastal areas, upward movement of poor quality water from deep parts of the aquifer, reduction in lake levels and loss of habitat. The potential cumulative impacts from the average 6.6 mgd withdrawal would not create adverse impacts and would be further addressed through the implementation of water reuse and recycling and minimization of water consumption.

Cumulative impacts from noise, transportation and other socioeconomic parameters including secondary induced impacts were also considered. Plant noise from construction and average operation should not generally elevate levels above average ambient levels. However, intermittent steam blow out, flare stack, and truck/train pass-by-noise are single events that can be expected to be intrusive to nearby human and wildlife receptors. While the proposed project at full build-out would have some operation-related impacts, all existing roadway links and intersections are expected to operate at an acceptable LOS. Employment opportunities for local residents would increase as a result of construction and operation of the proposed Polk Power Station. Tampa Electric Company would institute training coursework within the local community college curriculum for those residents interested in employment. The construction and operation of the Polk Power Station can be expected to secondarily support additional population growth and economic development in the region. Accordingly, developments resulting from this secondary or induced growth can be expected to create additional potential impacts in the region such as air pollution, soil erosion, water use and wetland losses.

7. Impact Avoidance, Minimization, and Mitigative Measures for Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

In the development of plans for the proposed Polk Power Station project, Tampa Electric has incorporated several impact avoidance and pollution prevention features or measures. These measures started with the previously discussed site selection study. The site selection process provided a systematic analysis and comparison of possible sites to balance the needs of the Tampa Electric Company system and avoidance of as many environmental impacts as possible. Additional efforts and best management practices (BMPs) by Tampa Electric Company to avoid impacts and minimize pollution due to the proposed power station are as follows:

- Implementation of existing conservation, load management and cogeneration programs to meet a significant portion of its power resources needs to limit the construction of new power plants, thereby avoiding impacts of the additional plants
- Selection of a proposed site which has been already highly impacted by phosphate mining activities to avoid potential impacts to an undisturbed "greenfield" land area
- Use of DOE CCT for Polk Unit 1 to reduce emissions of metals, acid gases, and organics from use of coal as a fuel source by treatment of the syngas before combustion to remove potential pollutants
- Directions to design engineers to review ongoing design efforts and to modify designs and systems which could decrease impacts by pollution prevention or measures to avoid impacts
- Extensive reuse of water in the proposed gasification facilities and extensive treatment of the wastewater to avoid discharges of potentially contaminated water
- Construction of the cooling reservoir in mined-out areas as a primarily below grade facility to reduce groundwater withdrawals and to avoid potential impacts due to unexpected berm failure
- Use of enclosed silos for coal storage to avoid potentially contaminated storm water runoff and leachate from open coal piles and to minimize fugitive coal dust emissions
- Use of lined material storage areas (i.e., slag and brine storage areas) with storm water runoff collection and leachate collection and treatment systems to avoid potential contamination impacts to groundwater and surface water

- Conversion of waste sulfur compounds removed from the syngas to a saleable H_2SO_4 by-product with productive off-site uses to avoid the need for permanent storage facilities
- Selection of a route for coal trucks between Big Bend Power Station and the proposed Polk Power Station that passes through primarily industrial and rural land uses to avoid potential impacts to residential areas
- Use of specially designed trucks for coal delivery with aluminum covers to avoid fugitive dust emissions during transport
- Siting of facilities within the proposed site to avoid potential impacts to sensitive environmental resources such as high-quality wetlands

In addition to these measures, Tampa Electric Company would implement other BMPs and pollution prevention and avoidance plans during construction and operation of the proposed Polk Power Station. These plans would include:

- BMPs and pollution prevention conditions in accordance with the requirements of the EPA draft NPDES permit
- A construction-dewatering monitoring and mitigation plan and operational groundwater monitoring plan
- Spill prevention control and countermeasure (SPCC) plan
- Resource conservation and recovery act (RCRA) contingency plan

Construction-Related Impacts

A number of measures would be employed to minimize many of the proposed project potential construction impacts. Fugitive dust emissions from the proposed construction activities would be minimized by using dust suppression controls including paving roads and applying water to roads and other exposed surfaces as needed. Emissions from open burning would be limited by removing materials that would produce excessive smoke (i.e., green vegetation), and by complying with applicable state and local regulations.

A PPP including construction BMPs for sedimentation and erosion control would be implemented to minimize impacts to on-site and off-site surface waters. During construction, inactive subareas of the cooling reservoir and areas to be reclaimed as wetlands would be used to retain storm water runoff and dewatering water on site. Swales would be constructed to convey construction site runoff to the inactive subareas or to sedimentation basins. Tampa Electric Company would also use ground cover techniques (such as seeding) to control erosion and sedimentation. As needed, additional erosion control BMPs would include construction of temporary perimeter berms, use of rip-rap, staked hay bales, silt fences, diversionary berms or swales.

Potential impacts to the surficial aquifer from dewatering drawdown would be reduced by retaining withdrawn water on site. Tampa Electric Company would also implement a SWFWMD-required dewatering monitoring and mitigation plan which would involve the installation of monitoring wells to determine if off-site drawdowns occur and, as needed, rim ditches to recharge the surficial aquifer.

Following construction, natural functions of the premining habitats would be restored or enhanced through the proposed reclamation plans for the site. The premining land forms on the site (primarily pine flatwoods/pine plantation, oak/pine woods, hardwood hammock, mixed swamp, hardwood swamp, freshwater marsh, shrub and brushland, grassland, mixed rangeland, lakes, citrus groves, and pastureland) would again be present.

The proposed development/reclamation/mitigation plan would result in a net increase of approximately 187 acres of wetlands on the site compared to premining conditions. Tampa Electric Company proposes to fill a total of approximately 253 acres of USACOE jurisdictional wetlands (212 acres of phosphate mine cuts and 41 acres of highly stressed wetlands) for construction of the proposed power station. As compensation for these wetland losses, Tampa Electric Company would create or enhance 168.41 acres of wetlands (see Table E-2). This proposed mitigation is subject to USACOE and other resource agencies review and approval.

The wetlands to be created/enhanced on site per project mitigation and the wetlands to be reclaimed on site from mined land per site reclamation are planned to remain as wetlands through the 2010 planning horizon. As the owner of the proposed site, Tampa Electric Company has no plans to change these parcels during or after this plan period. It should also be noted that if a change in use is desired at some point in the future by any party, it would be subject to public scrutiny through the regulatory review and permitting process.

Construction vehicle/machinery noise impacts during construction would be minimized by ensuring that machinery is only operated according to design specifications and only during daytime working hours. For steam blow-out events during the final construction phase, advanced notice will be published in local newspapers. Tampa Electric Company also will provide a special toll-free telephone number (1-800-282-4667, Extension 34269) to receive public comments regarding plant construction activities.

If the proposed project is implemented, Tampa Electric Company would construct certain geometric improvements at the intersections of site driveways and SR 37 and Fort Green Road to accommodate project construction and operational workforces. Entrances to the power station would be designed with appropriate deceleration, acceleration, and turn lanes, based on Florida Department of Transportation (FDOT) standards. If the proposed project is constructed, Tampa Electric Company will repair and maintain entrance areas to the site as necessary.

Table E-2. Project Wetland Mitigation and Site Reclamation Acreages Proposed by Tampa Electric Company

Mitigation/Reclamation	Wetland Type Forested (acres)	Herbaceous (acres)	Total (acres)
Project Wetland Mitigation (for USACOE)*			
Wetland Creation	62.69	63.58	126.27
Wetland Enhancement	18.94	23.20	42.14
Total Wetland Mitigation†	81.63	86.78	168.41
Site Reclamation (for FDEP)			
Premining Wetlands (total site)	335	277	612
Required Wetland Reclamation (mandatory lands)	283	260	543
Proposed Wetlands After Reclamation† (total site)	371	428	799
Proposed Increase in Wetlands Over Premining Conditions	36	151	187

* Mitigation for SWFWMD jurisdictional wetlands are included in the USACOE wetland mitigation acreages. Tampa Electric Company proposes to fill 253 acres of USACOE jurisdictional wetlands.

† The "Total Wetland Mitigation" acreages (e.g., 168.41 acres) are included in the "Proposed Wetlands After Reclamation" acreage totals (e.g., 799 acreages).

Sources: Tampa Electric Company's Joint Application for Works in the Waters of Florida (see Appendix C of this EIS).
TEC, 1992a

Operation-Related Impacts
The operation of Tampa Electric Company's proposed project would result in potential environmental impacts. However, these potential impacts would be minimized by the use of state-of-the-art impact control technologies in all project phases.

To minimize potential air quality impacts, Tampa Electric Company would implement BACT measures in the proposed project wherever feasible to reduce combustion, process, and fugitive emissions. Use of the IGCC unit represents the most efficient technology for producing electricity from coal. The IGCC and stand-alone CT and CC units would also use BACT for control of potential pollutants and emission sources. Use of low-sulfur and low-ash fuels would minimize emissions of SO_2 and particulates. Coal handling and slag systems would be designed to effectively control fugitive emissions of PM. The coal dust control system would involve the use of a combination of controls, including railcar and truck unloading in an enclosed building, coal storage in silos, enclosure of certain coal conveyors, baghouse particulate control at transfer points, and wet grinding in the rod mills. Slag would be transported wet to minimize or eliminate potential fugitive dust emissions.

Two potential sources of impacts to surface waters during operation are storm water runoff and wastewater discharges. The proposed cooling reservoir would be designed to minimize discharges to surface drainage systems. The reservoir would minimize the potential for downstream flooding impacts by acting as a storage basin for runoff in addition to the other proposed storm water retention basins on the site. Potential impacts from storm water runoff would be minimized by implementation of a storm water management plan consistent with SWFWMD and FDEP requirements. Potential wastewater discharge impacts would be minimized through appropriate treatment of process water prior to discharge to the cooling reservoir.

Impacts to groundwater resources could result from groundwater drawdown through consumptive use or contamination from effluent discharge or leachate. The proposed cooling reservoir design minimizes makeup water requirements and withdrawal drawdown impacts to the Floridan aquifer and prevents significant water quality impacts to the surficial aquifer resulting from reservoir seepage. In order to prevent or manage potential spills from the chemical handling and storage areas, a preliminary SPCC plan, a preliminary RCRA contingency plan, and a BMP plan have been developed by Tampa Electric Company. The measures outlined in these plans would limit the possibility of an accidental spill actually impacting groundwater.

Tampa Electric Company would consider noise reduction measures a priority as it evaluates equipment and prepares the detailed designs of the plant. In addition to the proposed vegetative buffer along the site boundary, options would include silencers for CT air intakes and the requirement that vehicles on the plant site travel at slow speeds. These proposed measures, in addition to attenuation by distance and a proposed vegetative buffer zone along site boundaries with public roadways, would collectively reduce the noise contributions of the proposed project operations at nearby residential receptors.

Project truck peak-hour noise levels are predicted to be below existing peak-hour traffic noise levels, although pass-by single events would be elevated (e.g., 85 dB $L_{eq(1)}$ at the nearest residence at 85 ft from edge of roadway). It should be noted that the number of residences/people along the considered 250-ft corridor along the proposed coal delivery route within the 5-mile project radius is relatively sparse (five residences), truck traffic is not a new noise along the proposed route due to existing phosphate mining, and Tampa Electric Company will also provide a special toll-free telephone number (1-800-282-4667, Extension 34269) to consider public comments regarding plant operation activities. Further minimization of project truck noise would be difficult since the truck delivery route is off the site. However, truck delivery scheduling may be one option for Tampa Electric Company to consider to minimize nighttime disturbance.

Site Reclamation

In addition to the previously described project mitigation for the loss of USACOE jurisdictional wetlands proposed by Tampa Electric Company, FDEP-required reclamation measures would also be implemented for the site. The proposed wetland mitigation/reclamation/development plan for the proposed Polk Power Station site would result in 799 acres of wetlands after reclamation of the site is completed. The 799 acres of wetlands represent a net increase of 187 acres of wetlands relative to site premining conditions. Although the FDEP-required site reclamation is a separate State of Florida process from the previously described project wetland mitigation, project wetland mitigation will be considered toward site reclamation, so that the mitigated acreage (168.41 acres) is included in the total site reclamation wetland acreage of 799 acres (see Table E-2). Further, even though the existing and premining wetlands on the site were not FDEP jurisdictional, Tampa Electric Company has committed to planting densities, success criteria, and monitoring requirements for reclaimed wetlands which exceed the typical FDEP mined land reclamation requirements.

8. State of Florida Site Certification Process Summary

The previously discussed State of Florida site certification process for this proposed project generally paralleled the EPA EIS process. It is a related but separate process from the EIS NEPA process. Consistent with the PPSA, the site certification process included (1) Tampa Electric Company filing an SCA with FDEP (July 30, 1992), (2) the state coordinating with EPA and other agencies during SCA review, (3) FDEP preparing an SAR, including the conditions of certification, (4) the state conducting the administrative hearings for certification (October 13, 1993), (5) the state hearing officer filing a recommended order (November 30, 1993) and State Governor and Cabinet (Florida Power Plant Siting Board) approval of the recommended order, subject to specific conditions of certification (January 25, 1994), which then became the final order, (6) the state approving the Final PSD Determination, which includes the PSD permit (February 24, 1994) for the 260-MW Polk Unit 1, and (7) the state approving the proposed site reclamation plans (approved in conjunction with approval of the recommended order) for site "PLK-A," which has been purchased (December 31, 1993) by Tampa Electric Company.

9. Resolution of Draft EIS Unresolved Issues

The unresolved issues at the DEIS stage either have been resolved or mechanisms to resolve them have been established. The unresolved issues at the DEIS stage primarily pertained to DOI-requested air quality depositional modeling, USACOE Section 404 dredge-and-fill permitting, and NEPA compliance with federal, state, and/or local agencies for several proposed linear facility alignments (i.e., transmission lines, railroad spur, natural gas line, and possibly fuel oil pipeline).

Air Quality Depositional Modeling

Issue--In response to EPA coordination during DEIS development, DOI indicated concerns regarding potential PSD air quality impacts to the Chassahowitzka National Wilderness Area (NWA) and requested additional modeling using a revised MESOPUFF II model to predict deposition and concentration of sulfate, nitrate, mercury, and beryllium.

Initial EPA Response--EPA's initial response to the DOI concerns was that Industrial Source Complex (ISC) dispersion modeling as opposed to MESOPUFF II modeling had been conducted for the four parameters. Additionally, EPA indicated that EPA had fully delegated the PSD Program to the State of Florida, that beyond the PSD incremental assessment the DOI Federal Land Manager (FLM) at the Chassahowitzka NWA may interpret the proposed power station to have an adverse effect on the environmental criteria for the Class I area, that the State of Florida consequently would be coordinating with the FLM, and that EPA would also consider the need for additional modeling from a NEPA perspective based on the FLM's decision.

Subsequent DOI-FDEP Coordination--Because the PSD Program is now fully delegated to the State of Florida, additional coordination occurred between DOI and FDEP. Relative to the Air Quality Related Values Analysis in a letter to FDEP dated February 14, 1994, DOI expressed concern about cumulative depositional effects of sulfate, nitrate, mercury, and beryllium and about the DEIS analysis not being cumulative for these pollutants. DOI stated, "We need to know: (1) the cumulative deposition of pollutants, and (2) the ecological consequences of this deposition" and "We ask that TECO be required to perform these analyses when they apply for permits for future phases of their Polk Power Station."

EPA's NEPA Resolution--From a NEPA perspective, EPA agrees with the State of Florida that additional modeling to determine potential cumulative depositional effects for sulfate, nitrate, mercury, and beryllium (as well as any other reasonable parameters that may need to be monitored) should be modeled for the proposed additional units beyond the 260-MW Polk Unit 1 (if Tampa Electric Company pursues these additional units and the additional need for capacity above the approved 220 MW is approved by the Florida PSC). Additional coordination should therefore be conducted by Tampa Electric Company with FDEP during the prospective application for such additional units up to 1,150 MW at the Polk Power Station. Based on the February 14, 1994, letter from DOI to FDEP, it appears that the mechanism for resolving the air quality modeling issue has been established for units beyond the 260-MW and up to the proposed 1,150-MW full build-out for the Polk Power Station.

USACOE Section 404 Permitting

Tampa Electric Company has submitted a dredge-and-fill permit application ("Joint Application for Works in Waters of Florida"), dated July 24, 1992, to USACOE and the State of Florida. A USACOE Public Notice regarding this application was issued by USACOE on October 7, 1992. At the subsequent request of EPA, which independently reviews Section 404 dredge-and-fill permit applications, USACOE has agreed to hold in abeyance Tampa Electric Company's application to fill approximately 253 acres of jurisdictional wetlands until the completion of the EIS NEPA process. More recently, Tampa Electric Company has submitted an update (May 9, 1994) to its original permit application to USACOE, and EPA has provided a comment letter (May 11, 1994) to the USACOE on their Public Notice. The USACOE permitting decision will follow after the completion of the NEPA process.

Pending successful completion of this EIS process, it is expected that USACOE would adopt this EPA EIS as NEPA documentation for any Section 404 permits USACOE may choose to issue. If the EIS is adopted, USACOE would also prepare, as appropriate, its own EIS ROD (separate from EPA's ROD) for its Section 404 permitting action.

NEPA Compliance for Linear Facility Alignments

Since the final alignments for the proposed off-site/on-site transmission lines and natural gas pipeline and the possible off-site/on-site fuel oil pipeline either have not been determined or have not been finalized at this time, additional coordination will be needed by Tampa Electric Company, since alignment finalization would not occur until after completion of this NEPA EIS process. Coordination for these interconnecting linear facilities would need to be made with appropriate federal and state agencies once alignments are finalized. For example, environmental impacts such as potential wetland, cultural resource and endangered species impacts will need to be properly coordinated with USACOE, Florida SHPO, and FWS, respectively. The transmission lines would be required at plant operation start-up while the need for a natural gas pipeline is expected by 1999 as a primary fuel source, and the fuel oil pipeline may or may not be needed. The interconnecting 200-ft railroad spur alignment adjacent to the site has been coordinated on site with the FWS and by telephone with the Florida SHPO; however, the USACOE may wish to review this alignment as part of the 404 permitting process and the Florida SHPO may request more formal coordination in conjunction with the other proposed alignments. The railroad spur would be required during both plant construction and operation.

10. Public Comments at the EPA Public Hearing and on the DEIS

EPA published a Notice of Availability (NOA) for the DEIS in the *Federal Register* on February 25, 1994 (59 FR 9211, EIS No. 940056), which initiated the 45-day public comment period for the DEIS. On March 31, 1994, during the comment period, EPA held a public hearing in Polk County in Bartow, Florida near the proposed project site. The public hearing was held at the Polk County Commission Board Room in the Administrative Building, which was provided for the evening courtesy of Polk County. This hearing was a joint public hearing for the EPA EIS (including DOE's CCT action) and EPA's NPDES permit action. The hearing was announced on February 24, 1994, in the *Polk County Democrat* and the *Tampa Tribune*.

In addition to four EPA representatives and associated personnel (third-party contractor and court reporter), 20 people registered at the public hearing. These attendees consisted primarily of DOE and Tampa Electric Company representatives and their contractors, but also included the public. One public speaker provided verbal comments at the public hearing. This speaker represented the Central Florida Development Council and promoted the proposed project.

Approximately 200 addressees were provided a copy/copies of the DEIS and an additional approximately 80 addressees were provided a copy of the DEIS Executive Summary (only) during the NEPA distribution at the DEIS stage. Nine (9) public comment letters on the DEIS were received by EPA, generally within the 45-day public comment period from February 25, 1994 to April 11, 1994. These letters were received from: U.S. Department of Housing and Urban Development (HUD - Atlanta, GA); U.S. Department of Agriculture (Soil Conservation Service (SCS) - Gainesville, FL); U.S. Department of Commerce (National Oceanographic and Atmospheric Administration (NOAA) - St. Petersburg, FL); Florida Department of State (Division of Historic Resources/State Historic Preservation Officer (SHPO) - Tallahassee, FL); Colorado State University (Documents Department - Fort Collins, CO); Federal Aviation Administration (FAA, Orlando Airports District Office - Orlando, FL); Florida Department of Environmental Protection (FDEP, Southwest District - Tampa, FL); Florida Department of Community Affairs (State Clearinghouse - Tallahassee, FL); and U.S. Department of Health and Human Services (Centers for Disease Control (CDC)/National Center for Environmental Health - Atlanta, GA). Of these, EPA considered comments provided by CDC, FDEP, and FAA as requiring substantive responses. Copies of all nine letters are provided with individual EPA responses in the FEIS. In addition to these comment letters, EPA and Tampa Electric Company corresponded generally throughout the EIS process.

Environmental concerns raised in the nine comment letters included the following:

- Cumulative human health effects of air-deposited pollutants attributable to the proposed Polk Power Station
- Presence/absence of chlorinated dioxins and furans during IGCC coal gasification

- Analysis of indirect human exposure risk due to plant emissions
- Hexavalent chromium levels due to IGCC coal gasification
- Adequacy of groundwater monitoring for the proposed plant
- Quality control of the coal gasification slag by-product, including toxicity characteristic leachate procedure (TCLP) testing and radionuclide levels
- Height of structures and stacks proposed for the plant and FAA permitting for structures greater than 200 ft above ground level
- Site inspection procedures for the proposed plant
- Potential EPA inclusion of more stringent conditions regarding penalties than those contained in the standard Part II NPDES permit language and Florida law
- Potentially linking NPDES permit conditions with final approval and continuance of the proposed DOE cost-shared financial assistance under the DOE CCT Demonstration Program
- Identification and hazardous waste potential of catalysts referenced in the DEIS (vanadium pentoxide)

As in the case of the DEIS stage, EPA has also published an NOA in the *Federal Register* to announce the availability of this FEIS.

11. EPA's Preferred Permit Action

As previously discussed, EPA's "EIS Action Alternatives" for this EIS are to issue, issue with conditions, or deny an NPDES permit for the operation of the proposed Polk Power Station. EPA's preferred EIS Action Alternative is to issue the NPDES permit with conditions, pending successful completion of this EIS process. The conditions of the permit will involve certain limits, conditions, monitoring requirements, and reporting requirements. These permit conditions are intended to evaluate the effectiveness of the proposed pollution control systems. Conditional issuance of the NPDES permit by EPA would allow Tampa Electric Company to operate the proposed Polk Power Station by allowing regulated point-source discharges from the spillway of the cooling reservoir to an unnamed reclaimed phosphate mining lake leading to Little Payne Creek (both water bodies are waters of the United States).

EPA has requested State of Florida certification for the draft NPDES permit. Any more stringent requirements received from the state will be incorporated into the final EPA NPDES permit.

Pending successful completion of this EIS process, EPA will prepare, as appropriate, an EIS ROD for its preferred NPDES permitting action for the proposed project.

12. DOE's Preferred CCT Financial Assistance Action

DOE's "EIS Action Alternatives" for this EIS are to provide cost-shared financial assistance or to deny the cost-shared financial assistance under the DOE CCT Demonstration Program. DOE's preferred action alternative is to provide Tampa Electric Company approximately $130 million in cost-shared financial assistance for the 260-MW IGCC Polk Unit 1 portion of the proposed Polk Power Station, pending successful completion of this EIS process. The $130 million figure has increased from the original $120 million estimate because of additional costs of design changes and improvements.

Pending successful completion of this EIS process, DOE expects to adopt this EPA EIS as NEPA documentation for its preferred CCT cost-shared financial assistance action for the proposed project. As appropriate, DOE would also prepare its own EIS ROD (separate from EPA's ROD) for its proposed action.

13. Post-DEIS Design Changes Proposed by Tampa Electric Company

Project design modifications and improvements proposed by Tampa Electric Company for the preferred alternative, i.e., Tampa Electric Company's proposed project (Preferred Alternative With DOE Financial Assistance), occurred during the EIS process. Relevant design aspects not documented in the published DEIS are incorporated in this FEIS. The preferred alternative documented in this FEIS essentially constitutes Tampa Electric Company's final design proposal, although this remains a somewhat ongoing and dynamic process. The design modifications have resulted in overall design improvements, cost reductions, and general environmental impact reductions. For the purposes of this EIS, the most significant design changes are the proposed use of coal storage silos instead of an on-site coal pile, and the increase in size and hours of operation of the auxiliary boiler.

The shift from a coal pile to the use of coal silos caused several changes in the proposed layout of the plant:

- Use of silos for coal storage instead of open piles requires a smaller area
- Deletion of the on-site rail loop and a change of the truck coal delivery system; maintainance of the proposed on-site rail spur for other deliveries
- Deletion of the coal pile mobile equipment maintenance shop
- Deletion of the coal pile runoff treatment package plant
- Routing of runoff water to sumps in the coal unloading and silo storage areas for use in coal grinding
- Routing of the wastewater filter backwash to the equalization basin instead of the coal pile detention basin

Engineering design considerations and the elimination of the coal pile caused an increase in the size and operation of the auxiliary boiler and a reconfiguration of the layout. Some alterations, such as in the size of the on-site subarea drainage basins, are attributable to one or more changes in the location and size of several components of the proposed facility:

- Increasing the size (49.5 to 120 MMBtu/hr), normal operating hours (1,000 to 3,000 hr/yr), and standby operating hours (0 to 8,760 hr/yr) for the auxiliary boiler
- Deleting of the administration/visitor building, the parking lot, and the associated 0.2-acre storm water detention basin
- Adding 60 operational parking spaces near the general services building
- Reducing the size of the southern construction lay-down area from over 20 acres to approximately 9 acres
- Deleting the brine storage area runoff basin
- Revising the structure dimensions for the 7F HRSG enclosure, SG-C wings 1 and 2, the gasifier, the cold box, the coal grinding day bin, coal storage silos 1 and 2, oil tanks 1, 2, and 3, and the coal delivery enclosure
- Revising the locations of the IGCC HRSG, the auxiliary boiler, and the thermal oxidizer stacks
- Routing the runoff from the substation area to the storm water detention basin instead of to the cooling reservoir
- Increasing the diameter of the discharge pipe from 10 to 18 inches in diameter
- Changing the initial storage cell from a 1-year storage capacity to a 2.5-year storage capacity
- Increasing the fire protection water system from 3,000 to 6,000 gpm and changing the primary source of system water from the service water tank to the cooling reservoir
- Changing the on-site subarea drainage basin sizes
- Routing a small (less than 40 gpm) waste stream from the sulfuric acid plant to the equalization basin
- Decreasing in the use of the HGCU system for the treatment of syngas
- Providing separate stacks for the sulfuric acid plant and the thermal oxidizer and decreasing the size of the thermal oxidizer for the HGCU unit

Although instances of increases in individual environmental impacts due to design changes exist, the design changes are not predicted to result in environmental compliance changes, i.e., aspects of the proposed Polk Power Station did not come out of or into compliance since the DEIS stage due to the proposed design modifications and improvements. However, FDEP may choose to modify the PSD permit for Polk Unit 1 due to certain air quality impact changes, such as an increase in the number of plant emission stacks. Also, the use of Tampa Electric Company's nearby Big Bend plant for coal pile storage beyond the on-site silos would not require a facility modification, but would require an FDEP permit modification, which was pursued by Tampa Electric Company. The permit modification was approved by FDEP on March 31, 1994.

The shift from an on-site coal pile to the use of coal storage silos is predicted to result in the following changes in environmental impacts:

- Reduction of more than 30 acres in the area needed for power plant facilities
- Elimination of leachate materials (particularly metals) from the coal pile in the wastewater system and in the water and sludge produced by this system
- Reduction in anticipated fugitive dust generation and associated particulate matter impacts on air quality
- Use of Tampa Electric Company's nearby Big Bend plant for coal storage beyond the on-site coal storage silos

The increase in size and operating hours for the auxiliary boiler are predicted to result in the following changes in environmental impacts:

- Slight increases (0.3 percent and 1.2 percent, respectively) in ambient air quality impacts from sulfur dioxide and nitrogen oxides
- Slight increase (1.3 percent and 1.0 percent, respectively) in ambient air quality impacts from CO and PM
- Required monitoring of continuous NO_x and opacity on auxiliary boiler emissions

All of the other changes are predicted to have minor influences upon the environmental impacts of Tampa Electric Company's proposal. The cumulative effects of these other changes are as follows:

- The storm water management plan has changed slightly due to the deletion of a small detention basin and minor changes in drainage area caused by other changes in layout.
- The land needed to be developed has been reduced slightly (approximately 30 acres).
- The generation of contaminated waste water has been additionally reduced.
- Changes in stack locations, number of stacks, and building dimensions have resulted in minor changes in air quality impacts.

CHAPTER 1.0

Introduction

1.0 INTRODUCTION

1.1 OVERVIEW

1.1.1 Identification of the Applicant

Tampa Electric Company is an investor-owned electric utility that serves west-central Florida, primarily Hillsborough County and portions of Polk, Pasco, Pinellas, and Highlands Counties (Figure 1.1.1-1). Currently, Tampa Electric Company serves more than 467,000 residential, commercial, industrial, and governmental customers within its service area. Tampa Electric Company's system has an installed net electric generating capacity of 3,281 megawatts (MW: note that EIS references to MW capacities of power generating units are understood to be "nominal net" capacities) from 24 generating units located at five different sites: Big Bend, Gannon, Hookers Point, Phillips, and Dinner Lake Stations.

1.1.2 History of the Project

As a public utility, Tampa Electric Company has the obligation to provide reliable and economical electric power service to its existing and future customers. To meet this obligation, Tampa Electric Company conducts ongoing, long-range integrated resource planning and load (i.e., demand) forecasting programs to predict its future power supply needs and to evaluate available options to meet these needs. These programs also consider Tampa Electric Company's extensive efforts to encourage conservation, load management programs, and cogeneration projects to reduce future power needs. As a result of these programs, Tampa Electric Company has determined the need for approximately 1,150 MW of new electric generating capacity (i.e., new power plant facilities) to meet its customer power demands beginning in the mid-1990s and continuing into the early twenty-first century. These additional power supply needs are primarily based on future electricity demands created by ongoing and projected population growth within its service area.

Through license/permit applications, Tampa Electric Company is proposing to construct and operate a new power plant and associated facilities on an approximately 4,348-acre site in southwestern Polk County, Florida. The proposed facilities would be known as the "Tampa Electric Company Polk Power Station." The proposed total net generating capacity of the units at the site would be approximately 1,150 MW. The generating units planned for the Polk Power Station would be developed at the site according to a phased schedule that matches Tampa Electric Company's forecasted growth in electricity demands beginning in 1996 and continuing into the year 2010. The first generating facility at the Polk Power Station site is proposed to be an integrated coal gasification combined cycle (IGCC) unit. This IGCC unit would be known as "Polk Unit 1." Cost-shared financial assistance for the IGCC unit would be provided by the U.S. Department of Energy (DOE) through the DOE Clean Coal Technology (CCT) Program, pending successful completion of this environmental impact statement (EIS) process. The 260-MW IGCC unit would consist of a 150-MW advanced combustion turbine (CT), heat recovery steam generator (HRSG), steam turbine (ST), and coal gasification (CG) facilities. The IGCC unit would be fueled by coal-derived gas called coal gas or syngas, which is produced in the CG facilities with low-sulfur No. 2 fuel oil as a backup fuel. Tampa Electric

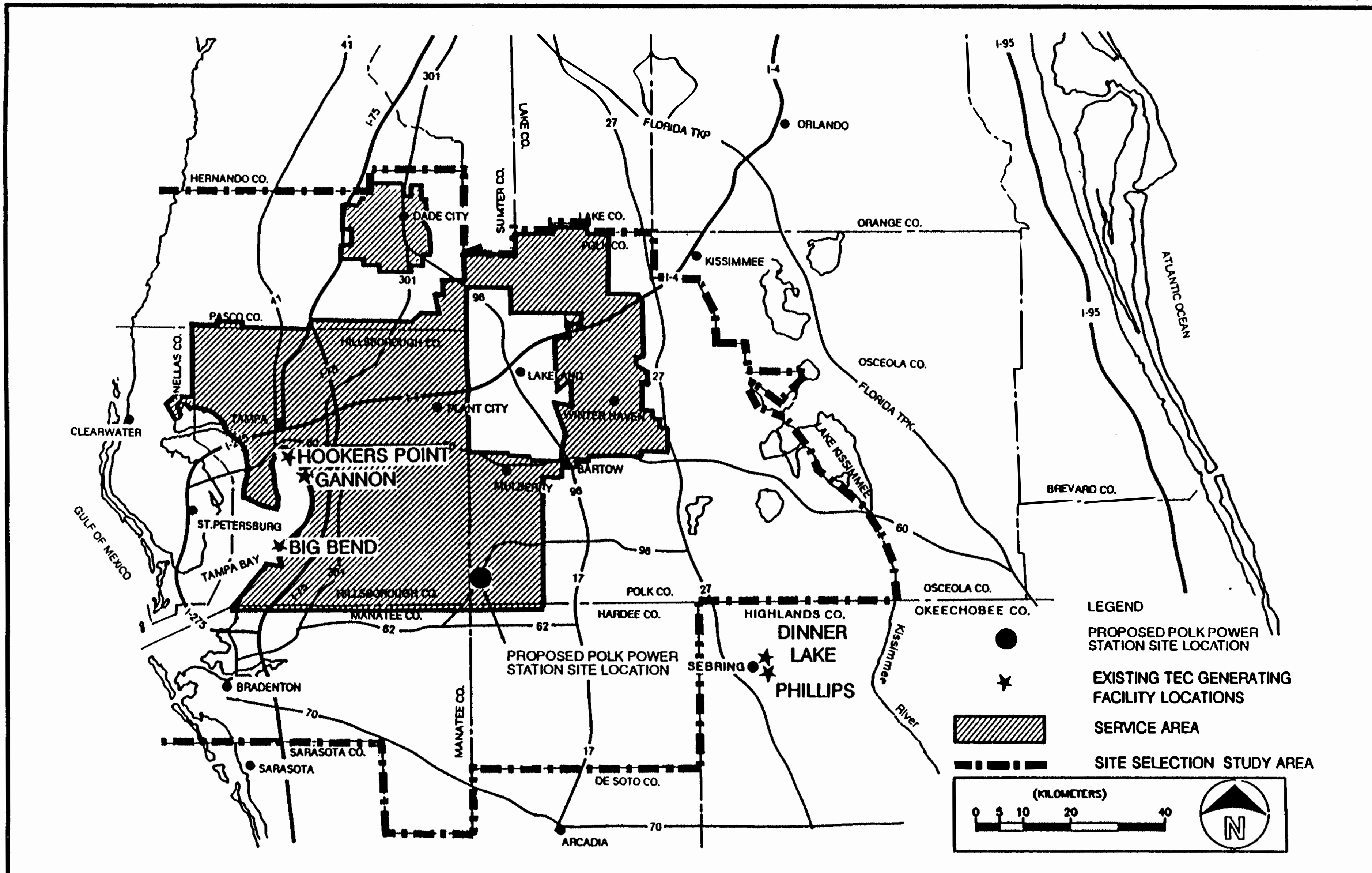

FIGURE 1.1.1-1.
Tampa Electric Company Service Area and Existing Generating Facility Locations and Site Selection Study Area.

SOURCES: ECT, 1992; TEC, 1992a.

U.S. Environmental Protection Agency, Region IV

Environmental Impact Statement

Polk Power Station Polk County, Florida

Company's current Integrated Resource Plan indicates that later facilities would consist of two combined cycle (CC) generating units and six simple-cycle CTs fueled by natural gas with low-sulfur No. 2 fuel oil as the backup fuel.

1.1.3 Proposed Project

Tampa Electric Company proposes to expand its electric generating capacity by establishing a 1,150-MW power station on an approximately 4,348-acre site in southwestern Polk County, Florida. Figure 1.1.3-1 shows the location of the proposed site in the region. The proposed power station would be known as the Polk Power Station and would consist of the phased construction and operation of CC generating units, multiple CT generating units, and CG facilities. The proposed facilities would include three new CC units, two of which are capable of firing natural gas and fuel oil, and one of which is capable of firing fuel oil and coal-derived gas (syngas); and six stand alone CTs. The proposed IGCC project would include on-site material handling and storage facilities for low-sulfur No. 2 fuel oil, coal, and the by-products of CG and syngas treatment: slag and sulfuric acid (H_2SO_4). The project would also involve an off-site rail spur, a natural gas pipeline, and transmission facilities.

Development of the proposed Polk Power Station would occur in three phases. The initial phase (Phase I) would be the construction of a 260-MW IGCC unit with attendant support facilities, including a cooling water system, an electrical switching yard, fuel oil storage, personnel support facilities, and coal and slag storage. This unit would burn coal-derived gas and would have the capability to burn low-sulfur No. 2 fuel oil as a backup fuel. Phase II would consist of construction of the two 220-MW CC units and one 75-MW CT unit. These units would burn natural gas as the primary fuel or low-sulfur No. 2 fuel oil as the backup fuel. Phase III would consist of construction of five more 75-MW CT units. These units would also burn natural gas as the primary fuel or low-sulfur No. 2 fuel oil as a backup fuel. The full build-out of the Polk Power Station as proposed by Tampa Electric Company (Phases I, II, and III) would create a power station with a generating capacity of approximately 1,150 MW. According to Tampa Electric Company's proposed plan, Phase I is expected to be placed in service in 1996, with Phase II planned to be fully operational by 2003 and Phase III by 2010. Figure 1.1.3-2 shows the arrangement of the power block and directly associated facilities at full build-out as proposed by Tampa Electric Company.

At this time, the Florida Public Service Commission (FPSC) has only determined a need for the proposed 260-MW facility. Prior to a potential full build-out of the Polk Power Station to a 1,150-MW facility as proposed by Tampa Electric Company, the need for such a build-out would have to be determined by FPSC. The proposed full build-out is documented herein in the event of such an FPSC need determination.

Tampa Electric Company proposes the construction of the 260-MW IGCC Polk Unit 1 under the DOE CCT Round III Cost-Shared Financial Assistance Program. Such financial assistance would allow Tampa Electric

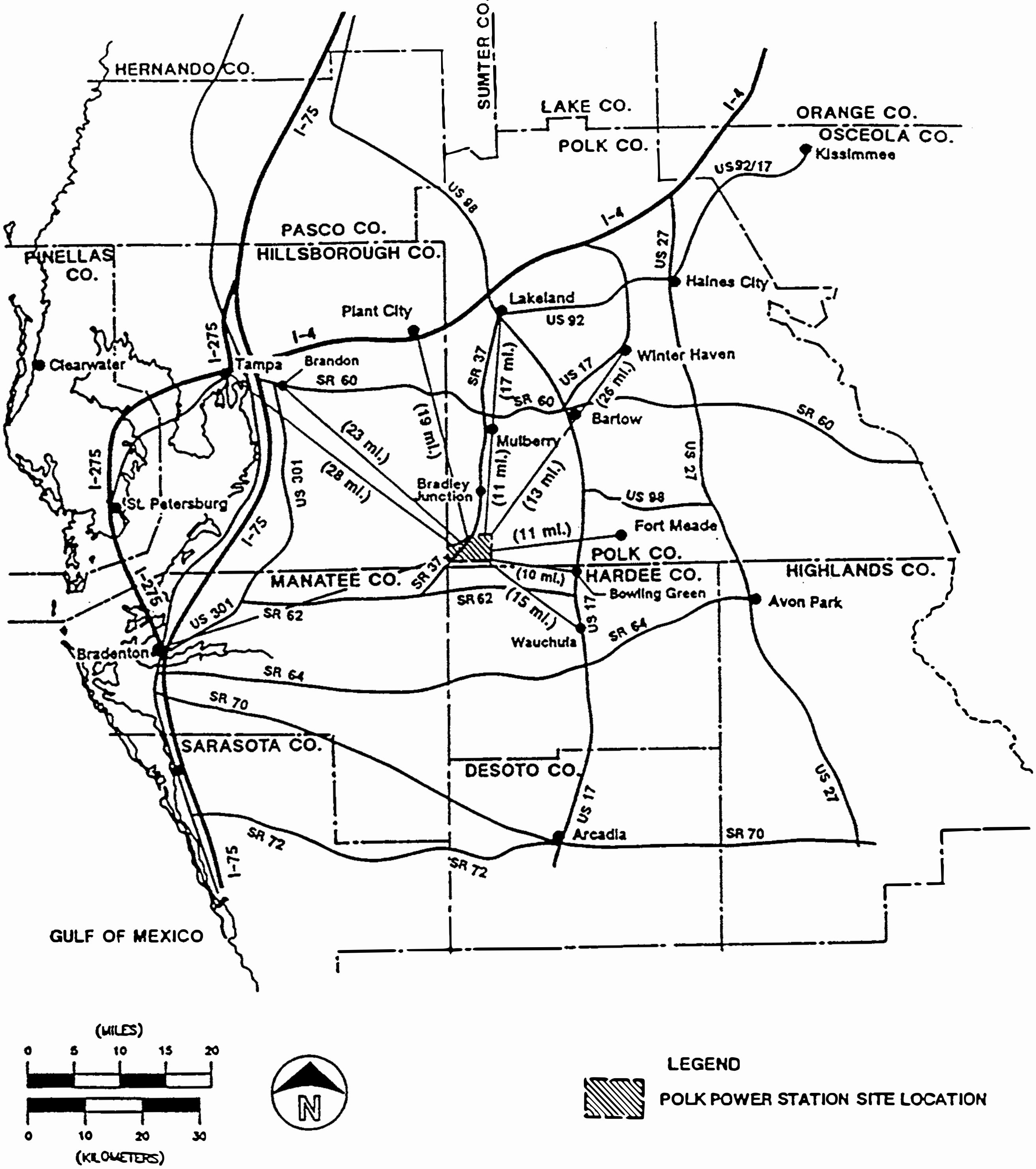

FIGURE 1.1.3-1.
Regional Location of the Polk Power Station Site.

SOURCES: ECT, 1992; TEC, 1992a.

U.S. Environmental Protection Agency, Region IV

Environmental Impact Statement

Polk Power Station
Polk Count , Florida

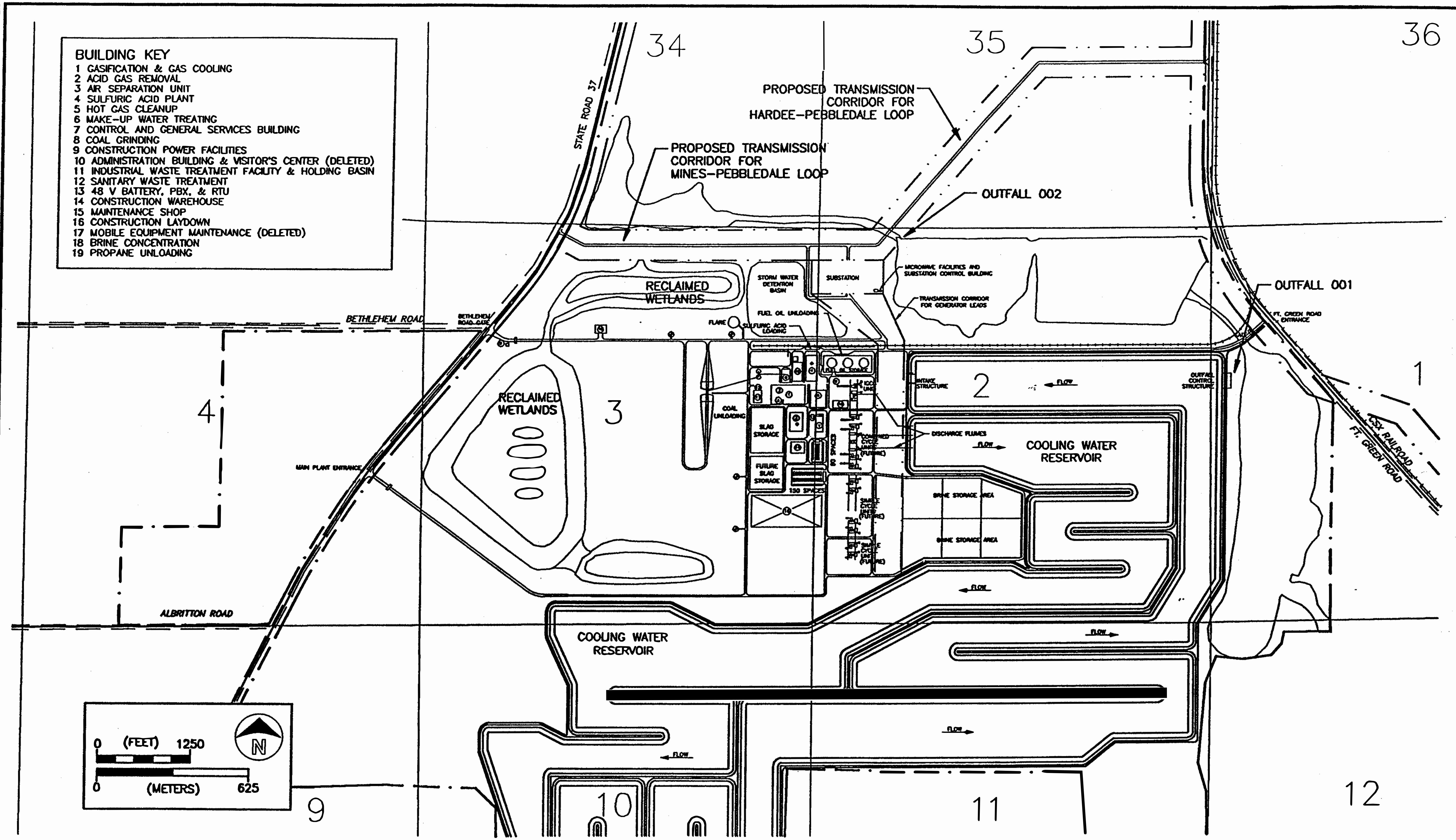

FIGURE 1.1.3-2.
Power Block and Directly Associated Facilities Arrangement.

SOURCES: UEC,1992; ECT, 1992; TEC, 1992a.

U.S. Environmental Protection Agency, Re ion IV

Environmental Impact Statement

Polk Power Station
Polk Count , Florida

Company to demonstrate for DOE "...the integration of CG and CC technologies and a new, potentially more efficient technology (i.e., hot gas cleanup [HGCU]) for removing sulfur from syngas prior to combustion" (TEC, 1992a) in a full-scale production facility.

Tampa Electric Company, as the applicant, is seeking issuance of all permits necessary to construct and operate the proposed Polk Power Station. Permits are requested from the U.S. Environmental Protection Agency (EPA), Florida Department of Environmental Protection (FDEP), and other federal, state, and local agencies, as appropriate. It should be noted that FDEP was formed (effective July 1, 1993) by combining the Florida Department of Environmental Regulation (FDER) with the Florida Department of Natural Resources (FDNR). In this document "FDER" and "FDNR" are still used to cite FDER and FDNR references that were published before the reorganization occurred.

This document relies extensively on the site certification application (SCA) prepared by Tampa Electric Company (TEC, 1992a) and submitted to the State of Florida (July 1992) as part of the State of Florida site certification process pursuant to the Florida Electrical Power Plant Siting Act (PPSA). Portions of the SCA text were directly utilized (excerpted, quoted), indirectly utilized (referenced, edited), and included in this final environmental impact statement (FEIS). This paragraph shall serve as a general citation for such inclusions, since the SCA citation (TEC, 1992a) was not included in every instance. However, excerpted or edited figures taken from the SCA are cited (TEC, 1992a) in each case.

This chapter provides an introduction to the project including: (1) purpose and need for the proposed action; (2) a summary of EPA, DOE, U.S. Army Corps of Engineers (USACOE), FDEP, and other federal, state, and local government responsibilities; (3) a discussion of other requirements relevant to the proposed project; (4) a summary of public scoping and information programs with the resulting issues that are addressed in the EIS; and (5) a summary of verbal comments received by EPA at the public hearing and in writing during the 45-day public comment period for the DEIS and responses to these comments.

1.2 PURPOSE AND NEED FOR PROPOSED PROJECT

1.2.1 Overview

Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, the rationale for project needs developed by Tampa Electric Company (see Sections 1.2.1.1 and 1.2.2), FPSC (see Sections 1.2.1.2 and 1.2.3), and DOE (see Sections 1.2.1.3 and 1.2.4) should be documented. In regard to a need for electric power, EPA acknowledges the FPSC role concerning their approval of existing power needs, considers the long-range forecasting of future power needs of the applicant (Tampa Electric Company), and emphasizes the use of conservation methods to reduce the need for new power resources. EPA defers to DOE regarding the need for the CCT demonstration project (IGCC unit, i.e., Polk Unit 1).

1.2.1.1 Tampa Electric Company Need for Additional Power Supply

Based on Tampa Electric Company's long-range integrated resource planning process, which includes the completion of a Need Determination Study (TEC, 1991), additional resources are needed to meet projected resource demand (approximately 800 MW beginning in 1996 through the year 2001, and approximately 1,300 MW from 2002 through 2010). Thus, over the future 15-year period, the company would need a total of approximately 2,100 MW of additional resources to meet its customer needs. The need for these additional resources is primarily based on the projected continued growth of population and resulting electricity demands in the Tampa Electric Company service area.

Based on this forecasted growth, Tampa Electric Company would not meet its dual system reliability criteria in this future timeframe without the additional resources. These reliability criteria are a minimum 20-percent winter reserve margin and an assisted loss of load probability (LOLP) of less than 0.1 day per year. This latter criterion is accepted by FPSC (FPSC, 1992) in determining the peninsular Florida capacity needs. The former criterion is adopted by Tampa Electric Company to meet intrastate transmission constraints or extreme weather conditions.

1.2.1.2 FPSC Need Determination for IGCC Unit

Tampa Electric Company provided FPSC with all information required to support the petition to determine the need for the proposed IGCC project, Polk Unit 1, as well as information documenting its additional future generating capacity needs planned for the Polk Power Station project. The information included: (1) the results of Tampa Electric Company's long-range integrated resources planning effort; (2) evaluations of available conservation, load management, and power purchase programs to avoid constructing new generating facilities; and (3) evaluations of alternative generation technologies to supply the needed electric power. FPSC issued a need determination order for Polk Unit 1 on March 2, 1992 (see draft environmental impact statement [DEIS], Appendix F).

1.2.1.3 DOE Need for IGCC Unit

Based on current and projected demands on coal-fired power plants, existing available technologies would have difficulty in satisfying power production needs, and rapidly changing environmental, economic, and technical performance requirements. In response, the DOE CCT Demonstration Program, a government- and industry-cofunded technology development effort, demonstrates innovative coal utilization processes in a series of large-scale facilities across the country. The program takes the most promising advanced coal-based technologies and moves them into the commercial marketplace through demonstrations. These demonstrations are on a scale large enough to generate all the data, from design, construction, and operation, necessary for the private sector to judge commercial potential. The projects in the program are demonstrating technologies capable of being applied to the U.S. coal resource base and encompass advanced electric power generation systems, high-performance pollution control devices, and coal processing for clean fuels and industrial applications.

The IGCC unit (Polk Unit 1) proposed for demonstration by Tampa Electric Company, offers tremendous potential as part of the solution to many complex problems in a changing arena dominated by energy, economic, and environmental issues (which collectively include air quality, acid rain, global climate change, power production, energy security, technology awareness, and international competitiveness). The proposed IGCC unit provides DOE the opportunity to demonstrate an oxygen-blown entrained-flow IGCC technology which is expected to achieve significant reductions of sulfur dioxide and nitrogen oxide emissions compared to conventional pulverized coal technologies used in existing and planned future coal-burning power plants.

1.2.2 Tampa Electric Company Forecast of Need for Power

1.2.2.1 Overview of Planning Process

Tampa Electric Company is charged with providing economical, reliable service to its customers. In order to fulfill this charge, Tampa Electric Company performs an annual evaluation of its power generation system and demand-side management systems. Because of the lead time involved in building additional generating capacity, a decision to construct must be made several years before the need manifests itself. This requires a forecast of electrical demand over the next 10 to 20 years.

Tampa Electric Company conducts ongoing integrated resource planning studies to ensure that the future demands of customers for reliable and economical electric power are met. In general, this complex planning process consists of two major components: (1) forecasts of customer demands and energy needs, fuel prices, and economic and financial conditions; and (2) evaluations and optimization of the timing and options to supply the future electricity requirements. These options include demand- and supply-side power resources. The demand-side options include Tampa Electric Company's continuing programs in energy conservation, load management, and cogeneration. The supply-side options include different types of power generating unit additions (TEC, 1993c). The results of these efforts form the basis for Tampa Electric Company's integrated resource plan that Tampa Electric Company believes provides the best mix of demand-side and supply-side alternatives for Tampa Electric Company's customers in terms of reliability and the cost of future electric energy, while meeting applicable environmental regulations and standards. Tampa Electric Company's overall integrated resource planning process is illustrated in Figure 1.2.2-1.

1.2.2.2 Future Energy and Demand Forecasts

Tampa Electric Company's customer demand and energy forecasts are the foundation from which the integrated resource plan is developed. Because of its critical importance, Tampa Electric Company combines state-of-the-art methodologies and proven statistical techniques with practical experience to develop forecasts with the highest probability of occurrence. The complex process results in forecasts of both Tampa Electric Company's peak monthly electricity usage (i.e., demand) and its total monthly electricity usage (i.e., energy). Since many factors can influence future demand and energy forecasts (e.g., weather, economic conditions, population growth, fuel prices), Tampa Electric Company continuously evaluates potential changes in these factors and, in turn, potential changes in its long-range forecasts.

In practice, the Tampa Electric Company demand and energy forecasting process involves five separate models or analyses:

- Detailed end-use model
- Multiregression model
- Trend analysis
- Phosphate method
- Conservation program analysis

The detailed description of the forecasting methodology is presented in Appendix A of the Polk Unit One Need Determination Study (TEC, 1991) and in the Ten-Year Site Plan for Electrical Generating Facilities and Associated Transmission Lines (TEC, 1993c), both of which were authored by Tampa Electric Company.

The first three techniques, detailed end-use model, multiregression model, and trend analysis, are combined to develop a demand and energy projection, excluding the phosphate industry electricity needs. The phosphate demand and energy requirements are forecasted separately and then combined in the final forecast. The effects of Tampa Electric Company's conservation, load management, and cogeneration programs are incorporated into the process by subtracting their expected reduction in demand and energy from the forecast. The final energy and demand forecast is established by combining the results of the five forecasting methods. As stated in its Order Determining the Need for Polk Unit 1 (see DEIS, Appendix F), FPSC concluded, "We believe that the forecasting methodology has produced a reasonably adequate prediction of TECO's future load" (FPSC, 1992).

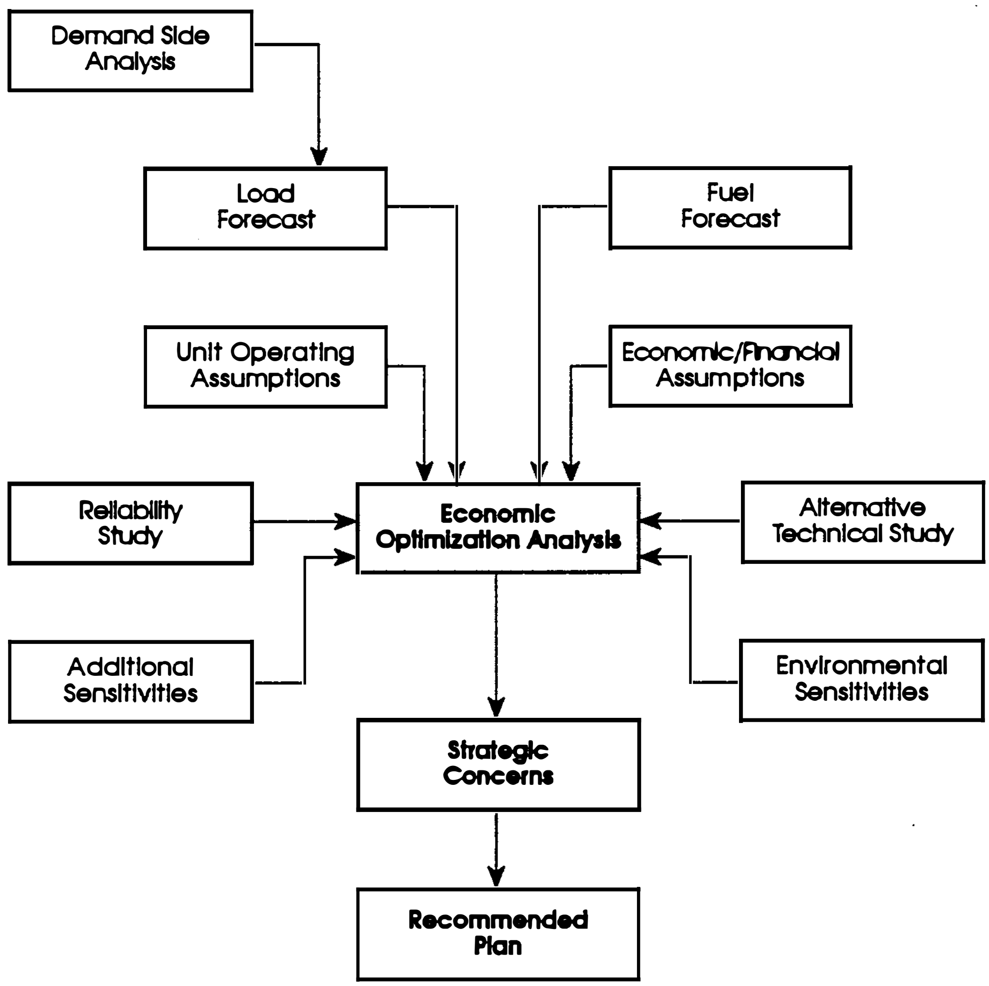

FIGURE 1.2.2-1.
Integrated Resource Planning Process.

SOURCE: TEC, 1992a.

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According to the demand and energy forecasts, Tampa Electric Company's firm summer and winter peak loads are projected to grow at an average annual rate of 2.7 and 2.6 percent, respectively, during the 1991 through 2000 period. The customer demand projection is for an additional 2,100 MW during the 1995 through 2010 period.

1.2.2.3 Demand and Energy Reductions, Including Conservation

Tampa Electric Company has developed conservation, load management, and cogeneration programs to achieve three major objectives: (1) to defer capital expansion, particularly production plants; (2) to reduce marginal fuel costs by reducing energy usage during higher-cost fuel periods; and (3) to give customers some ability to control their energy use and reduce their energy costs. The impact of these programs are included in Tampa Electric Company's demand and energy forecasts (TEC, 1993c).

The combined effects of these programs is expected to reduce Tampa Electric Company's total resource needs during the 1995 through 2000 period by 360 MW. During the period 2002 through 2010, the company projects more than 650 MW of additional resource needs would be met through nonconstruction alternatives, including conservation, load management, and power purchases from cogenerators. These reductions would total 1,010 MW. The 1,090-MW difference between Tampa Electric Company's projected need for power (2,100 MW to the year 2010) and the reduction in power needs (1,010 MW to the year 2010) approximates Tampa Electric Company's proposed capacity for facility build-out for the Polk Power Station (1,150 MW).

Conservation

The Florida Energy Efficiency and Conservation Act (FEECA) was established in 1980 by the Florida Legislature with the objective of reducing the state's dependence on oil and reducing electrical peak demand and consumption. Under authority of the law, FPSC approves conservation programs proposed by the utilities that are deemed cost effective and have reasonable market potential to reduce future demand and energy requirements. The cost for these approved programs is monitored by FPSC and is recoverable through rate adjustments.

During the 1980 through 1989 period, the program goals were in the form of demand and energy benchmarks that the utilities were not to exceed. The objective of these goals was to reduce consumption by requiring that demand and energy growth rates be limited to percentages of customer growth. For the 1980 through 1989 period, energy growth was limited to 75 percent of the actual growth rate for customers. Similarly, demand was limited to 72.25 percent of customer increases. Tampa Electric Company met all of the FEECA goals established by FPSC (TEC, 1991).

When FEECA was re-authorized in 1990, FPSC abandoned the universal numeric goals and proceeded to develop utility-specific goals. In its conservation plan filed with FPSC on February 2, 1990, Tampa Electric

Company filed an evaluation of its conservation programs. The following is a list of the Tampa Electric Company programs which are in place (excerpted from TEC, 1993c):

- Heating and Cooling - a program encouraging the installation of high-efficiency heating and cooling equipment. The program goals are a reduction of winter demand by 475 MW, summer demand by 7 MW, and energy consumption by 147 gigawatt hours (GWH) by 2002.
- Load Management - a residential program to reduce weather-sensitive heating, cooling, water heating, and pool pump loads through a radio signal control mechanism. At year-end 1992, 66,908 customers were participating. By 2002, the program goal is to have a combined estimated demand effect of 310 MW in winter, 131 MW in summer, and 1 GWH in energy savings. In addition, a commercial/industrial program is in effect.
- Energy Audits - presently four audits are available to Tampa Electric Company's customers; two are for the residential class and two are for commercial/industrial customers. The program is a "how to" information and analysis guide for customers. The expected savings from these programs during the next ten years are 25 MW in summer, 52 MW in winter, and 78 GWH in energy.
- Ceiling Insulation - an incentive program for existing residential structures that will help to supplement the cost of adding additional insulation. During the next ten years this program will be the catalyst for a 8-MW reduction in winter, a 6-MW reduction in summer, and a 10-GWH reduction in energy.
- Commercial Indoor Lighting - an incentive program to encourage investment in more efficient lighting technologies in existing commercial facilities. By 2002, this program is expected to save 4 MW in winter, 11 MW in summer, and 39 GWH in energy.
- Standby Generator - a program designed to utilize the emergency generation capacity of commercial/industrial facilities to reduce weather-sensitive peak demand. By 2002, this program is expected to save 9 MW of winter demand, 9 MW of summer demand, and 1 GWH of energy.
- Conservation Peak Value - a program for commercial/industrial customers that encourages additional investments in substantial demand shifting or demand reduction measures. Reductions of 5 MW in summer, 1 MW in winter, and 8 GWH of energy savings for 1992-2002.
- Duct Repair - an incentive program for existing residential structures that encourages the repair of the air distribution system. By 2002, the program goal is to have reductions in demand of 4 MW in the summer and 16 MW in the winter, and 18 GWH of energy savings.

- Cogeneration - a program whereby large industrial customers with waste heat or fuel resources may install electric generating equipment, produce their own electrical requirements, and/or sell their surplus to the company. During the next ten years cogeneration additions are expected to total 166 MW, generating 645 GWH. By 2002 it is expected that cogeneration will total 414 MW in the winter, 413 MW in the summer, and 2,831 GWH of energy annually.
- Street and Outdoor Lighting Program - completed in 1990, this program is anticipated to continue to provide energy reductions. The program, which provided for the replacement of mercury vapor lighting with the more efficient high-pressure sodium lighting, is expected to provide energy reductions of 32 GWH by 2002.

On April 23, 1993, FPSC issued an order wherein new and amended rules were adopted to implement FEECA. The rules provide for the periodic submission to FPSC of conservation programs and proposed conservation goals by the utilities. FPSC will establish numeric goals for each utility based on an estimate of the total cost-effective demand and energy savings reasonably achievable through demand-side management in each utility's service area over a 10-year period. On June 28, 1993, FPSC set the dates in June 1994 for formal evidentiary hearings to establish the numerical demand-side management goals for investor-owned utilities.

In developing technical market potential results, each utility was instructed to refer to the report entitled "Electricity Conservation and Energy Efficiency in Florida: Technical, Economic and Achievable Results, Final Reports" (Florida Energy Office, 1993), and specifically to the 110 potential demand-side measures listed in the report. Each utility was also encouraged to evaluate original conservation measures which may not be included in the report.

Load Management

Load-management programs include a residential program ("Prime Time") designed to alter the system loadcurve by reducing summer and winter demand peaks, and a commercial/industrial program intended to complement the residential program and help reduce summer and winter peak demands. Interruptible service has reduced the 1990/91 winter peak by 244 MW and the 1991 summer peak by 266 MW. Interruptible service loads are served, without compromising firm load system reliability, from Tampa Electric Company's generating system.reserve and external power purchases.

Cogeneration

Tampa Electric Company planned for 373 MW of cogeneration on its system in 1993. This amount is expected to increase to a total of 414 MW by 2002, of which 337 MW is projected to be used by the cogenerators to serve their own internal load requirements, 50 MW are projected to be purchased by Tampa

Electric Company from the cogenerators on a firm basis, and 27 MW are projected to be purchased on a nonfirm basis. The cogeneration purchased on a firm basis would be provided primarily by resource recovery and phosphate facilities (TEC, 1993c).

1.2.2.4 Forecast of Power Resource Requirements

Based on the forecasted energy requirements, the second major component of the integrated resource planning process involves evaluations of future demand- and supply-side options to meet future customer power needs. The objective is to determine the long-range mix of power resource options that represent Tampa Electric Company's best plan to provide economical and reliable electric service to Tampa Electric Company's customers. As shown in Figure 1.2.2-1, the resource planning process incorporates a reliability analysis to determine the timing of future need, alternative technology screening to select options to meet future needs, and a supply-side analysis and optimization evaluation to determine which alternatives are perceived to meet future needs best. Finally, a sensitivity/strategic concerns analysis is conducted to ensure that the perceived best plan is chosen under possible changes in the planning assumptions.

Regarding system reliability, the Polk Unit 1 Need Determination Study of September 1991 (TEC, 1991) stated the following (excerpted):

> Reliability analysis is used by Tampa Electric Company to determine the adequacy of the existing and future generating resources required to reliably satisfy the current and projected demand and energy requirements, after demand side management, of the Tampa Electric Company system. The primary measures of generating system reliability are assisted LOLP and percent reserve margin. The assisted LOLP incorporates both the isolated system reliability and the availability of other resources accessed via Florida's transmission grid and Tampa Electric Company transmission interconnects.
>
> Tampa Electric Company established reliability criteria from an analysis of historical performance data, a review of acceptable industry standards for comparable regions and applying engineering judgement regarding operating conditions specific to their system. The current reliability criteria for the Tampa Electric Company system are an assisted LOLP of 0.1 loss-of-load days per year and a minimum reserve margin at the time of winter peak demand of 20 percent.

Specifically, in its order determining the need for Polk Unit 1 (see DEIS, Appendix F), FPSC stated: "We find these criteria to be reasonably adequate for planning purposes. The 0.1 days per year LOLP criteria is consistent with the LOLP criteria used by the Florida Electric Power Coordinating Group (FCG), and the winter reserve margin is a reasonable one for a utility of Tampa Electric's size. The planning criteria are applied to TECO's load forecast to determine whether TECO will need additional capacity in 1995 and beyond" (FPSC, 1992).

These planning criteria were applied to Tampa Electric Company's load forecast and existing power resources, including long-term purchase power, beginning in 1993 to determine whether the company needed additional capacity in 1995 and beyond. To meet the established reliability criteria, the Tampa Electric Company analysis showed a need for a series of generating capacity additions.

As shown on Table 1.2.2-1, Tampa Electric Company's winter reserve margin is predicted to fall below 20 percent and its LOLP is projected to rise above the 0.1 day per year in 1995 if additional capacity is not placed into service. FPSC concurred with the results of Tampa Electric Company's analysis that the acceptable reliability criteria would be violated with a delay in the in-service date of the proposed Polk Unit 1: "It is clear from the record that if the additional capacity is not placed into service by 1996, TECO's winter reserve margin is expected to fall below 20 percent and its LOLP is projected to rise above the 0.1 days per year maintained for system reliability" (FPSC, 1992).

1.2.2.5 Analysis of Alternative Generation Technologies

An integral step in Tampa Electric Company's integrated resource planning process is the identification and consideration of alternative generation technologies that could be used to meet future customer demands. The objective of the alternative generation technology study is to identify the most reliable, feasible, environmentally-acceptable, and cost-effective generating facilities for consideration in a comprehensive resource plan (TEC, 1992a).

The alternative technology study conducted by Tampa Electric Company in 1991 involved a systematic review and assessment of a wide variety of conventional and nonconventional energy generation technologies. Initially, 46 technologies were identified for evaluation. These alternative technologies were screened in a two-step process: preliminary and economic. In step one, a preliminary screening analysis was conducted to eliminate those technologies that could not be used because regional geography and/or weather are not suitable, costs were higher when compared to similar type technology alternatives, proven demonstration of the technology has not been performed, public opposition to technology exists, and/or questions exist regarding safety. In step two of the screening analysis, the economics of the technologies that were selected in the preliminary screening were compared using economic screening curves that reflect levelized annual/lifecycle costs of the technologies at different capacity factors. Based on this screening analysis, a final group of technologies was selected for the detailed economic optimization analysis. These screening analyses of the alternative technologies are described in Section 2.4.2 in this EIS.

Table 1.2.2-1. Tampa Electric Company System Reliability Excluding New Unit Additions

Year	Net LOLP (days per year)	Winter Reserve Margin (percent)
1993	0.045	25.2
1994	0.067	22.2
1995	0.140	19.1
1996	0.199	16.2
1997	0.259	13.4
1998	0.361	10.8
1999	0.526	8.3
2000	0.770	5.9

Note: Figures include capacity from the Tampa Electric Company Power Services Purchase Agreement in 1993.

Sources: TEC, 1991; TEC, 1992a.

Based on these analyses, the technologies selected for the economic optimization analysis included the following:

Baseload Technologies

- Conventional pulverized coal (PC) with flue gas desulfurization (FGD)
- IGCC

Intermediate Load Technologies

- IGCC
- CC
- Phosphoric acid fuel cell
- Photovoltaic solar cell
- Solar thermal

Peaking Technologies

- CT

The baseload conventional coal and IGCC technologies were maintained because of their relatively lower levelized costs compared to other baseload technologies and because of the favorable environmental performance of IGCC units compared to conventional coal units. The CC technology had the best economics of all of the intermediate technologies, but the fuel cells and solar technologies were advanced into the economic analysis because of their exceptional environmental performance (low noise, low or no emissions, and possibility of siting in or close to load centers).

1.2.2.6 Economic Optimization Analysis

The goal of the economic optimization analysis was to identify Tampa Electric Company's perceived best supply-side plan for serving the forecasted energy requirements. The development of the supply-side plan involved the use of dynamic programming to optimize the mix of generating capacity on the system. The objective function of the optimization analysis was to minimize present worth revenue requirements for the Tampa Electric Company system. The supply-side scenario for meeting future capacity requirements includes repowering existing units, delaying retirements, constructing new unit additions, making firm power purchases from other generating entities, establishing joint ownership of generating capacity, and making modifications of the transmission systems to increase import capability (TEC, 1991).

The capital expenditures associated with each capacity addition were determined based on the types of generating unit, fuel type, and in-service year. The fixed charges resulting from the capital expenditures were expressed in 1992 dollars for comparison purposes.

The fuel and the operation and maintenance costs associated with each scenario were projected based on estimated unit dispatch. The projections, also expressed in 1992 dollars, were combined with the fixed charges to obtain the total present worth of revenue requirements for each alternative resource plan.

The generation expansion plan that was initially identified by this analysis as having the lowest revenue requirements was then compared to other generation plans that may be strategically superior for Tampa Electric Company and its customers. These various generation expansion plans were again compared to one another on an economic basis, including an analysis of the sensitivity of the revenue requirement projections to changes in base-case assumptions regarding fuel availability and costs.

1.2.2.7 Strategic Considerations

The final step in the integrated resource planning process was a strategic issues/risk analysis that was conducted to compare the overall performance of each individual generation expansion plan alternative under additional factors that were not easily quantified. These strategic issues could affect the type, capacity, and/or timing of Tampa Electric Company's future generation resource requirements. These issues, such as high and low fuel prices, natural gas availability, environmental legislation, and potential joint ownership projects, were evaluated in the process of determining the optimal expansion plan. In this way, an economically-sound generation expansion plan was selected that has the flexibility to respond to future technologies and economic changes.

1.2.2.8 Selection of Optimum Power Resource Plan

Tampa Electric Company's integrated resource planning efforts resulted in the selection of their best perceived series of generating capacity additions to meet its customer needs during the 1995 through 2001 period. These efforts indicated a need for approximately 480 MW of new generating capacity for this period. The increased generating capacity need is a result of projected increases in customer electricity demands due to population growth in Tampa Electric Company's service areas (TEC, 1992a) as forecasted by Tampa Electric Company's Economic Planning and Forecasting Department. Tampa Electric Company also analyzed its new generating capacity needs beyond the typical 10-year planning timeframe. Tampa Electric Company's site selection program, which resulted in the selection of the proposed Polk Power Station site, also considered its generating capacity needs to the year 2010. Tampa Electric Company recognized that its long-range resource plans may change based on such factors as changes in planning assumptions, the availability of power supplies from other sources, the relative success of demand-side management programs and advances in electric generation technologies.

In addition to the 480 MW of generating capacity in the 1995 to 2001 timeframe, Tampa Electric Company's long-range integrated resource plan demonstrates the need for approximately 670 MW in new generating capacity in the 2002 through 2010 period. These generating capacity additions are also needed to meet projected increases in customer electricity demands primarily due to forecasted population growth in west-central Florida. Thus, due to forecasted population growth and despite Tampa Electric Company's previously discussed (Section 1.2.2.3) existing conservation efforts, load management, and cogeneration programs to reduce energy demands, Tampa Electric Company currently has determined the need for a total of approximately 1,150 MW in new generating capacity from 1996 to 2010 (TEC, 1992a). Based on these long-range planning studies, the phased schedule for operation of all needed electric generating units at the Polk Power Station site is presented in Table 1.2.2-2.

1.2.3 Need Determination by FPSC

The proposed electrical power generating facilities are subject to the Florida PPSA, Sections 403.501 to 403.519 Florida Statutes (F.S.). Under PPSA, FPSC has the sole responsibility for determining and approving the need for construction of new power plants in Florida. Per Section 403.19 of the PPSA, there are five major topics FPSC must consider in making a determination of need (excerpted):

- The need for electric system reliability and integrity
- The need for adequate electricity at a reasonable cost
- Whether the proposed plant is the most cost-effective alternative available
- Conservation measures, taken by or reasonably available to the applicant, that might mitigate the need for the proposed plant
- Other matters within the Commission's jurisdiction that it deems relevant

FPSC must evaluate these specific items in relation not only to the system needs of the applicant proposing the new power plant, but also to the power supply and customer needs of peninsular Florida. The FPSC evaluation must consider compliance of the proposed project with the mandates of the FEECA. FEECA requires increasing the efficiency of the electric systems in Florida, increasing the conservation of expensive resources such as petroleum fuels, reducing the growth rate of weather-sensitive peak demand, and reducing and controlling the growth rate of kilowatt hour consumption to the extent that it is cost effective. Finally, in accordance with state regulations, FPSC is required to determine the need for a proposed electrical power plant and to file its order making that determination with FDEP prior to final certification of a proposed power plant under PPSA.

On September 5, 1991, Tampa Electric Company filed a "Petition to Determine Need for Electrical Power Plant and Related Facilities" with FPSC, pursuant to Section 403.519, F.S., and designated Docket No. 910883-EI. A copy of this petition is provided in the DEIS as Appendix E. In conjunction with this filing, Tampa Electric Company submitted to FPSC a document entitled "Polk Unit One Need Determination Study" (TEC, 1991) to support the petition and provide the information required under the FPSC rule

Table 1.2.2-2. Tampa Electric Company's Proposed Phased Schedule for Ultimate Electric Generating Capacity at the Polk Power Station Site (Tampa Electric Company's Proposed Project [Preferred Alternative With DOE Financial Assistance])

Year In Service	Nominal Generating Capacity Addition	Ultimate Unit Configuration
1996	260 MW IGCC* (Polk Unit 1)	
1997	--	
1998	--	
1999	75 MW CT	220 MW CC (1999–2001)
2000	75 MW CT	
2001	70 MW HRSG/ST	
2002	75 MW CT	
2003	220 MW CC	
2004	--	
2005	--	
2006	75 MW CT	
2007	75 MW CT	
2008	75 MW CT	
2009	75 MW CT	
2010	75 MW CT	

* 220 MW when operated in CC mode and fired on fuel oil. 260 MW when operated in IGCC mode with gasifier and air separation unit.

Source: Modified from TEC, ad.

Chapter 25-22.081, Florida Administrative Code (FAC). Copies of this document are available for inspection at FPSC, Division of Records and Reporting, 101 East Gaines Street, Tallahassee, Florida.

In the petition to determine need, Tampa Electric Company provided FPSC with information from its integrated resource plan that demonstrated the need for an additional 440 MW of new generating capacity during the period of 1995 through 2000. The information provided by Tampa Electric Company also showed that the company's total resource needs to meet customer demands for the 5-year period were almost 800 MW and that more than 40 percent of these needs would be met through the company's extensive programs to promote conservation and load management and by power purchases from cogenerators. According to Tampa Electric Company's integrated resource plan, the remaining resource needs would be most cost-effectively and reliably met by the construction of the proposed IGCC unit with a commercial operation date of July 1996, and a phased 220-MW CC unit with an in-service date of 2001. Authority to construct Polk Unit 2 was not sought in the petition by Tampa Electric Company because such action was thought to be premature. The proposed Polk Unit 1 was originally to be a 220-MW IGCC with an estimated heat rate of 9,060 British thermal units (Btu)/kilowatt-hour (kWh). Results from a Tampa Electric Company engineering study, completed after the need petition was filed on September 5, 1991, showed that the projected capacity of the unit would actually be 260 MW and the heat rate would decrease to 8,486 Btu/kWh, the result largely of Tampa Electric Company's decision to use a more efficient CT.

A public hearing on Tampa Electric Company's petition to determine the need for an electrical plant was held by FPSC on December 10 and 11, 1991, in Tallahassee, Florida. Prior notice of the hearing was published in the *Florida Administrative Weekly* and local newspapers according to the requirements of Section 403.519, F.S.

Post-hearing briefs were filed by Tampa Electric Company and Floridians for Responsible Utility Growth (FRG) on January 3, 1992. The Tampa Electric Company post-hearing brief is available for inspection at the FPSC office in Tallahassee, Florida. FRG filed proposed findings of fact with its brief, and the ruling by FPSC on each proposed finding is included in the order determining need contained in the DEIS as Appendix F. Tampa Electric Company's Petition for Determination of Need for a Proposed Electrical Power Plant and Related Facilities in Polk County was granted on March 2, 1992, with the conditions set out in the body of the order. FPSC approved the plant's construction on the condition that Tampa Electric Company does receive the $120 million of DOE cost-shared financial assistance (amended to approximately $130 million because of additional costs of design changes and improvements) to help defray the costs of the project.

In its order dated March 2, 1992, FPSC concluded the following major facts (excerpted from FPSC, 1992; see DEIS, Appendix F):

The Need for Electric System Reliability and Integrity

TECO used a combination of criteria to determine its need for 220 MW of additional capacity in the 1995 through 1997 timeframe, including minimum 20 percent winter reserve margin and assisted Loss of Load Probability (LOLP) of 0.1 days per year. We find these criteria to be reasonably adequate for planning purposes...We believe that the forecasting methodology has produced a reasonably adequate prediction of TECO's future load...TECO's reliability criteria will not be met unless the proposed IGCC unit is completed in the timeframe requested. TECO would also risk losing the DOE funding it will receive for design, construction, and operation of the unit. Thus any delays in the construction of the plant could ultimately cost TECO its most cost effective alternative to meeting future capacity needs...Thus the addition of capacity from the proposed IGCC unit is needed for TECO to maintain acceptable reliability criteria...TECO's proposed 220 MW IGCC unit is also needed to contribute to the reliability and integrity of the electric system of the State as a whole.

The Need for Adequate Electricity at a Reasonable Cost

With certain reservations we find that TECO's fuel price forecast is reasonably adequate for planning purposes...It appears that different fuel price forecasts have little impact on the proposed IGCC project's cost effectiveness...TECO provided sufficient assurance in this case that primary and secondary fuel will be available for the proposed plant on a long and short term basis at a reasonable cost. Fuel purchases will be made at market prices...The record in this case demonstrates that TECO adequately took into account the costs of environmental compliance associated with the Clean Air Act when it evaluated its future generation needs. TECO plans to comply with the Clean Air Act by one or more of the following: fuel switching; installing scrubbers; alternative technologies; and, purchasing allowances. Phase I compliance with the Clean Air Act will not be affected by the proposed IGCC plant, but the plant will be an asset to TECO in Phase II compliance. The company estimates savings in the range of $50 to $100 million over the life of the proposed IGCC unit, compared to fuel switching or other Clean Air Act compliance strategies...We believe that TECO's proposed project is commercially viable.

Most Cost Effective Alternative

TECO has demonstrated that the proposed IGCC unit is the most cost-effective alternative to provide the additional needed capacity for TECO and peninsular Florida. Using TECO's most recent financial estimates, the proposed IGCC unit is estimated to save TECO's ratepayers $195 million over the life of the Unit compared to TECO's next best option. These savings are primarily attributable to fuel savings (resulting from the use of coal), and the $120 million DOE contributions [Note: $120 million of DOE cost-shared financial assistance was amended to approximately $130 million because of additional costs of design changes and improvements]....In other words the IGCC unit had the lowest present worth revenue requirements (PWRR) of the other generating alternative available.

Conservation

TECO projects that its 1996 winter peak demand will be reduced by 205 MW as a result of load management, and 277 MW as a result of its conservation programs. This 482 MW total represents 13% of TECO's projected 1996 winter peak demand (3103 MW). TECO currently spends 95 percent of its demand-side management dollars on programs targeted at residential customers. Between 1981 and 1990, 94 percent of the demand reductions TECO achieved through conservation were achieved through its residential programs, and it appears that TECO's residential conservation programs are doing a reasonable job of saturating the eligible market. The participation rates for some of TECO's commercial and industrial programs, however, appear to be low...We do believe TECO has adequately considered the conservation measures that would be reasonably available to avoid the need for this proposed plan...It does not appear that additional timely and cost effective conservation measures can reliably defer the need for capacity in 1995...However, we also believe that TECO needs to demonstrate to us why it cannot be more aggressive in pursuing conservation, particularly for its commercial and industrial customers. We will therefore require TECO to resubmit its conservation plan no later than one year prior to filing its next need determination petition.

Purchased Power Alternatives

The record demonstrates that TECO adequately explored and evaluated the availability of purchased power from other electric utilities. TECO currently plans to purchase firm capacity from TECO Power Services (TPS) in 1993...TECO also evaluated the possibility of importing capacity from the Southern Company via the 500 kilovolt (kV) transmission line...50 percent participation in an 300 MW coal unit with a 1998 in-service date, and the possibility of purchasing 100 MW of firm capacity in both 1998 and 1999. These evaluations indicated that the proposed IGCC plan was still the most cost-effective alternative.

Conclusion

Based on our resolution of the factual and legal issues presented in this case, for the reasons explained above [in the Order], and with the conditions explained above [in the Order], we grant TECO's petition for determination of need for a 220 MW IGCC unit, with 150 MW on-line in 1995 and 70 MW on-line in 1996. We believe that TECO's petition satisfies the statutory requirements of section 403.519, Florida Statues...It appears that further timely and cost effective conservation methods cannot reliably defer the need for the IGCC unit.

Therefore, it may be noted that the FPSC, in their Order of March 2, 1992, approved the need for the 220-MW capacity (Note: not 260 MW as stated in the DEIS) proposed in Tampa Electric Company's "Petition of Determination of Need for Electrical Power Plant" filed September 5, 1991, for Polk Unit 1. However, EPA understands from Tampa Electric Company that results from a Tampa Electric Company engineering study completed before the FPSC's March 2, 1992, order showed that the actual expected capacity from the IGCC unit would be 260 MW. Based on EPA coordination with FPSC (1994), the FPSC is aware of Tampa Electric Company's proposed 260-MW capacity for Polk Unit 1 and that the Tampa Electric Company is including it in its future plans. Although the FPSC has at this time only approved a 220-MW capacity for Polk Unit 1, Polk Unit 1 is nevertheless referred to in this EIS as a "260-MW" facility since it is proposed to have such a design capacity. Furthermore, Tampa Electric Company projects that future demands will exceed the approved 220-MW capacity or the expected 260-MW capacity of Polk Unit 1. Also, the environmental impacts of 260-MW generation are expected to be nominally the same as for 220-MW generation.

It should be emphasized that the FPSC did not approve the entire 1,150-MW capacity for facility build-out proposed by Tampa Electric Company. Because FPSC approval was only for 220 MW, Tampa Electric Company would need to make an additional need determination application to FPSC for the proposed future capacity beyond the approved 220-MW and up to the proposed 1,150-MW build-out capacity.

1.2.4 DOE Need for Demonstration Project

1.2.4.1 DOE CCT Program

In December 1985, Congress made funds available to DOE to conduct the cost-shared CCT Demonstration Program. The CCT Demonstration Program is designed to address a wide range of issues including acid rain, global climate change, improved energy efficiency, energy security, and environmental quality. Under this program, advanced coal technologies are of an adequate scale to generate data needed to judge commercial potential and are incorporating new power generation technology and pollution control concepts. Congress has appropriated a total budget of nearly $2.75 billion for the CCT Demonstration Program. These funds are being committed to demonstration projects through five competitive solicitations. The first four of these solicitations have resulted in a combined commitment by the federal government and the private sector of about $4.7 billion. DOE's cost share for these projects would be some $1.8 billion, or approximately 38 percent of the total. Upon final DOE approval, the project sponsors (such as Tampa Electric Company) would provide the remainder of more than $2.9 billion, or approximately 62 percent of the total estimated cost. The response to DOE's fifth solicitation would bring the combined commitment by the federal government and the private sector to approximately $6.9 billion, thereby increasing the average industry cost share to about 66 percent, which far exceeds the 50 percent non-DOE share mandated by Congress.

Under terms of Public Law No. 100-446, Congress provided approximately $575 million to DOE to support the construction and operation of demonstration facilities selected for cost-shared financial assistance as part of the third round of DOE's CCT Demonstration Program. The CCT projects cover a broad spectrum of technologies having the following in common:

- All are intended to increase the use of coal in an environmentally-acceptable manner
- All are ready to be proven at the demonstration scale

According to the 1992 DOE CCT Demonstration Program Update (DOE, 1992a), among the various methods used for cleaning coal, converting coal to gas before burning, is "among the cleanest and most efficient of the emerging clean coal technologies." In coal gasification, sulfur compounds, as well as particulates, are removed before the fuel is burned in the CT. The process of cleaning the coal gas produces H_2SO_4 and a chemically-inert slag. The H_2SO_4 can be sold as a chemical commodity, while the slag has several uses, (e.g., it can be used as a material in road paving). The IGCC technology has a high removal rate, not just on regulated pollutants but also on nonregulated pollutants.

The IGCC process could also prove more economical because it burns coal more efficiently and harnesses more of the energy released by the burning of coal. An IGCC plant can produce up to 25 percent more electricity from burning the same amount of coal than a conventional plant. According to DOE's calculations, the efficiency of a conventional coal-fired plant with added IGCC technology can increase from 35 percent to 40 percent, and the overall plant output from 50 percent to 150 percent. Also, less carbon dioxide is released in the atmosphere when generating the same amount of electric power (DOE, 1992a).

In its NOI published in the *Federal Register* (FR) at 57 FR 33331 on July 28, 1992, (see Appendix E), DOE presented the following background information on the CCT Demonstration Program (excerpted from DOE NOI [DOE, 1992b]):

> On May 1, 1989, DOE issued Program Opportunity Notice (PON) Number DE-PSO, for round III of the CCT program, soliciting proposals to conduct cost-shared projects to demonstrate innovative, energy efficient, economically competitive technologies. These technologies must be capable of: (1) achieving significant reduction in the emissions of sulfur dioxide and/or the oxides of nitrogen dioxide from existing facilities to minimize environmental impacts such as transboundary and interstate pollution and/or (2) providing for future energy needs in an environmentally acceptable manner. The demonstration projects may be at new facilities provided the technology is capable of retrofitting or repowering applications. In response to the solicitation, 48 proposals were received.
>
> From these 48 proposals, thirteen projects were selected by DOE for negotiation in December 1989, including a project proposed by CRSS Capital, Inc. and TECO [Tampa Electric Company] Power Services Corp. known as the Air-Blown IGCC Demonstration Project. After selection, CRSS Capital and TECO formed a partnership entity called Clean Power Cogeneration, Inc. (CPC). At that time, the proposed project site was the City of Tallahassee Florida's Arvah B. Hopkins power station. DOE published a *Federal Register* NOI for the CPC project on March 7, 1991. However, uncertainties regarding the project resulted in the publication of the notice of postponement of the scoping meeting.

In September 1991, the site of the proposed project was relocated to Polk County, Florida. Additionally, the CPC Limited Partnership was restructured. CRSS Capital has ceased its participation in the project and TECO has assumed all of CRSS Capital's previous obligations.

TECO has requested financial assistance from DOE for the design, construction, and demonstration of an approximately 1900-tons-per-day (nominal 260 MW) IGCC plant. The proposed IGCC project would be fueled with medium- to high-sulfur content eastern bituminous coal to produce electric power for the utility grid. Cost, environmental, and technical data from the project would be developed for use by the utility industry in evaluating this technology as a commercially viable power generation alternative. After the anticipated 24-month federally assisted demonstration period of operation, TECO intends to continue operating the plant commercially to meet customer needs for power.

The estimated cost-shared portion of the proposed demonstration project is approximately $242 million of which DOE's share would be 50 percent. The project would last approximately 84 months including design, construction, and demonstration. Construction would begin in [was originally proposed by Tampa Electric Company for] January 1994; however, no DOE funds would be provided for construction until the NEPA process has been completed.

DOE's "NEPA Policy of Reasonable Alternatives for the Clean Coal Technology Demonstration Program" is provided for reference in Appendix E.

1.2.4.2 DOE Need for the Proposed IGCC Unit

The electricity-producing industry largely depends on coal as its primary fuel. In 1989, 86 percent of the coal used in the United States was consumed for the generation of electricity, and by 2010, the coal use in the electricity production industry is predicted to increase at least 50 percent and to double by 2030, even with optimistic estimates of contributions from conservation, renewable resources, and nuclear energy. However, the existing available technologies for coal-fired power plants would have difficulty in satisfying the rapidly changing environmental, economic, and technical performance requirements being imposed on power plants (DOE, 1992a).

The coal-fired power plant of the future must be capable of meeting stringent siting and environmental demands while producing power efficiently and with a high level of reliability. Further, the ability to rapidly add generation capacity in modules that closely match load growth will be an important factor in keeping electricity costs reasonable. Hence, over the next 10 years, it will be critical to bring new technology options into the marketplace to satisfy not only the requirements of the traditional utility industry but also the requirements of independent power producers and cogenerators that are producing an increasing share of power in the United States. Based on such considerations and pending successful completion of the NEPA process for this EIS, DOE is considering cost-shared financial assistance for Polk Unit 1 under the CCT Demonstration Program through a cooperative agreement with Tampa Electric Company.

If DOE provides cost-shared financial assistance to Tampa Electric Company, demonstration of an oxygen-blown, entrained-flow IGCC technology is proposed for the Polk Power Station. Tampa Electric Company would demonstrate the IGCC technology for a two-year period. Tampa Electric Company would also demonstrate the HGCU system for a two-year period. In a conventional IGCC system, the syngas is cooled prior to sulfur removal and then reheated prior to firing in the CT. These cooling and reheating processes result in a less efficient power generation system. Part of the reason Tampa Electric Company is being considered under this CCT Demonstration Program is due to the demonstration of an HGCU system. By using a bed of metal oxide particles, the syngas can be cleaned without first cooling it down, resulting in a more efficient system. The demonstration period would involve significant testing and optimization to determine the cost and performance of the HGCU system, as well as the overall integration of the CG and CC technologies. Successful operation would enable future IGCC systems to operate more efficiently, providing more opportunities to meet the goals of the CCT Demonstration Program. Such a demonstration is expected to show that the unit can achieve significant reductions of sulfur dioxide and nitrogen oxides emissions when compared to existing and future coal-fired power plants using available, conventional PC technologies.

The integrated performance to be demonstrated would include all major subsystems in the IGCC system, including coal feeding; a pressurized, oxygen-blown entrained-flow gasifier capable of using caking coal; an air separation unit to provide oxygen to the gasifier and nitrogen to the CT for nitrogen oxide control and power augmentation; a commercially proven cold gas cleanup (CGCU) system capable of treating 100 percent of the syngas flow and a parallel demonstration HGCU system capable of treating a nominal 10 to 15 percent of the syngas flow, both capable of removing sulfur compounds, particulates, and other contaminants as necessary to meet environmental and CT fuel requirements; an advanced CT appropriately modified to use low-Btu syngas as fuel; the HRSG system; the ST system; all control systems; and associated facilities.

1.3 AGENCY RESPONSIBILITIES

The proposed project would be subject to NEPA requirements. The proposed EPA National Pollutant Discharge Elimination System (NPDES) permitting action and DOE CCT action for the proposed project would each constitute a major federal action significantly affecting the quality of the human environment and therefore require NEPA review and documentation in the form of an EIS. As such, both EPA and DOE have "EIS Action Alternatives" for this EIS. In addition, the proposed USACOE permitting action for the proposed project would also require an appropriate form of NEPA review and documentation. Although USACOE action would be related to the EIS, it would not be considered to have "EIS Action Alternatives" associated with it. EPA and other agencies would also have additional EIS-related actions associated with the proposed project that would not be considered "EIS Action Alternatives" (see Sections 1.3.5 and 1.3.6).

Through a memorandum of understanding (MOU) among EPA, DOE, and USACOE signed in March 1993, and through an EPA EIS NOI published in the *Federal Register* at 58 FR 29577 on May 21, 1993 (see Appendix B), it was formally established that EPA is the federal Lead Agency for this EIS, and that DOE and USACOE are Cooperating Agencies to EPA. DOE and USACOE have therefore assisted in the technical development of this document. It had been previously established in a DOE EIS NOI published in the *Federal Register* at 57 FR 33331 on July 28, 1992 (see Appendix E), that DOE, because of its CCT Demonstration Program interests in this proposed project, was the federal Lead Agency and that EPA was a Cooperating Agency to DOE for this EIS. However, EPA assumed the role of federal Lead Agency from DOE and announced this transfer in the EPA EIS NOI of May 21, 1993. Letters from DOE to EPA dated February 3, 1993, and March 10, 1993, and from EPA to DOE dated March 17, 1993, were exchanged regarding the federal Lead Agency role transfer from DOE to EPA. Copies of these letters and EPA's EIS NOI are provided in Appendix B. Reasons for changing the federal Lead Agency include increasing the scope of the EIS for DOE (i.e., from a 260-MW power station to a 1,150-MW power station at full build-out) and EPA's NPDES NEPA responsibilities for new sources in Florida.

In addition to EPA, DOE, USACOE, and other federal agency responsibilities, all steam electrical generating facilities located in the State of Florida producing 75 MW or more must be certified by the State of Florida under PPSA. Certification under PPSA is issued by the Governor and Cabinet, sitting as the Siting Board. The FDEP is charged with the procedural coordination of the certification process. All state, regional, and local agencies with regulatory jurisdiction over the electrical power plant may become parties to the certification proceeding. PPSA is a "one-stop" permitting procedure for major electrical power plants determined to be needed by FPSC. Certification under the PPSA is the sole license required of any state, regional, or local agency for the construction and operation of the certified facility. Electrical power plants certified under the PPSA include associated facilities that directly support the construction and operation of the plant, including transmission lines that connect the plant to an existing transmission network.

To obtain certification for the proposed electrical power plant, Tampa Electric Company must demonstrate compliance with all applicable regulatory standards of state, regional, and local agencies with jurisdiction over the project, unless the Governor and Cabinet grant a variance, exception, exemption, or other relief from a standard.

In addition to the federal and state responsibilities, regional and local agencies also participate as part of the PPSA process. Table 1.3-1 presents a summary of the federal, state, and local statutes/laws and permits/certifications relevant to the proposed Polk Power Station.

1.3.1 EPA Responsibilities

Tampa Electric Company has applied to EPA for an NPDES permit for the point-source discharge of water from the proposed power station cooling reservoir to waters of the United States (an unnamed reclaimed phosphate mining lake leading to Little Payne Creek), in accordance with the provisions of the Clean Water Act (CWA), as amended (33 United States Code [USC] 1251 *et seq.*; EPA, 1989a). The cooling reservoir would receive storm water, treated industrial and sanitary wastewater, and groundwater. The NPDES permit application was for the full build-out (1,150 MW) facility proposed by Tampa Electric Company.

EPA has determined that this proposed discharge is subject to the requirements of 40 Code of Federal Regulations (CFR) 423.15 (EPA, 1989b). The Polk Power Station would be classified as a "Steam Electric" industry (40 CFR 423) facility by the Standard Industrial Classification (SIC) Codes, for which New Source Performance Standards (NSPS) exist. Therefore, pursuant to the definition of "new source" in 40 CFR 122.2, EPA has determined that the proposed project facility is a new source and therefore would require an NPDES permit based on NSPS. Appendix A provides a copy of the EPA draft NPDES permit.

Pursuant to 40 CFR 122.29 and Section 511(e) of the CWA, the issuance of an NPDES permit to a new source may be a major federal action significantly affecting the quality of the human environment. Consistent with 40 CFR 122.29 and 40 CFR 122.21, EPA has determined that the proposed project is a major federal action significantly affecting the quality of the human environment requiring an NPDES permit and that an EIS is therefore required. EPA must comply with the environmental review requirements of 40 CFR 6.600 *et seq.*

EPA is the federal Lead Agency for the development of this EIS. The primary reason for EPA preparing an EIS for this proposed project is that Tampa Electric Company has applied to EPA for an NPDES permit for this project. EPA has not delegated the administration of the CWA to the State of Florida for proposed projects in Florida subject to the PPSA. Therefore, EPA's "EIS Action Alternatives" for this EIS relate to the EPA NPDES permitting decision. Additional EPA and other federal responsibilities that are related to, but may not by themselves require an EIS, are presented in Section 1.3.5.

Table 1.3-1. Federal, State, and Local Statutes/Laws and Permits/Certifications Relevant to the Proposed Polk Power Station

FEDERAL STATUTES

Clean Water Act
Clean Air Act
Endangered Species Act of 1973, as amended
Fish and Wildlife Coordination Act
National Historic Preservation Act
Resource Conservation and Recovery Act of 1976, as amended
National Environmental Policy Act of 1969, as amended
Rivers and Harbors Act of 1899, as amended
Executive Order 11990 (Protection of Wetlands) of 1977

STATE OF FLORIDA STATUTES

Florida Electrical Power Plant Siting Act (PPSA)

FEDERAL PERMITS

U.S. Environmental Protection Agency (EPA)

National Pollutant Discharge Elimination System (NPDES) (construction and operational)
Section 404 (Clean Water Act: CWA) permit application review (submitted to USACOE for its permit review)
Section 404(c) permitting veto authority

U.S. Army Corps of Engineers (USACOE)

Section 404 wetland permit(s) under CWA

STATE OF FLORIDA PERMITS AND CERTIFICATIONS

PPSA
NPDES permit certification
Section 404 permit(s) certification
Prevention of Significant Deterioration (PSD)
PPSA process replaces the need to seek separate permits from state agencies because of the coordinated review involved

REGIONAL AND LOCAL PERMITS AND CERTIFICATIONS

PPSA process replaces the need to seek separate permits from regional and local government because of the coordinated review involved

EPA's "EIS Action Alternatives" for Tampa Electric Company's proposed project are to issue, to issue with conditions, or to deny the NPDES permit for the operation of the proposed Polk Power Station. EPA's preferred permit action for this proposed project is to issue the NPDES permit with conditions, pending successful completion of this EIS process.

This document constitutes the EPA FEIS for the proposed project and follows the EPA DEIS published in February 1994. The main objectives of the EPA EIS are (1) to describe the need for the proposed new power station; (2) to consider and develop, as appropriate, reasonable alternatives to the project; and (3) to investigate and describe measures that could be taken to avoid, minimize, and/or mitigate identified adverse impacts.

As the federal Lead Agency for the preparation of this EIS, EPA has published its *Federal Register* NOI to prepare an EIS at 58 FR 29577 on May 21, 1993, soliciting public comments within a 30-day review period. The NOI also provided notice that EPA assumes the federal Lead Agency status from DOE for this proposed project, and that DOE and USACOE are Cooperating Agencies to EPA. On February 25, 1994, EPA published a Notice of Availability (NOA: see Appendix F) for the DEIS for public review (59 FR 9211, EIS No. 940056). EPA also conducted a joint public hearing for the EIS (including DOE's CCT action) and the draft NPDES permit in Polk County, Florida, on March 31, 1994, following announcements in the *Polk County Democrat* and the *Tampa Tribune* (see Appendix F). The meeting occurred at 7:00 p.m. at the Polk County Commission Board Room, located at 330 West Church Street in Bartow, Florida. In addition to the four EPA representatives and associated personnel (third-party contractor and court reporter), an audience of twenty (20) people attended the public hearing, including one (1) speaker.

A transcript of the EPA joint public hearing is provided in Appendix G. The 45-day public-comment period for postmarked written comments on the DEIS and/or draft NPDES permit officially ended on April 11, 1994. Pending successful completion of the EIS, EPA will also prepare its Record of Decision (ROD) for this EIS within the context of its NPDES permitting action.

1.3.2 DOE Responsibilities

DOE is a Cooperating Agency to EPA for the preparation of this EIS due to DOE's project involvement with the DOE CCT Demonstration Program. Specifically, the proposed Polk Power Station includes a 260-MW IGCC unit, which is being considered by DOE for approximately $130 million of cost-shared financial assistance (amended from $120 million because of additional costs of design changes and improvements) to Tampa Electric Company under the CCT Demonstration Program. The proposed 260-MW demonstration project would constitute Polk Unit 1 of the Polk Power Station. It is DOE's responsibility to administer the CCT Demonstration Project.

The DOE decision to provide or not to provide the cost-shared financial assistance to Tampa Electric Company to demonstrate a 260-MW IGCC unit has been determined by DOE to be a major federal action subject to NEPA, pursuant to 10 CFR Part 1021 and 40 CFR Parts 1500-1508. In the absence of a need for an NPDES permit triggering an EPA EIS for this project (Section 1.3.1), the DOE CCT decision for this project would alone trigger an EIS with DOE as the federal Lead Agency. This EIS describes the potential environmental impacts of the construction and operation of the proposed IGCC project. The environmental consequences of the DOE decision are therefore included in this EPA EIS, with DOE being a Cooperating Agency to EPA. The DOE "EIS Action Alternatives" for this EPA EIS are to provide cost-shared financial assistance or to deny such financial assistance. DOE's preferred action alternative for this proposed project is to provide the cost-shared financial assistance, pending successful completion of this EIS process. DOE expects to adopt this EPA EIS, as appropriate, to comply with its NEPA review responsibilities for its preferred CCT action. DOE would, as appropriate, also prepare its ROD (separate from the EPA ROD) for such a CCT action.

Due to DOE's CCT involvement with the Polk Power Station, DOE and EPA had previously agreed that DOE would assume the federal Lead Agency role for the development of the EIS and that EPA would be a Cooperating Agency to DOE for the EIS. As previously explained, DOE and EPA have subsequently agreed that EPA would assume the federal Lead Agency role from DOE and that DOE would be a Cooperating Agency to EPA for this EIS. Should DOE decide to deny the cost-shared financial assistance for this proposed project, an NPDES permit would still be required if the project were pursued as proposed by Tampa Electric Company. The project need for an NPDES permit would trigger an EPA EIS, with or without a DOE CCT demonstration.

As the former federal Lead Agency for the development of this EIS, DOE published its *Federal Register* NOI to prepare an EIS at 57 FR 33331 on July 28, 1992 (see Appendix E). DOE also held an announced public scoping meeting on the evening of August 12, 1992, at the Fort Meade Community Center in Fort Meade, Florida, to obtain public input on key issues to be addressed in the EIS. A transcript of the DOE scoping meeting is provided in the DEIS as Appendix H. The primary public comments from this scoping meeting are summarized in Section 1.4.2 of this FEIS, with reference documentation provided in the DEIS as Appendix I.

1.3.3 USACOE Responsibilities

In addition to DOE, USACOE (Jacksonville, Florida District) is also a Cooperating Agency to EPA for the preparation of this EIS. USACOE has received a Section 404 permit application (original and updated) from Tampa Electric Company to fill wetlands on Tampa Electric's preferred site. USACOE's permitting alternatives are to issue, issue with conditions, or deny the Section 404 permit(s). As part of USACOE's public review process and as the 404 permitting agency, USACOE considers various alternatives to avoid or minimize wetland impacts. EPA provides independent review comments to USACOE on wetland functional values/impacts and alternatives to minimize the impacts. Since Section 404 permitting is also subject to NEPA, USACOE, as the permitting agency, expects to adopt this EPA EIS, as appropriate, to comply with its NEPA review responsibilities associated with appropriate NEPA documentation for any Section 404 permits that USACOE may choose to issue. If the EIS is adopted, USACOE would also prepare a USACOE ROD to complete its NEPA review process.

1.3.4 FDEP Responsibilities

Under the provisions of the PPSA (Chapter 403.501-519, F.S.), FDEP must prepare a Staff Analysis Report (SAR) on which the state's decision to license any new steam electric power plant will be made. Applicants under PPSA must file comprehensive applications for certification, frequently comprising several notebook volumes, addressing the proposed facility's environmental and land-use impacts under the regulatory jurisdiction of state, regional, and local agencies. The FDEP is responsible for determining the completeness and sufficiency of the application. The application is distributed to other regulatory agencies including: FDEP, Florida Department of Community Affairs (FDCA), Florida Game and Fresh Water Fish Commission (FGFWFC), the Southwest Florida Water Management District, the Central Florida Regional Planning Council, and the local government within the jurisdiction of which the project is proposed. These agencies are then required to submit reports addressing the matters within their regulatory jurisdiction.

Under the PPSA, a land-use hearing is conducted for the purpose of determining whether the proposed electrical power plant site is consistent with existing land-use plans and zoning ordinances. If the site is not in compliance with these regulations, the Governor and Cabinet may grant the necessary rezoning or land-use plan amendment. Under PPSA, a certification hearing is conducted before a Florida Division of Administrative Hearings hearing officer at a location in proximity to the proposed project. If FPSC has not determined already that the power plant is needed, it must hold a hearing before the certification hearing. At the certification hearing, the applicant, the regulatory agencies, and substantially affected persons may present testimony and evidence related to the project's compliance with applicable regulations. In addition, a public hearing is conducted to receive comments on the project from the public. The Governor and Cabinet then consider the recommendations of the hearing officer for the electrical power plant.

To obtain site certification, Tampa Electric Company has filed an SCA (TEC, 1992a) with FDEP pursuant to Chapter 17-17, FAC. The Tampa Electric Company SCA proposes the 1,150-MW Polk Power Station addressed in this EIS. The SCA and supporting data were developed in accordance with the scope, quantity, and specificity of information presented in the environmental licensing plan of study for the project. The plan of study for this SCA was reviewed by FDEP and other state, regional, and local agencies.

The land-use hearing for the proposed Polk Power Station was held in Bartow, Florida, on October 29, 1992. Based on this hearing, the hearing officer and subsequently, the siting board, found the proposed use of the site to be consistent with land-use plans and zoning ordinances on January 26, 1993.

Following its review of Tampa Electric Company's SCA, FDEP developed the SAR, in consultation with EPA and other agencies, including conditions of certification. The SAR and certification conditions have been considered by a state hearing officer appointed by the Florida Division of Administrative Hearings, and a state certification hearing was held in Bartow, Florida, on October 13, 1993. The record of that hearing is available to the public for review in Tallahassee at the Division of Administrative Hearings. The hearing officer has prepared a Recommended Order for consideration by the State of Florida Governor and Cabinet, who comprise the Power Plant Siting Board. The Siting Board approved the state site certification of Tampa Electric Company's proposed project subject to specific conditions at their January 25, 1994, meeting.

As part of the State of Florida final decision regarding state certification, the state issues a preliminary determination on the PSD permit, provides an appropriate public comment period, and subsequently issues a final determination on the PSD permit. As the fully-delegated PSD permitting agency (see Appendix D), the FDEP ultimately issues, issues with conditions, or denies the PSD permit. The PSD permit for the 260-MW Polk Unit 1 increment was signed by the Secretary of FDEP on February 24, 1994. A copy of the Final PSD Determination (which includes the FDEP-approved PSD Permit) is provided in Appendix D (Note: This PSD permit may be modified by FDEP as a result of design refinements presented by Tampa Electric Company after FDEP approval). The state is also responsible for certifying the NPDES and Section 404 permit under Section 401 of the CWA.

1.3.5 Other Federal Requirements

In addition to the previously discussed EPA NPDES permit and USACOE Section 404 permitting, several other federal requirements must also be met in order for the proposed Polk Power Station to be in federal compliance. These include issuance of an EPA NPDES permit for operation point source discharges from plant operation and storm water runoff to waters of the United States (Note: for the proposed Polk Power Station, the EPA NPDES permit applied for by Tampa Electric Company will also address NPDES storm water permitting for plant operation); coverage under the EPA NPDES General Permit issued on September 25, 1992, regarding plant construction storm water point source discharges to waters of the United States (i.e., General Permit for "Storm Water Discharges from Construction Sites"); EPA overview of the PSD permitting process under the Clean Air Act, which is now fully delegated to the State of Florida; EPA independent review and comment for the USACOE on the Section 404 permit application prior to the USACOE permitting decision; compliance with the Federal Endangered Species Act (ESA) of 1973, as amended, administered by the U.S. Fish and Wildlife Service (FWS); compliance with Executive Order No. 11990 for wetlands protection; and Federal Aviation Administration permitting regarding emission stack/building heights. A copy of EPA's draft NPDES permit, which also addresses NPDES storm water runoff during plant operation, is provided in Appendix A. A copy of Tampa Electric Company's original "Joint Application for Works in Waters of Florida" (which includes application for a USACOE Section 404 permit) and the associated USACOE Public Notice for the application are presented in Appendix C along with a Tampa Electric Company update of its Section 404 application. A copy of the Final PSD Determination (which includes the PSD permit for the proposed 260-MW Polk Unit 1) is provided in Appendix D. Also included in Appendix D is a copy of FDEP's notice of intent to issue the PSD permit and EPA comments on the Preliminary PSD Determination.

1.3.6 Other State and Local Requirements

In Florida, other state and local permitting requirements and agency approvals for new power plants are coordinated within the SCA review and certification process. In addition to filing an SCA, Tampa Electric Company also filed applications to reclaim Tampa Electric Company's preferred site to accommodate the Polk Power Station in accordance with FDEP rules and regulations pertaining to phosphate mining. Site reclamation will be the responsibility of Tampa Electric Company since the site was purchased by Tampa Electric Company on December 31, 1993.

A majority of the land at the Polk Power Station site preferred by Tampa Electric Company has been mined to recover phosphate or disturbed due to mining-related activities. Current mining of portions of the site lying west of State Road (SR) 37 and north of SR 674 are to continue into 1994. Due to these past and ongoing mining activities, approximately 94 percent of the 4,348-acre site would be mined or disturbed by mining activities prior to Tampa Electric Company's proposed use of the site for the Polk Power Station.

Section 211, F.S. and Chapter 16C-16, FAC, describe the State of Florida requirements to reclaim lands mined for phosphate subsequent to July 1975, commonly referred to as "mandatory lands." Reclamation of lands mined prior to July 1, 1975, is not mandatory; however, state severance tax-based funding is available to reimburse owners of certain "nonmandatory" lands for some or all of the cost of voluntary reclamation activities. Nonmandatory reclamation is governed by Section 378, F.S., and Chapter 16C-17, FAC. Both of these regulatory programs are administered by FDEP. The Polk County Phosphate Mining Ordinance 88-19 also prescribes the requirements for reclamation of mined lands in the county.

Because most of the site has been mined, and because FDEP and Polk County are now an integral part of the SCA process (Section 403, F.S.), these regulatory requirements have been incorporated into the SCA for Polk Power Station. The complete description of the reclamation plan and the completed FDEP forms are contained in the Conceptual Reclamation Plan Application submitted by Tampa Electric Company to FDEP as a separate document. This application has been incorporated in the SCA and was approved by the Siting Board in conjunction with its approval of the site certification on January 25, 1994.

Tampa Electric Company has also coordinated with the Florida State Historic Preservation Officer (SHPO) in the Florida Division of Historical Resources (FDHR; see an example of a coordination letter in DEIS, Appendix Q). Full coordination regarding the proposed transmission lines will occur following Tampa Electric Company's selection of a preferred right-of-way within the proposed corridor.

Polk County has evaluated the consistency of Tampa Electric Company's proposed project with county zoning and land use. The county has issued a Conditional Use Permit (CUP) that indicates Polk Power Station is compatible with the Polk County Comprehensive Plan and zoning ordinances.

The Southwest Florida Water Management District (SWFWMD) regulates groundwater withdrawal and surface water management at the proposed Polk Power Station site. The maximum permissible groundwater drawdown at the site boundary is five feet (ft) according to SWFWMD Water Use Permit (WUP) requirements, in accordance with Chapter 40D-2, FAC, regulations. SWFWMD requirements and criteria for surface water management systems and discharges at the proposed site are provided in Chapter 40D-4, FAC.

1.4 PUBLIC SCOPING AND INFORMATION PROGRAMS

1.4.1 Power Plant Site Selection and Siting Task Force

To identify a suitable site for the needed power plant facilities, Tampa Electric Company conducted a Power Plant Site Selection Assessment program between September 1989 and November 1990. The overall objective of this site selection program was to select a site or sites that were considered the most suitable based on a combination of environmental, socioeconomic, land-use, and engineering/economic factors. The six-county study area for the siting program in west-central Florida is shown on Figure 1.1.1-1. An integral aspect of this program was the fonnation by Tampa Electric Company of a public Siting Task Force that actively participated in the site selection efforts. The Siting Task Force comprised 17 private citizens from environmental groups, businesses, and universities in the Tampa Electric Company service area and throughout Florida. Tampa Electric Company's objective for involving the Siting Task Force in the site selection process was to ensure that local and statewide public issues and environmental concerns relative to new power plant development were adequately and accurately considered in selecting a suitable site for the new power plant. Appendix J in the DEIS lists the Siting Task Force members and a brief description of their backgrounds. Descriptions of the Power Plant Site Selection Assessment program approach, evaluation methodologies, and findings are provided in Section 2.5.

Based on the results of detailed environmental and engineering/economic evaluations, the Siting Task Force recommended three adjacent areas located in southwest Polk County as the most suitable or preferred sites for locating the planned power plant facilities. The three preferred sites had similar environmental characteristics since each had been disturbed by previous and ongoing phosphate mining activities. The Siting Task Force recommended that Tampa Electric Company pursue acquisition and environmental licensing efforts for any one of the three preferred sites. Tampa Electric Company concurred with the recommendations of the Siting Task Force and selected one of the preferred sites in southwest Polk County as the proposed location for the Polk Power Station.

Following this selection, and prior to the initiation of the present NEPA process, Tampa Electric Company proceeded to meet with public agencies and the public in the vicinity of the proposed site. Public meetings were held in several local cities and communities: in Chicora on April 30, 1992; in Fort Meade on May 7, 1992; in Mulberry on May 12, 1992; and in Bartow on May 19, 1992.

1.4.2 DOE EIS Notice of Intent and Public Scoping Meeting

The intent of the public scoping meeting was to present to the public the proposed federal action(s) and to allow the public an opportunity to further identify concerns, issues, and potential impacts related to the proposed project. The EIS public scoping meeting, as well as the EIS public hearing (which was held subsequent to DEIS issuance for public review), are part of the NEPA public involvement process.

As the former federal Lead Agency for the preparation of the EIS, DOE published its NOI in the *Federal Register* on July 28, 1992 (57 FR 33331), announcing a DOE EIS public scoping meeting. The Public scoping meeting was held on August 12, 1992, in Fort Meade, Florida, and was led by DOE and attended by representatives from the EPA, which was the Cooperating Agency at that time. A copy of the NOI is included in Appendix E, and the scoping meeting transcript is included in the DEIS as Appendix H.

In response to the DOE's NOI, approximately 60 people attended the public scoping meeting (although only 15 people signed the register). Twelve speakers gave oral comments and 22 follow-up comment letters were received by DOE within the 30-day scoping period following the scoping meeting. Copies of the scoping comments and letters are included in the DEIS as Appendix I. The issues raised by the public, other than those raised by EPA, are summarized as follows (the numbers in parentheses following each concern indicate the section numbers or appendices where the topic is addressed within this FEIS):

- The effects of electromagnetic fields (EMF) from proposed transmission lines on humans (4.12.2.3)
- The effects of release of air pollutants such as sulfur dioxide and nitrogen oxides upon the local population (4.12.2.1)
- Cumulative effects on air quality and groundwater from the Polk Power Station and other proposed facilities planned for the area over the next 10-20 years (4.13.1 and 4.13.3)
- Mercury emissions from the proposed facility adding to the recently identified mercury problem in Florida (4.13.1.1)
- Impact of the proposed action upon orange groves (4.5.1.2; also addressed at the public scoping meeting—see transcript included in the DEIS as Appendix H)
- The consideration of serving Fort Meade customers (beyond scope of EIS)
- The concern over possible use of high-sulfur coal (2.3.4 and 2.3.5)
- Impact of the proposed action upon the tax base of the area (4.7.1.2)
- Include FPSC's determination of need (see DEIS, Appendix F)
- Include the energy conservation measures taken and planned by Tampa Electric Company (1.2.2.3.1)
- Review the site selection process (1.4.1 and 2.5.1)
- Concern over possible presence of bald eagles and gopher tortoises (3.5.5 and 4.5.1.1.3)
- Compare wetland resources on the final three to five alternative sites (2.5.5.1)
- Discuss noise from construction and operation of proposed project (4.11)

Several other issues raised by EPA when DOE was the federal Lead Agency are addressed by EPA in this EIS (see EPA scoping letter to DOE dated September 8, 1992, in the DEIS as Appendix I).

1.4.3 EPA EIS Notice of Intent

As the current federal Lead Agency for the preparation of this EIS, EPA published its *Federal Register* NOI for preparation of this EIS at 58 FR 29577 on May 21, 1993. In addition to announcing an EPA intent to prepare this EIS, the NOI also announced that EPA was assuming the federal Lead Agency status from DOE for this EIS, and that DOE and USACOE would be Cooperating Agencies to EPA for this EIS. Two written comment letters on the NOI were received by EPA within the 30-day comment period indicated in the NOI. The first letter was a request from the U.S. Department of Agriculture, Rural Electrification Administration, to be added to the mailing list for the DEIS and FEIS (see Appendix B). The second letter was from the Legal Environmental Assistance Foundation (LEAF) and commented primarily on project need, alternatives analysis, and cumulative impacts (see Appendix B). Enclosures to LEAF's letter are available for public inspection at Tampa Electric Company's office in Mulberry, Florida, and at EPA's Region IV office in Atlanta, Georgia. Alternatives, project need, and cumulative effects are addressed in Chapter 2, Section 1.2, and Section 4.13 of this EIS, respectively.

In addition to these letters, several related telephone calls from four parties were received by EPA. One caller was a reporter for the *Environment Reporter* in Washington, D.C., who called twice and primarily requested the reason for changing the federal Lead Agency from DOE to EPA and nature of comments solicited in the NOI. Another caller was a representative of LEAF, who primarily requested a copy of the DOE scoping meeting transcript and DOE NOI comment letters received by DOE. A representative of Texaco, Inc., in Denver, Colorado, also called to request being put on the EIS mailing list. Additionally, a Florida reporter for McGraw-Hill's *Utility Environment Report* called for an interview during and after the NOI review period (called twice) and primarily referred to DOE and EPA NOI and requested information on the project in general, including EPA's scoping comments to DOE dated September 8, 1992 (see DEIS, Appendix I). Because the purposes of scoping appear to be satisfied without an additional public scoping meeting and EPA does not feel that these purposes would be significantly advanced by a second public scoping meeting, EPA has decided that it will not hold an additional public scoping meeting for the EIS subsequent to the DOE public scoping meeting.

1.4.4 EPA Coordination

EPA, as the federal Lead Agency, initiated coordination with the Florida SHPO, FWS, and U.S. Department of the Interior (DOI).

The SHPO responded that the EPA-provided information is correct and current and that FDHR has no concerns regarding historic properties at the site. The SHPO noted that when the final locations of the power line and pipeline corridors are selected, another review must occur. EPA and SHPO correspondence is provided in Appendix B.

Also, in response to these coordination letters, FWS expressed concern about possible presence of red-cockaded woodpeckers and Florida scrub jays on the site and provided updated lists for the threatened and endangered species for the area. FWS inspected the site on December 23, 1993. Based on the site visit, FWS's concerns for the species appear to be resolved for the site preferred by Tampa Electric Company, the adjacent railroad spur, and the transmission line corridor. EPA and FWS correspondence is provided in Appendix B.

In response to EPA coordination during DEIS development, DOI indicated concerns regarding potential PSD air quality impacts to the Chassahowitzka National Wilderness Area (NWA) and requested additional modeling using a revised MESOPUFF II model to predict deposition and concentration of sulfate, nitrate, mercury, and beryllium. EPA, DOI, and FDEP correspondence regarding this concern is provided in Appendix B.

EPA's initial response to the DOI concerns was that Industrial Source Complex (ISC) dispersion modeling, as opposed to MESOPUFF II modeling, had been conducted for the four parameters. Additionally, EPA indicated that EPA had fully delegated the PSD program to the State of Florida, that beyond the PSD incremental assessment the DOI Federal Land Manager (FLM) at the Chassahowitzka NWA may interpret the proposed power station to have an adverse effect on the environmental criteria for the Class I area, that the State of Florida consequently would be coordinating with the FLM, and that EPA would also consider the need for additional modeling from a NEPA perspective based on the FLM's decision.

Because the PSD Program is now fully delegated to the State of Florida, additional coordination occurred between DOI and FDEP. Relative to the Air Quality Related Values Analysis in a letter to FDEP dated February 14, 1994, DOI expressed concern about cumulative depositional effects of sulfate, nitrate, mercury, and beryllium and that the DEIS analysis was not cumulative for these pollutants. DOI stated, "We need to know: (1) the cumulative deposition of pollutants, and (2) the ecological consequences of this deposition" and "We ask that TECO be required to perform these analyses when they apply for permits for future phases of their Polk Power Station."

From a NEPA perspective, EPA agrees with the State of Florida that additional modeling to determine potential cumulative depositional effects for sulfate, nitrate, mercury, and beryllium (as well as any other reasonable parameters that may need to be monitored), should be modeled for the proposed additional units beyond the 260-MW Polk Unit 1 (if Tampa Electric Company pursues these additional units and the additional need for capacity above the approved 220 MW is approved by the Florida PSC). Additional coordination should therefore be conducted by Tampa Electric Company with FDEP during prospective application for such additional units up to 1,150 MW at the Polk Power Station. Based on the February 14, 1994 letter from DOI to FDEP, it appears that the mechanism for resolving the air quality modeling issue has been established for units beyond the 260-MW and up to the proposed 1,150 MW full build-out for the Polk Power Station.

CHAPTER 2.0

Alternatives Including Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

2.0 ALTERNATIVES INCLUDING TAMPA ELECTRIC COMPANY'S PROPOSED PROJECT (PREFERRED ALTERNATIVE WITH DOE FINANCIAL ASSISTANCE)

The purpose of this section is to identify the potential alternatives, including Tampa Electric Company's (applicant's) proposed project (preferred alternative, project proposal, proposed project, or proposal), which were considered for this EIS. EPA is required by NEPA to identify and assess reasonable alternatives to the proposed project that could potentially avoid or minimize adverse effects on the quality of the human environment. To be considered as reasonable for assessment in the EIS, the alternatives should meet the following criteria:

- Provide some environmental advantage to lessen, minimize, or avoid potential adverse effects compared to the proposed action
- Meet reasonable additional power capacity needs in the 1996 to 2010 timeframe, including the 260-MW Polk Unit 1 currently approved by FPSC
- Be technically feasible and implementable within the required timeframe
- Be relatively cost-effective

The following sections on alternatives (Sections 2.1 - 2.6) identify and consider regulatory, technology, site, and design alternatives to the Tampa Electric Company preferred alternative. These alternatives/subalternatives are considered in the EIS as the following:

- Federal "EIS Action Alternatives" - (Section 2.1): EPA and DOE have "EIS Action Alternatives." EPA's "EIS Action Alternatives" are regulatory and involve an NPDES permitting decision, while DOE's "EIS Action Alternatives" involve a cost-shared, financial-assistance decision under the DOE CCT Demonstration Program.
- Related Federal, State, Regional, and Local Actions - (Section 2.2): In addition to the "EIS Action Alternatives", project-related federal, state, regional, and local actions by EPA, USACOE, FDEP, and other agencies are addressed.
- Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance) - (Section 2.3): Tampa Electric Company proposes a full build-out of the power station to 1,150 MW to be implemented with DOE cost-shared financial assistance for Polk Unit 1 under the CCT Demonstration Program.
- Alternatives to the Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance) - (Section 2.4): Several site and technology alternatives to the Tampa Electric Company's proposed project are considered as alternate ways of implementing the project including:
    - Alternatives to Constructing New Generating Facilities - (Section 2.4.1): A discussion concerning nonconstruction alternatives (demand- and supply-side), such

as conservation, load management, interruptible load, and power purchasing, is provided.

   - Alternative Generation Technologies - (Sections 2.4.2 and 2.4.3): A summary of the technology screening process conducted by Tampa Electric Company in their resource planning is provided. The technology proposed for the Polk Power Station (with DOE financial assistance) is compared against alternative project technologies (three CC units without CG facilities, three IGCC units, and PC with FGD units).
   - Alternative Site Analysis - (Section 2.5): A summary of the Tampa Electric Company site selection process and a discussion of two other acceptable site alternatives to the site selected by Tampa Electric Company are presented.
   - Alternative Processes and Facilities - (Section 2.6): Alternatives to the site layout, major processes, facilities, and systems proposed for the Polk Power Station are discussed.
   - Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance) - (Section 2.7): If DOE decides not to provide Tampa Electric Company with cost-shared financial assistance for Polk Unit 1, Tampa Electric Company proposes a full build-out to 1,150 MW with more conventional technology as an alternate means of implementing the project.

- No-Action Alternative - (Section 2.8): The consequences of not building the proposed Polk Power Station are discussed (i.e., if EPA denies the NPDES permit and no federal project is permitted, if FDEP denies the certification, and/or if Tampa Electric Company decides to withdraw its NPDES permit application and other applications and does not pursue the proposed project). In the absence of the proposed project, on-site reclamation construction for mining impacts would still need to be implemented.

Various options under these alternatives/subalternatives are considered in this FEIS. Reasonable options are discussed further while options considered unreasonable were rejected for specified reasons. Project alternatives and subalternatives are summarized in Section 2.9 (Table 2.9-1).

Project design modifications and improvements proposed by Tampa Electric Company for the preferred alternative, i.e., Tampa Electric Company's proposed project (Preferred Alternative With DOE Financial Assistance), occurred during the EIS process. Relevant design aspects not documented in the published DEIS are incorporated in this FEIS. In addition, the design changes and improvements to Tampa Electric Company's proposed project are specifically summarized in Section 2.3.13.

2.1 FEDERAL "EIS ACTION ALTERNATIVES"

The proposed project requires major federal actions on the part of EPA and DOE, each action requiring NEPA documentation. As such, this EIS was considered the appropriate NEPA documentation for the proposed EPA and DOE major federal actions.

EPA and DOE have "EIS Action Alternatives" for this EIS concerning NPDES permitting and the CCT Demonstration Program, respectively. EPA will issue, issue with conditions, or deny the NPDES permit. EPA's preferred permit action for this proposed project is to issue the NPDES permit with conditions, pending successful completion of this EIS process. DOE will provide financial assistance for the IGCC unit or not provide such financial assistance. DOE's preferred action alternative for this proposed project is to provide the cost-shared financial assistance, pending successful completion of this EIS process.

EPA and DOE have "EIS Action Alternatives" for this EIS concerning NPDES permitting and the CCT Demonstration Program, respectively. EPA will issue, issue with conditions, or deny the NPDES permit. DOE will provide financial assistance for the IGCC unit or not provide such financial assistance.

2.1.1 "EIS Action Alternatives" Available to EPA

As the applicant, Tampa Electric Company requested issuance of an NPDES permit from EPA Region IV for point-source discharges from the cooling reservoir of its proposed Polk Power Station to an unnamed reclaimed phosphate mining lake leading to Little Payne Creek (both water bodies are waters of the United States). Tampa Electric Company's NPDES permit application to EPA was for the full build-out of the Polk Power Station to 1,150 MW, which is proposed by Tampa Electric Company for completion in 2010. Tampa Electric Company has formally requested an EPA "new-source determination." By letter dated January 11, 1994, to Tampa Electric Company (see Appendix A), EPA has tentatively determined the proposed Polk Power Station to be a "new source" requiring an NPDES permit based on NPDES NSPS. As discussed in Section 1.3, alternatives available to EPA are NPDES permit action alternatives in accordance with its regulatory and permitting authority pursuant to Section 402 of the CWA. Specifically for EPA Region IV, this authority would apply to the present Tampa Electric Company proposal subject to the PPSA since EPA Region IV has not delegated the NPDES permit program to the State of Florida. EPA's "EIS Action Alternatives" are to issue, issue with conditions, or deny the NPDES permit for this proposed project.

Issuance of the NPDES permit by EPA for the full build-out to 1,150 MW would allow Tampa Electric Company to operate the proposed Polk Power Station by allowing controlled point-source discharges from the spillway of the cooling reservoir to an unnamed reclaimed lake leading to Little Payne Creek. The cooling reservoir would receive (1) point-source discharges from treated storm water runoff from by-product storage areas; (2) treated sanitary wastewater effluent; (3) treated industrial wastewater effluent (including noncontact cooling water from the units); and (4) low-volume waste sources. Point-source discharge of wastewater from the cooling reservoir would occur on a continuous basis.

The proposed Polk Power Station industrial wastewater treatment (IWT) systems provide for recycling and treatment of the various industrial wastewater streams prior to release to the cooling reservoir. The direct surface discharges of water from the cooling reservoir to the unnamed lake leading to Little Payne Creek constitute the point-source discharges of industrial wastewater from the proposed Polk Power Station.

2.1.1.1 EPA Issuance of the NPDES Permit

An NPDES permit issued by EPA without conditions would normally still be subject to certain constituent limitations and associated monitoring and reporting. Proposed limitations in a draft NPDES permit are subject to further modification by EPA and the public, and is contingent upon Section 401 (CWA) certification by the State of Florida.

2.1.1.2 EPA Conditional Issuance of the NPDES Permit

An NPDES permit issued with conditions by EPA would involve inclusion of special project conditions in addition to normal constituent limitations and associated monitoring and reporting.

For the proposed project, EPA's preferred permit action is to issue the NPDES permit with conditions, pending successful completion of this EIS process. For the draft NPDES permit for the proposed project (see Appendix A), the draft permit conditions, limitations, monitoring, and reporting requirements are discussed in Parts I, II, III, and IV of the draft permit.

At this time, EPA has requested State of Florida 401 certification for the draft NPDES permit. Any more stringent requirements received from the state will be incorporated into the final NPDES permit.

2.1.1.3 EPA Denial of the NPDES Permit

If it were determined that the proposed Polk Power Station point-source discharges from the cooling reservoir to the unnamed reclaimed lake and eventually reaching Little Payne Creek would not be in compliance with the NSPS or Florida water quality standards, EPA would deny the NPDES permit for the proposed project. Furthermore, EPA could deny the permit if environmental resources such as endangered species, historic or archaeological sites, wetlands, or floodplains would be significantly impacted and measures for avoiding or for mitigating the impacts are unacceptable. The denial would be the equivalent to the No-Action Alternative and would result in not allowing point-source discharge of the cooling reservoir to waters of the United States. If the permit were denied by EPA, Tampa Electric Company would have the option to redesign the project and to resubmit the permit application to EPA, locating and evaluating the proposed project at another site, pursuing the No-Action Alternative, or contesting the determination.

2.1.2 "EIS Action Alternatives" Available to DOE

The "EIS Action Alternatives" available to DOE are either to provide cost-shared financial assistance for the proposed 260-MW IGCC unit of the proposed project under the CCT Demonstration Program or to deny the financial assistance.

2.1.2.1 DOE Provides Cost-Shared Financial Assistance

DOE cost-shared financial assistance would allow Tampa Electric Company to construct and operate the proposed 260-MW IGCC unit. This unit would constitute the "Polk Unit 1" of Tampa Electric Company's proposed eventual full build-out of the proposed Polk Power Station to 1,150 MW. This unit is expected to demonstrate a higher efficiency in the amount of power produced per ton of coal than found with conventional coal-based technology. It would also provide much needed full-scale operating experience to pave the way for expanded adoption of this more efficient system by the power industry. This operating experience would also provide information on other expected advantages of the oxygen-blown IGCC power plant as compared to a conventional PC power plant with FGD. Expected advantages of the IGCC unit would include lower environmental emissions and natural resource requirements. Sulfur oxides (SO_x), nitrogen oxides, and particulate emissions are expected to be lower than for a conventional PC plant with FGD. Land area and water requirements are also expected to be less for IGCC. In addition, coal consumption is expected to be less due to higher plant thermal efficiency.

For this proposed project, DOE's preferred action alternative is to provide the cost-shared financial assistance, pending successful completion of this EIS process.

2.1.2.2 DOE Denial of Financial Assistance

DOE denial of cost-shared financial assistance for Tampa Electric Company to construct and operate the IGCC unit could result from the NEPA process, reallocation of resources, and/or new information on the design of the IGCC unit. Without DOE cost-shared financial assistance, Tampa Electric Company would revert to its Alternative Power Resource Proposal, i.e., the Tampa Electric Company's Alternative Power Resources Proposal (Without DOE Financial Assistance), described in Section 2.7. This proposal would involve construction of the two nominal 220-MW CC units, then a nominal 75-MW CT unit and a nominal 500-MW PC with FGD unit. In the final phase, three nominal 75-MW CT units would be added.

2.2 RELATED FEDERAL, STATE, REGIONAL, AND LOCAL ACTIONS

In addition to the EPA and DOE "EIS Action Alternatives", EPA, USACOE and FDEP have project-related regulatory responsibilities. EPA has oversight responsibilities for the State of Florida PSD air quality permit. USACOE is the permitting agency for the Section 404 permit application (CWA dredge-and-fill permit). EPA provides independent review comments to USACOE in response to the USACOE Public Notice for the Section 404 permit application. Additionally, at the request of EPA (as the federal EIS Lead Agency) and USACOE (as the 404 permitting agency), FWS reviews the project relative to potential impacts to federally protected flora and fauna, and their habitat.

2.2.1 Alternatives Available to USACOE, EPA and FWS

2.2.1.1 Dredge-and-Fill Permitting

Section 404 of the CWA requires that an individual or a general Section 404 permit be issued by USACOE for a specified type of activity before jurisdictional wetlands can potentially be filled. Jurisdictional wetlands are currently defined by USACOE consistent with their 1987 manual (USACOE, 1987). Section 404 applies to wetlands filled on both federal and nonfederal lands.

As the federal permitting agency for dredge-and-fill applications in waters of the United States, USACOE issues, issues with conditions, or denies such permits pursuant to Sections 10 and 11 of the Rivers and Harbors Act of 1889 (as amended), and Section 404 of the CWA. As such, USACOE has permitting authority over dredge-and-fill activities in wetlands. Tampa Electric Company has applied to USACOE for an individual Section 404 permit to construct the proposed Polk Power Station and to fill wetlands on Tampa Electric Company's preferred site.

As part of USACOE's public review process and as the Section 404 permitting agency, USACOE considers various alternatives to avoid or minimize wetland impacts. EPA provides independent review comments to USACOE on wetland functional values/impacts and alternatives to minimize the impacts. Since Section 404 permitting is also subject to NEPA, USACOE, as the permitting agency, expects to adopt this EPA EIS, as appropriate, to comply with its NEPA review responsibilities associated with appropriate NEPA documentation for any Section 404 permits USACOE may choose to issue. If the EIS is adopted, USACOE would also prepare a USACOE ROD to complete their NEPA review process.

For proposed projects involving Section 404 permit applications, EPA reviews individual and some general Section 404 permit applications for USACOE. In general, the EPA's review emphasizes the avoidance of wetland losses and impacts consistent with the Section 404(b)(1) guidelines, which require the selection of the least environmentally damaging, predictable alternative that minimizes wetland impacts. Avoidance of wetlands is therefore the primary goal of the EPA review, followed by minimization of unavoidable impacts. EPA review comments are provided to USACOE and, as the permitting agency, USACOE makes the decision to issue, issue with conditions, or deny the Section 404 permit. In the event EPA does not concur with USACOE's permitting decision, EPA has the authority to veto the decision pursuant to Section 404(c) of the CWA. This option has been exercised by EPA for other proposed projects.

As a part of EPA's 404 permit application review phase, EPA typically requests compensatory mitigation for unavoidable wetland impacts. The goal for such mitigation is that no net loss of wetland functions and values is incurred due to project implementation. EPA-preferred methods of wetland compensation include: (1) restoration of former wetlands (such as an applicant purchase of nearby farmed wetlands or prior-converted wetlands at an appropriate site within the project area and the subsequent restoration of those wetlands); (2) enhancement of existing wetlands (such as the improvement of wetland circulation); and (3) creation of new wetlands. Also, if a mitigation bank has been established in the general area, the applicant could purchase bank credits to compensate for wetland impacts at a determined compensation ratio. In general, in-kind mitigation (e.g., functional replacement of tidal wetlands with tidal wetlands) on site (same watershed) is considered desirable by EPA. For wetland enhancement, restoration, and creation methods, EPA also recommends applicant monitoring of the wetlands for three to five years (depending on the wetland type) to ensure successful establishment of the wetland system.

Draft EPA mitigative guidance for appropriate compensation ratios (i.e., wetlands gained during compensation versus wetlands affected during construction) are as follows: the ratio for functional restoration of former wetlands is 2:1; for functional enhancement of existing wetlands is 4:1; and for functional creation of new wetlands is 3:1. These ratios concerning the amount of mitigation can be used as a baseline; however, depending on the determined relative quality of the wetlands to be converted and various resource agency inputs and policies, these ratios could increase or decrease.

Tampa Electric Company plans to provide on-site wetland mitigation in the vicinity of the proposed location of the power block (see Chapter 5.0). Section 404 requires Tampa Electric Company to offset impacts to the approximately 253 acres of USACOE jurisdictional wetlands that are to be filled by the proposed project. These wetlands consist of approximately 212 acres of phosphate mine cuts and approximately 41 acres of highly disturbed wetlands (see Appendix C). The proposed offset would be accomplished through the enhancement and restoration of both forested and herbaceous wetlands. The level of compensation proposed by Tampa Electric Company is 168.41 acres, which is subject to the review of USACOE and other resource agencies such as EPA. Additionally, in satisfaction of the type-for-type reclamation requirements of FDEP, Tampa Electric Company proposes to restore an additional approximate 458 acres of wetlands (for a total of approximately 626 acres) and approximately 781 acres of forested uplands for like communities displaced through mining operations and the proposed project development.

USACOE review of the Tampa Electric Company Section 404 permit application will include consultation with FWS. Although FWS does not issue separate construction or operating permits, FWS comments on Section 404 permit applications pursuant to Section 404(m) of the CWA. Additionally, FWS reviews other federal actions under the Fish and Wildlife Coordination Act of 1965, as amended, and Section 7 of the ESA of 1973, as amended. FWS reviews the proposed action for potential adverse impacts of federally protected endangered and threatened species or the habitats of such species.

If it is determined that the proposed construction and operation of the Polk Power Station would not be in compliance with applicable Section 404 permit requirements, USACOE would deny the required dredge-and-fill permit(s). USACOE could also deny the permit(s) if ecologically-sensitive, unique, or high-value wetlands or waters of the United States are significantly impacted, and measures for mitigating these impacts are unacceptable. The denial of the permit(s) would result in not allowing the filling or construction in wetlands or waters of the United States. If USACOE denies the permit, Tampa Electric Company would have the options of re-designing the project to change the degree of intrusion into jurisdictional wetlands, changing the mitigation plan, locating and evaluating another site, or pursuing the No-Action Alternative. Similarly, adverse findings by FWS in regard to endangered species and their habitats may require Tampa Electric Company to make specific changes (e.g., plant layout design) in the proposed action or mitigate potentially adverse impacts.

2.2.1.2 PSD Permitting

Tampa Electric Company applied to the State of Florida for a PSD permit as part of the state site certification process. Full delegation of permitting authority for sources subject to both the federal PSD regulations and the PPSA, §403.501 *et seq.*, F.S. (1991), has been granted to the State of Florida. For PSD permit applications, the FDEP permit alternatives are to issue, issue with conditions, or deny the PSD permit. For the proposed project, FDEP has issued both Preliminary and Final PSD Determinations. These PSD determinations for the proposed project were prepared by the FDEP during the State of Florida site certification process pursuant to the PPSA and were made in response to the SCA submitted to FDEP by Tampa Electric Company (TEC, 1992a). The PSD permit for the proposed project, which is included in the Final PSD Determination, was approved by the Secretary of the FDEP on February 24, 1994. However, the PSD permit for the proposed project is only for the Polk Unit 1 increment (i.e., only for the 260-MW IGCC unit), so that additional permit applications would be needed for the additional units proposed by Tampa Electric Company for the facility's full build-out to 1,150 MW. The PSD permit is also subject to modification by FDEP based on the final design proposed by Tampa Electric Company. (See Appendix D for the EPA letter dated October 26, 1993, to FDEP regarding full EPA delegation of PSD permitting authority to FDEP; the FDEP Final PSD Determination, which includes the PSD permit; and the FDEP notice of intent for the PSD permit.)

2.2.1.3 General NPDES Permit for Storm Water Discharges

Construction of the proposed Polk Power Station would also require coverage under a general NPDES permit for storm water point-source discharges to waters of the United States. Tampa Electric Company filed its notice of intent to be covered under the General Permit for Storm Water Discharges from Construction Sites on August 25, 1993. Although storm water discharges from the construction site would be authorized under the general permit, EPA strongly recommends that no construction occur until the completion of the present NEPA EIS process. Any construction that would occur prior to completion of this NEPA process would be solely at the risk of Tampa Electric Company. EPA's preferred permit action to issue with conditions an NPDES for the operation of the plant would not be finalized until the end of the NEPA process and documentation in an EPA ROD. Therefore, NPDES permit issuance for power station operation is not guaranteed, and without such NPDES coverage, the proposed Polk Power Station could not legally operate if point-source discharges to waters of the United States occur.

2.2.2 Alternatives Available to FDEP

FDEP administers a state wastewater discharge permit program under the Florida Air and Water Pollution Control Act. FDEP also certifies federally-issued NPDES permits in Florida under Section 401 of the CWA. In the case of new power generating facilities, review and permitting under these and other environmental programs in Florida are coordinated into a one-stop process pursuant to the PPSA. Under the PPSA, FDEP conducts a coordinated review for each new power plant project that incorporates all state, regional, and local agency reviews. A final written report, known as the SAR, and officially entitled the Electric Power Plant Site Certification Review, is prepared and includes FDEP recommendation(s) concerning final state site certification of the project. The SAR contains: (1) reports from FDCA, FPSC, SWFWMD, and other state agencies; (2) results of studies of the project conducted by FDEP; (3) a statement of compliance with FDEP rules; (4) conditions of certification; and (5) a recommendation for final action. The SAR is considered by a hearing officer appointed by the Florida Division of Administrative Hearings. The hearing officer also conducts a site certification hearing and prepares a Recommended Order for consideration by the Governor and Cabinet (the Power Plant Siting Board) in making the final decision regarding the certification or approval of the proposed power plant facilities.

The CAA, as amended in 1990, and as codified at 40 CFR §51.166 and 40 CFR §52.21, require that a PSD permit be secured for projects such as the proposed Polk Power Station before construction begins. As previously described, FDEP reviews the PSD permit application concurrent with the review of the SCA. EPA has granted full delegation of PSD authority to the State of Florida. FDEP is the permitting agency responsible for final approval and issuance of the PSD permit.

A PSD permit application typically addresses the following subject areas:

- Emission controls, including NSPS, if applicable, and Best Available Control Technology (BACT)
- Existing ambient air quality
- Projected impacts on air quality due to the proposed facility
- Other impacts of the proposed facility, such as impacts on soils and vegetation, impacts on visibility (especially at PSD Class I areas) and secondary impacts due to population growth resulting from the proposed project

In Florida, the procedures for review of a PSD Permit Application for projects subject to the PPSA include:

- PSD application review by FDEP for completeness and sufficiency
- Completion by FDEP of a SAR (which includes state Preliminary PSD Determination)
- State public hearing notice publication
- PSD permit public comment period during which a PSD public hearing may be requested
- State site certification hearing proceedings on the SCA (which often includes a PSD summary and must include PSD information if a PSD hearing is requested)
- State issuance of a Finding of Facts by the hearing officer (which includes a recommended order for consideration by the Power Plant Siting Board)
- Power Plant Siting Board concurrence/nonconcurrence with the recommended order
- Final state determination on the issuance or denial of the PSD permit

Appendix D provides a copy of FDEP's PSD permit with conditions for the 260-MW Polk Unit 1 as part of the FDEP's Final PSD Determination.

2.2.3 Alternatives Available to Other State, Regional, and Local Agencies

The final state site certification for a new power plant represents the final state approval for all state, regional, and local requirements applicable to the project, and it may mandate specific conditions pursuant to compliance with various standards and regulations. Under the certification process, the alternatives available to FDEP pursuant to the PPSA are to recommend certification of the project as proposed, certification of the project with conditions, or denial of certification. The ramifications of certification or denial of certification would be similar to those described for an EPA issuance or denial of the NPDES permit described in Sections 2.1.1.2 and 2.1.1.3.

FPSC, FDCA, and SWFWMD are required by statute to prepare reports on the SCA on matters within their jurisdiction. Tampa Electric Company provided copies of the SCA with a request for comments to these state agencies as well as to the following state, regional, and municipal agencies:

- Central Florida Regional Planning Council (CFRPC)
- Florida Department of Agriculture
- FGFWFC
- Polk County Department of Planning
- Florida Department of State
- FDHR
- Florida Department of Transportation (FDOT)
- Office of Planning and Budgeting, Executive Office of the Governor

In Florida, any permitting, review, or approval procedures and alternative actions for other state, regional, and local agencies are coordinated through FDEP within the site certification process under the PPSA.

The State of Florida Governor and Cabinet, sitting as the Power Plant Siting Board, approved the state site certification of the Polk Power Station with specific conditions on January 25, 1994.

2.3 TAMPA ELECTRIC COMPANY'S PROPOSED PROJECT (PREFERRED ALTERNATIVE WITH DOE FINANCIAL ASSISTANCE)

Tampa Electric Company proposes that the Polk Power Station and associated facilities be located on an approximately 4,348-acre site in southwest Polk County, Florida. Based on Tampa Electric Company projections, the proposed station in association with Tampa Electric Company's existing power stations and power distribution network would allow Tampa Electric Company to continue providing reliable and economical electric power service to its existing and future customers through the year 2010.

This section is based on project design and engineering information available from Tampa Electric Company and will discuss the design and operation characteristics of key components, systems, and associated facilities that compose the proposed power plant. The descriptions include, to the extent possible, estimates of the expected character, quality, and quantity of discharges and emissions from the plant facilities and operations. Measures and systems that control and treat the pollutant emissions and waste discharges are also discussed. In addition to employing control measures to clean waste discharges and/or pollutants emissions, the proposed Tampa Electric Company Polk Power Station also incorporates measures of eliminating or reducing pollutant emissions and waste discharges at their sources, in compliance with the Pollution Prevention Act (PPA) of 1990 (see Section 5.2).

Project design modifications and improvements proposed by Tampa Electric Company for the preferred alternative, i.e., Tampa Electric Company's proposed project (Preferred Alternative With DOE Financial Assistance), occurred during the EIS process. Relevant design aspects not documented in the published DEIS are incorporated in this FEIS. For example, design changes and improvements to Tampa Electric Company's proposed project are incorporated below in Section 2.3 and are specifically summarized in Section 2.3.13.

2.3.1 Description of Project Site and Proposed Facilities

The site proposed by the Tampa Electric Company for the Polk Power Station is located in southwest Polk County, Florida (Figure 1.1.3-1), in the vicinity of the City of Tampa, Florida, approximately 17 miles south of the City of Lakeland, 11 miles south of the City of Mulberry, and 13 miles southwest of the City of Bartow. It covers an area of approximately 4,348 acres and is bordered by the Hillsborough County line along the western boundary, Fort Green Road (County Road [CR] 663) on the east; CR 630, Bethlehem, and Albritton Roads along the north; and SR 674 and several phosphate clay settling ponds on the south (Figure 2.3.1-1).

Southwest Polk County is relatively flat, with elevations ranging between 120 and 150 feet above mean sea level (ft-msl). The elevation of the Polk Power Station site is about 140 ft-msl and approximately 94 percent of the 4,348-acre site has already been or is to be mined or disturbed by phosphate mining activities prior to Tampa Electric Company's proposed use of the site.

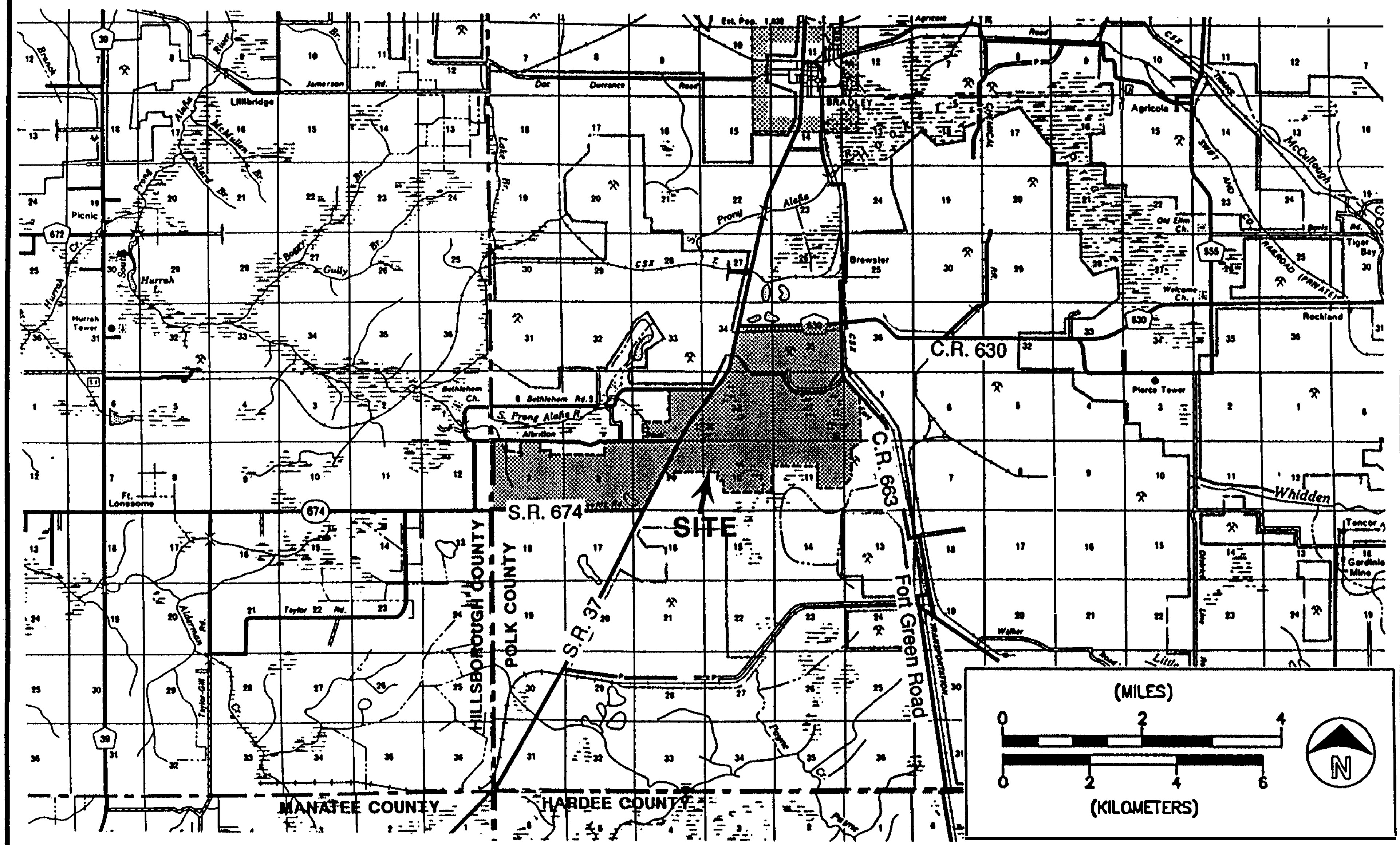

FIGURE 2.3.1-1.
Vicinity Map and Boundaries of the Tampa Electric Company Preferred Polk Power Station Site.

SOURCES: FDOT Map, Fl.; ECT, 1992; TEC, 1992a.

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According to the 100-year floodplain for the premining conditions on the site, documented by the Federal Emergency Management Agency (FEMA), only a small portion of the site area to the west of SR 37 is within the 100-year flood. Under premining conditions, portions of the site area to the east of SR 37 containing floodplains are primarily associated with the headwaters of Little Payne Creek. However, as shown on the aerial photograph in Figure 2.3.1-2, the majority of these floodplains have been mined and are not currently connected to the nearby creek systems.

SR 37 bisects the property, running in a southwest to northeast direction. The portion of the property to the east of SR 37 consists primarily of mined-out lands with water-filled mine cuts between spoil piles surrounding an unmined parcel of land and old mined and unreclaimed lands. The area to the west of SR 37 currently is being mined for phosphate matrix and these operations are scheduled to continue into 1994. In general, lands surrounding the site and in the region have been impacted by previous and ongoing phosphate mining activities.

2.3.2 General Facility Description and Site Layout

In order to match Tampa Electric Company's power resources with its currently projected customer demands in the 1995 through 2010 timeframe, Tampa Electric Company is proposing the Polk Power Station project. This project involves the phased construction and operation of electric generating units and associated facilities on the site. The proposed station would consist of a 260-MW IGCC unit named Polk Unit 1, two 220-MW CC units, and six stand-alone 75-MW CT units. When in operation (subject to various conditions including FPSC determination of need for a 1,150-MW facility at full build-out), these units would provide a total ultimate generating capacity (nominal net) of 1,150 MW at the Polk Power Station site. Table 1.2.2-2 shows the phased schedule for operation of the proposed generating units.

2.3.2.1 General Facility Description

The proposed project development plan was designed to fulfill the State of Florida's regulatory reclamation requirements while taking full advantage, environmentally and economically, of site conditions existing after the mining activities have ceased.

Tampa Electric Company proposes that the main power plant facilities and structures be developed on lands to the east of SR 37 that were not mined but were disturbed by mining-related activities. Fill materials for the plant site area would be obtained from the development activities for the cooling reservoir. As shown in Table 1.2.2-2, Tampa Electric Company has scheduled the operation of Polk Unit 1 to begin in July 1996. Tampa Electric Company's scheduled in-service date of the sixth and last stand-alone CT unit (Polk Unit 9) for the site is January 2010.

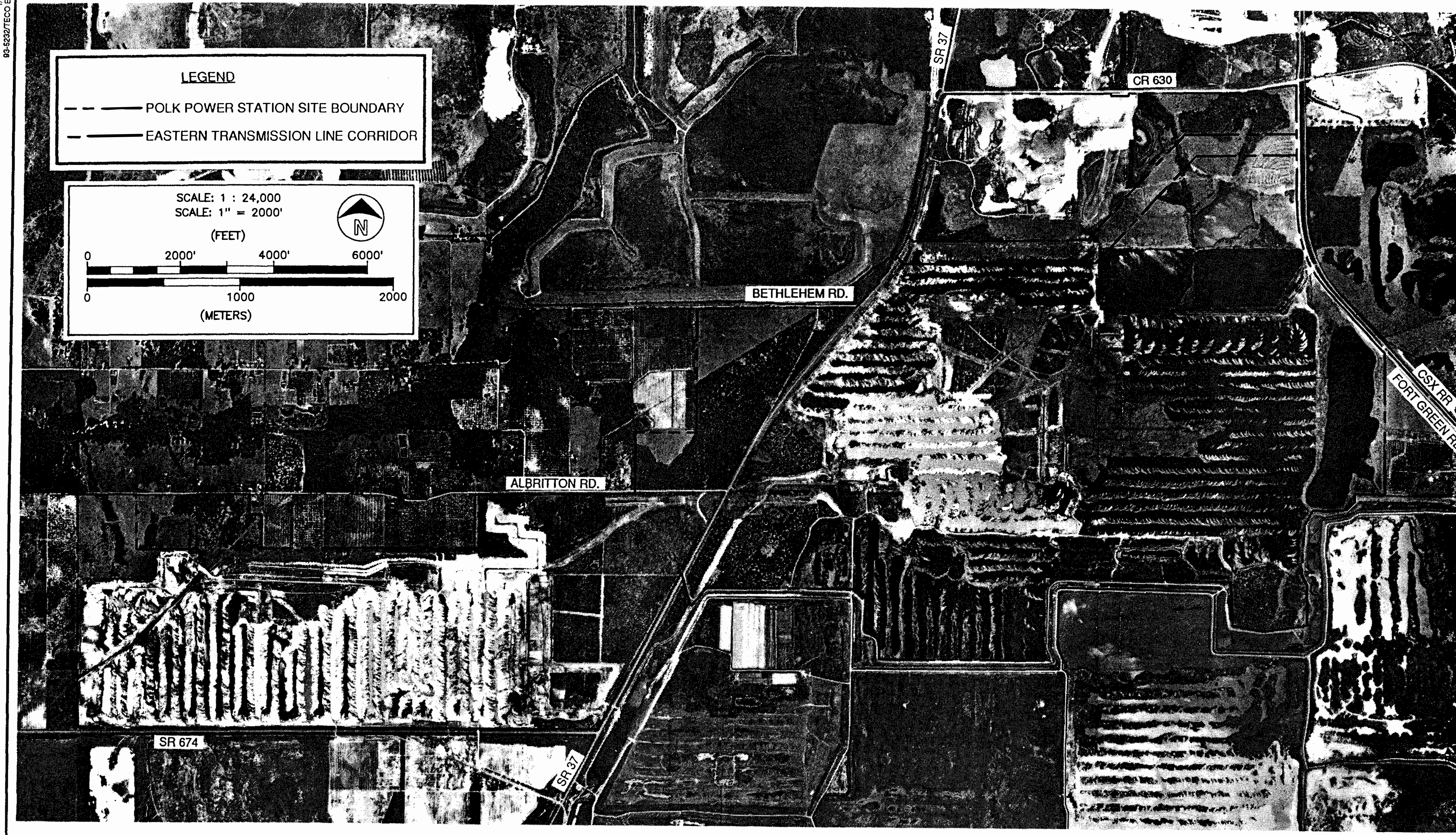

FIGURE 2.3.1-2.
Polk Power Station Site and Adjacent Lands.

SOURCE: SRMC, 1992; ECT, 1992; TEC, 1992a.

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Since the majority of the site has been, is currently, or is to be mined (into 1994) or disturbed by phosphate mining activities, the overall site preparation involves activities to make the site suitable for development of the proposed generating units and associated facilities, as well as to comply with the mined land reclamation requirements of FDEP (Chapter 16C-16, FAC) and Polk County Phosphate Mining Ordinance 88-19.

The proposed development/reclamation plans for the 1,511-acre portion of the site to the west of SR 37 are intended to result in an environmentally suitable wildlife habitat and corridor resource area in southwestern Polk County. Other mined-out areas on the site would be reclaimed to uplands and wetlands and integrated into the overall storm water runoff management plans for the proposed project. These areas would provide wildlife habitat resource areas on the site after development of the project.

2.3.2.2 Site Layout

The proposed site layout plan for the entire 4,348-acre Polk Power Station site, as proposed by Tampa Electric Company, is shown in Figure 2.3.2-1. The proposed land-use/land-cover classifications of the site areas that would be reclaimed or would not be changed from existing conditions are also shown in the figure. The reclaimed, undeveloped areas would provide a combination of buffer, water management, and wildlife habitat/corridor functions on the site. Table 2.3.2-1 provides a summary of the approximate areas of the proposed power plant facilities and other land-use/land-cover classifications on the site after full build-out of the project.

As shown in Figure 2.3.2-1, Tampa Electric Company proposes the main power plant facilities to be located in the central area of the portion of the site to the east of SR 37. This area was not mined for phosphate, but has been disturbed by surrounding mining activities. The distance from the main power plant facilities to the nearest off-site property is more than 2,500 ft; to the west, the distance to residential areas along Bethlehem Road is over 1.5 miles; and to the southeast, the distance to residential areas along Mills Road is 2.8 miles. A vegetated buffer strip would be provided along public roadways surrounding the eastern site tract (i.e., SR 37, CR 630, and Fort Green Road).

The proposed cooling reservoir would be constructed in mined-out areas located to the east and south of the main facility site. The use of existing on-site mined-out areas for the cooling reservoir would allow it to be developed as a primarily below-grade facility, which reduces the construction and maintenance costs and groundwater withdrawals for the cooling water makeup.

The other mined-out portions of the eastern site tract to the west and north of the main facilities would be reclaimed/developed into a series of wetlands and uplands used for management of storm-water runoff. The two proposed transmission line corridors would run through the northern site area. The remaining areas of the eastern tract (i.e., the southwest and southeast corners, the 775-acre area north of the main plant site and

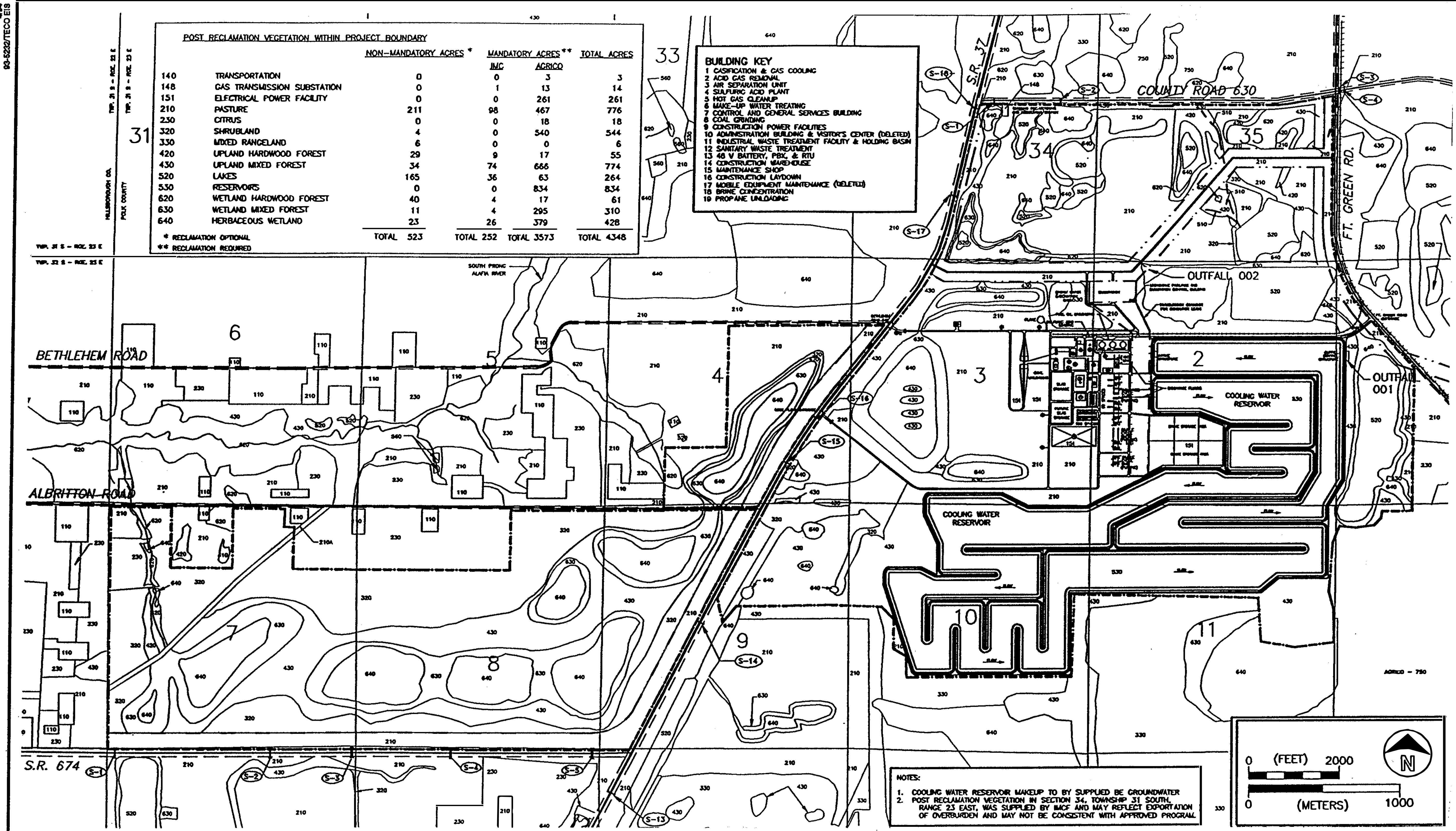
Table 2.3.2-1. Acreages of Land-Use/Land-Cover on Polk Power Station Site After Full Build-Out as Proposed by Tampa Electric Company

Code	Land-Use/Land-Cover Classification*	Acres	Percent
140	Transportation	3	0.1
148	Gas transmission pipeline	14	0.3
151	Electrical power facilities	261	6.0
210	Pastureland†	776	17.9
230	Citrus grove	18	0.4
310	Grassland	0	0
320	Shrub and brushland	544	12.5
330	Mixed rangeland	6	0.1
410	Coniferous forest	0	0
420	Upland hardwood forest	55	1.3
430	Upland mixed forest	774	17.8
520	Lakes	264	6.1
530	Reservoirs	834	19.2
620	Wetland hardwood forest	61	1.4
630	Wetland mixed forest	310	7.1
640	Herbaceous wetland	428	9.8
	TOTAL	4,348	100.0

* The Florida Land Use and Cover Classification System (FLUCCS) of 1976 was used for the land-use and cover classification on the Tampa Electric Company Polk Power Station project. Level II FLUCCS is used for 200 to 600 series classifications, while urban or built-up (100) uses are classified at Level III.

† Patureland includes 141 acres within the on-site electrical transmission line corridors (FLUCCS Code 152)

Sources: ECT, 1992; TEC, 1992a; Bechtel, 1994.



POST RECLAMATION VEGETATION WITHIN PROJECT BOUNDARY

		NON-MANDATORY ACRES *	MANDATORY ACRES **		TOTAL ACRES
			IMC	AGRICO	
140	TRANSPORTATION	0	0	3	3
148	GAS TRANSMISSION SUBSTATION	0	1	13	14
151	ELECTRICAL POWER FACILITY	0	0	261	261
210	PASTURE	211	98	467	776
230	CITRUS	0	0	18	18
320	SHRUBLAND	4	0	540	544
330	MIXED RANGELAND	6	0	0	6
420	UPLAND HARDWOOD FOREST	29	9	17	55
430	UPLAND MIXED FOREST	34	74	666	774
520	LAKES	165	36	63	264
530	RESERVOIRS	0	0	834	834
620	WETLAND HARDWOOD FOREST	40	4	17	61
630	WETLAND MIXED FOREST	11	4	295	310
640	HERBACEOUS WETLAND	23	26	379	428
		TOTAL 523	TOTAL 252	TOTAL 3573	TOTAL 4348

* RECLAMATION OPTIONAL
** RECLAMATION REQUIRED

FIGURE 2.3.2-1.
Tampa Electric Company Preferred Site Layout and Post-Reclamation Plan.

SOURCES: UE&C, 1992; ECT, 1992, TEC, 1992a

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cooling reservoir extending to CR 630, and the reclaimed lake to the east of the reservoir) would not be significantly altered by the proposed project. The 1,511-acre portion of the site to the west of SR 37 would be reclaimed to a wildlife habitat/corridor system consisting of an integrated series of forested and nonforested wetlands and uplands.

Figure 1.1.3-2 shows the proposed arrangement of the power plant and associated facilities on the eastern portion of the site at a more detailed scale. As indicated in Table 2.3.2-1, after full build-out, about 261 acres, excluding the cooling reservoir, would be classified for use as power plant facilities; however, of this 261 acres, about 150 acres would actually be used for main power plant facilities and structures, including coal, fuel oil, by-product, and brine storage areas, and IWT systems. Figure 1.1.3-2 also shows the proposed locations of the outfall control structure (No. 001) for discharges from the cooling reservoir to the reclaimed lake on the eastern portion of the site and the second point (No. 002) for storm water runoff discharge from the plant site area. Off-site water discharges from the Polk Power Station to the Little Payne Creek system would occur at the southern edge of the reclaimed lake to a man-made ditch that runs along the western side of Fort Green Road.

Table 2.3.2-2 presents a listing and the dimensions of the proposed buildings and structures on the site that could cause plume downwash and the size of the proposed exhaust air emission stacks. The tallest building is the gasifier structure at 300 ft above ground level, and the tallest stack is associated with the H_2SO_4 plant at 199 ft above ground level.

2.3.3 Power Generation Systems

This section provides descriptions of the proposed power plant facilities, the key components and systems of the plant and their operations, and the directly associated facilities that compose the proposed Tampa Electric Company Polk Power Station. The estimates of the expected character, quality, and quantity of discharges and emissions from operating plant facilities are also discussed. Proposed measures and systems for control of pollutant emissions and discharges of waste are described. Measures to eliminate and/or reduce pollutants at their source are also described.

2.3.3.1 General Description

The proposed generating units include a 260-MW IGCC unit (Polk Unit 1), two 220-MW CC units, and six stand-alone 75-MW CT units. The construction and operation of these units would provide a total, ultimate generating capacity of 1,150 MW at the Polk Power Station site.

2.3.3.2 Polk Unit 1 Process Descriptions

If DOE decides to provide Tampa Electric Company with cost-shared financial assistance, the Polk Unit 1 would be developed on site in conjunction with the cooperative agreement with DOE under the CCT

Table 2.3.2-2. Dimensions of All Structures Exceeding 50 Feet in Height and Exhaust Stacks on the Proposed Polk Power Station Site

Elements	Structure Dimensions Length (ft)	Width (ft)	Height (ft)
Gasifier structure	60	63	300
Syngas cooling wings (2)	152	25	90
Air separation unit cold box	23*	--	165
Coal grinding structure	50	25	90
IGCC HRSG	131	43	90
CC HRSGs (4)	75	33	57
H_2SO_4 plant absorbers (2) and dryer (1)	8*	--	60
H_2SO_4 plant gas cooling tower	8*	--	70
Acid gas removal stripper	10*	--	100
Water wash column	10*	--	80
Acid gas removal absorber	10*	--	100
Coal storage silos (2)	59*	--	197
HGCU	65	52	279
Oil storage tanks (3)	100*	--	57

Exhaust Stacks	Stack Height (ft)	Stack Diameter (ft)
IGCC HRSG stack	150	19
CC HRSG stacks (4)	150	14.5
Auxiliary boiler stack	75	3.7
Flare	150	4
CC/bypass stacks (10)	75	18†
H_2SO_4 plant stack	199	2.5
HGCU thermal oxidizer stack	125	4

Note: All heights in feet above ground level; the height of the HGCU changed significantly from 218 ft in the DEIS to 279 ft because of design changes.
* Diameter.
† Equivalent diameter. Stack is usually square.

Sources: Texaco, 1992.
TEC, 1992a.
Bechtel, 1994.

Demonstration Program. This program provides utilities and other power producers with an opportunity to commercially demonstrate environmentally acceptable and economically viable means of generating electricity with coal, the most abundant energy resource in the United States.

The proposed Polk Unit 1 would be an IGCC power generating plant. IGCC integrates CG and CC technologies to develop a highly efficient new technology for removing sulfur from syngas prior to combustion. Recent studies confirm that the IGCC has advantages over the conventional PC technology with regard to thermal efficiency, environmental emissions, and natural resource requirements. Sulfur dioxide (SO_2), nitrogen oxides (NO_x), and particulate matter (PM) emissions are lower; land area and water requirements are less; and coal consumption is less due to the higher thermal efficiency. It has been shown that approximately 96 percent of sulfur that exists in coal can be removed with IGCC technology, which is much better than the requirement of NSPS. Moreover, the removed sulfur compounds will be converted to marketable H_2SO_4 and sold for off-site uses. It has also been shown that NO_x emission rates for the IGCC plant are approximately half of those for the PC plant. At Polk Unit 1, the advanced CT will use nitrogen produced from the air separation unit to control and minimize NO_x emissions during syngas firing.

The 150-MW advanced General Electric (GE) 7F CT unit would be integrated with HRSG and ST generator facilities to form a CC generating unit and with CG facilities to comprise the proposed 260-MW Polk Unit 1.

Texaco's pressurized, oxygen-blown, entrained-flow gasifier would be used to produce a medium-Btu fuel gas. Coal/water slurry and oxygen would be combined at high temperature and pressure to produce a high-temperature syngas. Molten coal-ash would flow out of the bottom of the vessel and into a water-filled quench tank where it would be turned into a solid slag. The syngas from the gasifier would move to a high-temperature heat recovery unit that cools the gases. The cooled gases would flow to a particulate removal section before entering gas cleanup trains. When both the conventional CGCU and demonstration HGCU systems are used, about 10 to 15 percent of the syngas would be passed through a moving bed of zinc titanate absorbent in the HGCU system to remove sulfur. The remaining syngas would be further cooled through a series of heat exchangers before entering a conventional CGCU train where sulfur would be removed by an acid gas removal system. After the demonstration period, these combined cleanup systems are expected to maintain sulfur levels below 0.17 pounds (lbs)/million Btu (95.6 percent capture). The cleaned gases would then be routed to a CC system for power generation. Thermally generated NO_x would be controlled to below 0.10 lbs/million Btu by injecting nitrogen as a dilutent in the CT's combustion section. An HRSG uses heat from the CT exhaust to produce high-pressure steam. This steam, along with the steam generated in the gasification process, would be routed to the ST to generate an additional 70 MW. The heat rate for the IGCC unit is expected to be below 8,500 Btu/kWh (more than 40 percent efficient). By-products from the process—H_2SO_4 and slag—can be sold commercially, the H_2SO_4 by-product as a raw material to make agricultural fertilizer and the nonleachable slag for use in roofing shingles and asphalt roads and as a structural fill in construction projects. The advanced CT unit would have a generating capacity of 190 MW when fired on the syngas and operated with the addition of nitrogen gas from the air separation unit. To provide required flexibility in the event of unanticipated disruptions in the delivery of coal or unplanned unavailability of CG facilities, the facilities would maintain the capability to fire low-sulfur No. 2 fuel oil as backup fuel and to be operated in a CC mode. Polk Unit 1 is scheduled to be operational in July 1996 in order to meet Tampa Electric Company's baseload power resource needs as approved by FPSC.

Air emission controls for the advanced CT of Polk Unit 1 when operated in the CC mode and fired on the backup low-sulfur No. 2 fuel oil would be a combination of measures: SO_2 emissions would be controlled by the use of low-sulfur content fuel; NO_x emissions would be reduced by water injection to control the combustion temperature and thus limit NO_x formation. Carbon monoxide (CO), volatile organic compounds (VOCs), and PM less than or equal to 10 micrometers in diameter (PM_{10}), and trace elements would be controlled primarily by the fuel oil characteristics and by the efficient design and operation of the CT unit.

Polk Unit 1 would contain the following major systems and processes:

- Coal grinding and slurry preparation
- Air separation unit
- Gasification system
- Slag handling and storage
- Syngas scrubbing and cooling systems
- Gasification process black-water handling and brine concentration system
- Acid gas removal unit
- HGCU system
- H_2SO_4 plant
- Power production

Figure 2.3.3-1 shows an overall block flow diagram of these major systems and processes. Each of these systems will be described in detail below.

<u>Coal Grinding and Slurry Preparation</u>

The coal grinding and slurry preparation system for the IGCC unit prepares coal for input to the gasifier. The proposed grinding mill would be a conventional rod-type system with an overflow discharge of slurry. In operation, coal from the coal storage silos would be fed to the grinding mill with recycled process water and makeup water from the water supply system. The grinding mill may also be fed fine coal recovered by the

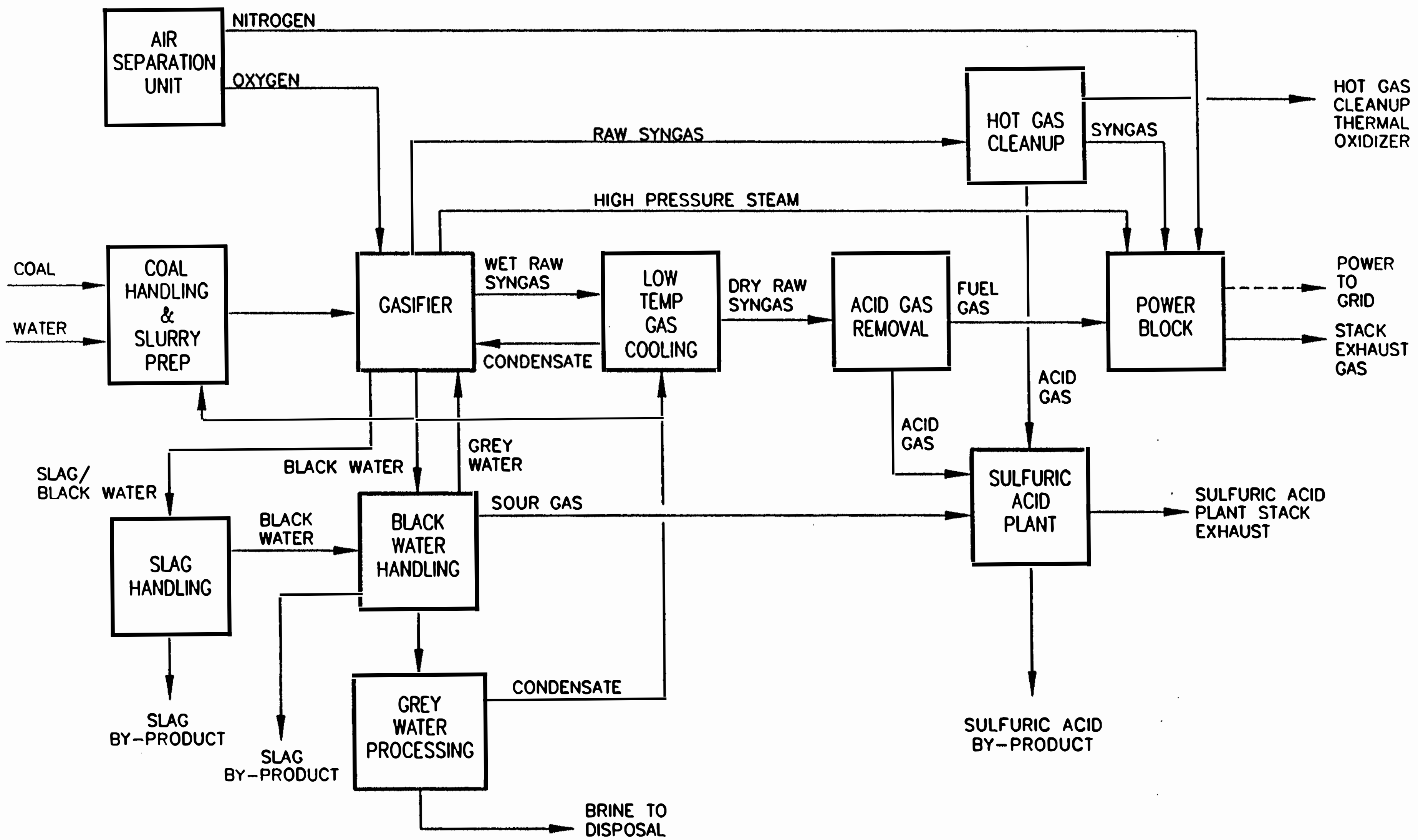

FIGURE 2.3.3-1.
Generalized Flow Diagram of IGCC Systems and Processes.

SOURCES: ECT, 1992; TEC, 1992a; Bechtel, 1994.

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dust collection system. Ammonia (NH_3) may be added for pH adjustment, if necessary. A slurry additive for reducing viscosity would also be pumped to the grinding mill.

The grinding mill would reduce the feed coal to the design particle size. Slurry discharged from the mill would pass through a trammel screen and over a vibrating screen to remove oversized particles before entering the slurry tank (Figure 2.3.3-2). Oversized particles will be recycled to the grinding mill. A below-grade grinding sump is to be located centrally within the coal grinding and slurry preparation area to handle and collect any slurry drains or spills in the area. Materials collected in the sump would be routed to the recycle tank for reuse in the process.

Water would be provided primarily by the moisture contained in the coal-fed and/or recycled and grinding sump water. Additional makeup water to the slurry system would come from the overall plant service water system. All process water would be fed to the gasifier and no wastewater would be discharged from the system into the environment. Potential PM air emissions from the coal storage silos, grinding mill, and rod mill overflow discharge are primarily controlled by the wet nature of these subsystems and by the use of enclosures for the subsystems with vents through fabric filters. The grinding sump and slurry tank vents would be equipped with carbon canisters for absorption of hydrogen sulfide (H_2S) or NH_3 emissions.

Air Separation Unit

The proposed air separation unit would utilize ambient air to provide oxygen for use in the gasification system and H_2SO_4 plant recovery unit, and nitrogen for the advanced CT and other plant uses. The addition of nitrogen in the CT combustion chamber has dual benefits: (1) it increases the fuel mass flow rate, which in turn leads to a higher power output, and (2) it helps to control potential NO_x air emissions by reducing the flame temperature, which reduces the formation of NO_x in the combustion process.

In the air separation unit, ambient air would be filtered in a two-stage air filter to remove PM. The first filter stage involves a blanket roll filter; the second filter stage contains removable elements that are periodically replaced. Air then would be compressed in a multistage centrifugal compressor. The compressed air would be cooled, scrubbed in an aftercooler, and then fed to the molecular sieve contaminant absorbers where any remaining water vapor, carbon dioxide (CO_2), and saturated and unsaturated hydrocarbons in the air would be removed. Finally, the air would be filtered in the dust filter to remove any entrained molecular sieve particles. Regeneration of the molecular sieve adsorbent would be accomplished by heating a nitrogen stream in the regeneration heater and passing it through the off-stream bed to drive off the adsorbed contaminants. The regeneration gas would simply be vented to the atmosphere and small amounts of intermittent PM air emissions may result from the venting of the regeneration gas, which would be the only air pollution source in the air separation unit.

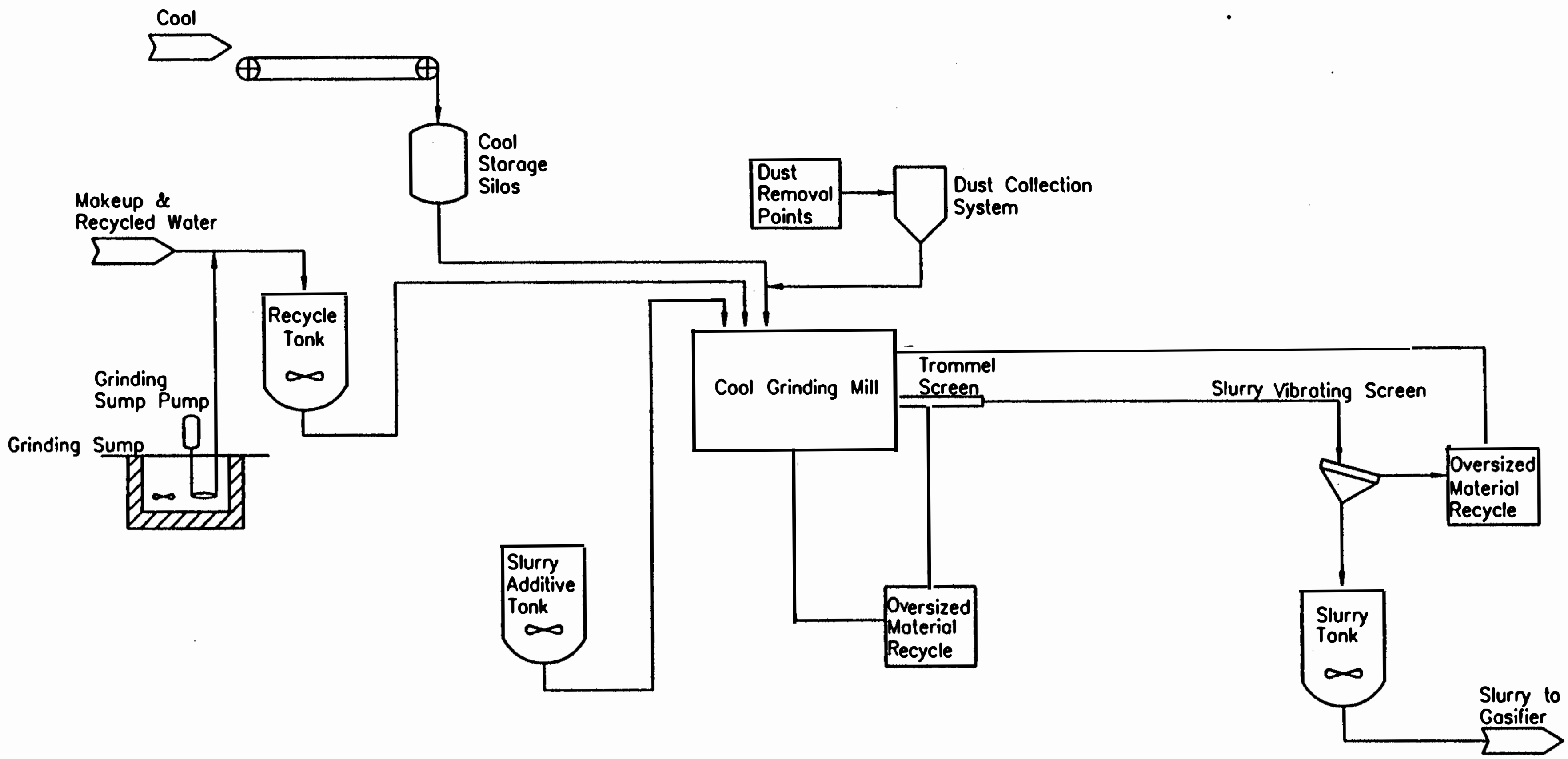

FIGURE 2.3.3-2.
Coal Grinding and Slurry Preparation Schematic.

SOURCES: Texaco, 1992; TEC, 1992a; Bechtel, 1994.

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The purified air would be fed to the cold box where it would be cooled against returning gaseous product streams in a primary heat exchanger (PHX). A small fraction of the air would be extracted from the PHX at its midpoint and expanded through the compressed air turbo-expander to provide refrigeration for the cryogenic process. The cooled, expanded air then would be fed to the low-pressure distillation column for separation.

The remaining air would exit the cold end of the PHX a few degrees above its dew point. The air would be fed to the high-pressure distillation column and then to the low-pressure distillation column, where it would be separated into a gaseous nitrogen vapor and an oxygen-enriched liquid stream. The nitrogen vapor would then be condensed in the high-pressure distillation column condenser against boiling liquid oxygen, and the liquid nitrogen would be used as reflex in the high- and low-pressure distillation columns.

The liquid nitrogen reflux, kettle liquid, and turbine discharge would be fed to the low-pressure distillation column for oxygen and nitrogen separation. Heat from the condensing air vapor would provide reboiler action in the liquid oxygen pool at the bottom of the low-pressure distillation column. The oxygen vapor would be warmed to near the ambient temperature in the PHX and fed to the oxygen compressor, where it would be compressed to the pressure required by the gasification unit. Nitrogen vapor from the low-pressure distillation column would be warmed slightly in a superheater against subcooling nitrogen reflex liquid and then warmed in the PHX. The nitrogen vapor would be compressed and sent to the advanced CT.

As potential backup systems to the proposed air separation unit, liquid oxygen and nitrogen storage systems may be provided. The air separation unit process would neither consume water nor produce or discharge wastewaters. Only minor, intermittent PM would be emitted from venting of the regeneration gas.

Gasification System

Polk Unit 1 would use the Texaco oxygen-blown, entrained-flow gasification system to produce syngas for the advanced CT. Figure 2.3.3-3 shows the schematic of the process flow in such a system. It involves a single-train gasifier that would be capable of converting approximately 2,325 tons per day (tpd) of coal, on a dry basis, to syngas. Coal slurry from the slurry feed tank and oxygen from the air separation unit would be fed to the gasifier and sent to the process burner. The gasifier would be a refractory-lined vessel capable of withstanding high temperatures and pressures. The coal slurry and oxygen would react in the gasifier at high temperatures to produce syngas. The syngas would consist primarily of hydrogen, CO, water vapor, CO_2, and small amounts of H_2S, carbonyl sulfide (COS), methane, argon, and nitrogen. Coal ash and unconverted carbon in the gasifier would form a liquid melt material known as slag.

Hot syngas and slag from the gasifier would flow downward into a radiant syngas cooler, which is a high-pressure steam generator equipped with a waterwall to produce steam and protect the vessel shell. Heat would

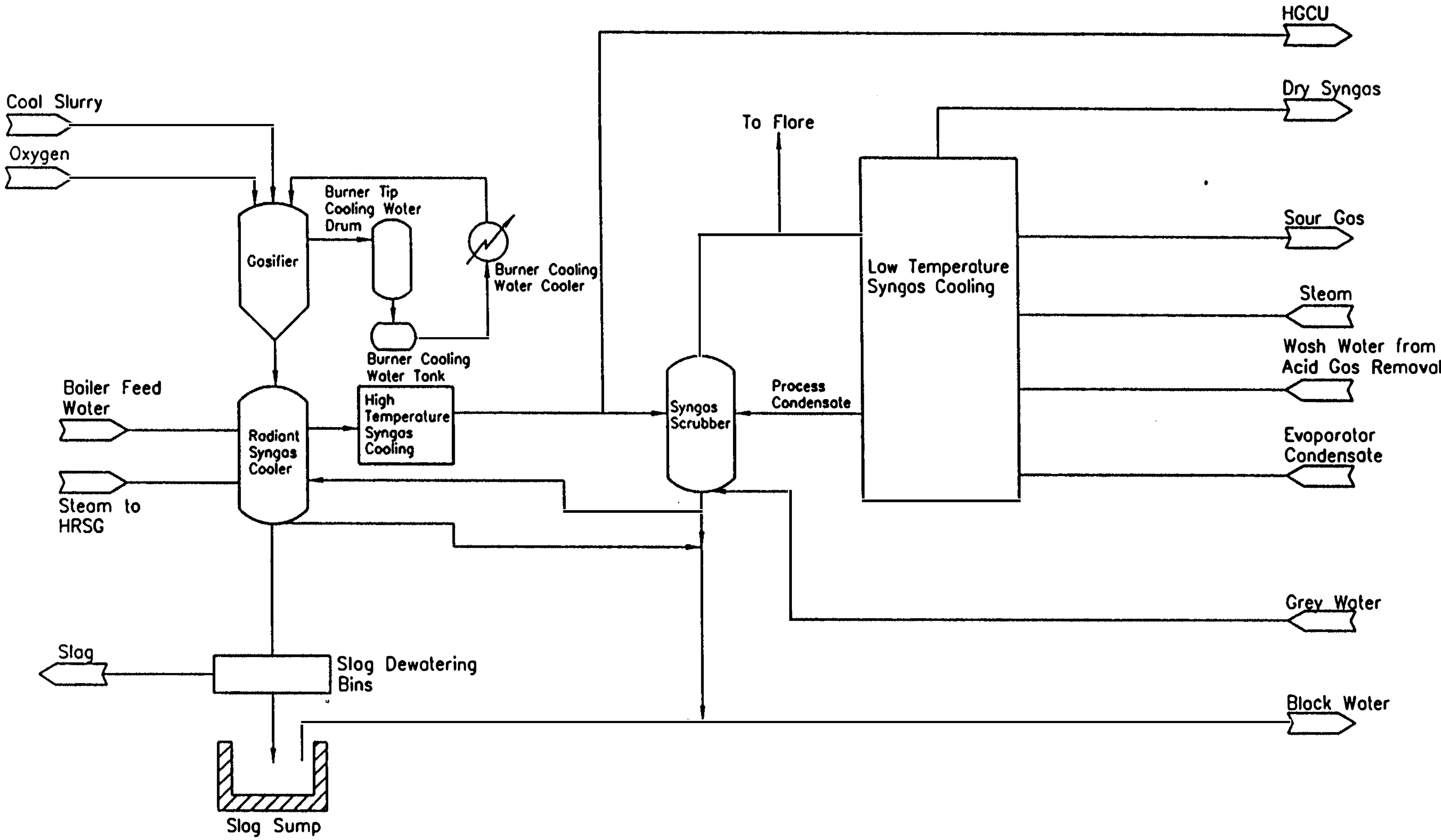

FIGURE 2.3.3-3.
Gasification, Slag Handling, and Syngas Cooling System Schematic.

SOURCES: Texaco, 1992; TEC, 1992a.

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be transferred primarily by radiation from the hot syngas to the feed water circulating in the water wall. High-pressure steam produced in this process would be routed to the HRSG in the power block area, which supplements the heat input to the HRSG and thus increases the efficiency of the generating unit.

The syngas would pass over the surface of a pool of water at the bottom of the radiant syngas cooler and exit the vessel. The raw syngas would then be routed to the high-temperature syngas cooling system for further heat recovery and to the HGCU system. The slag would drop into the water pool where it would then be piped to the slag dewatering bins.

The system would be designed to maintain high-pressure and to control syngas flows, thus, potential air emissions or leaks from the gasifier to the atmosphere would be negligible. The wastewater generated in the gasification system, known as black water, would be piped into the slag dewatering bins together with the slag in the bottom of the radiant syngas cooler. The proposed system for handling and processing the black water is described in Section 2.3.8.4.

Slag Handling and Storage

The slag handling system would be designed to remove ungasified solids from the gasification system. These solids consist of the coal ash and unconverted coal components (primarily carbon) that exit the gasifier in the solid phase. The schematic slag handling process flow also is shown in Figure 2.3.3-3.

In the gasification system, coarse solids and some of the fine solids would be flushed from the radiant syngas cooler and piped to the slag dewatering bins. Two concrete dewatering bins would be provided, so that one bin is always active while the other bin is dewatering and being cleaned out. Water drained from the slag would accumulate in the slag dewatering sump and would be pumped to the black-water handling system. The slag, which is for off-site use, either would be loaded into trucks and delivered immediately or would be transported to an on-site slag storage area (see Section 2.3.10.1) for temporary storage until it can be transported off site.

The system would generate slag at a maximum rate of 210 short tons per day (stpd) on a dry basis; the material generally contains 25 percent moisture. Slag is classified as nonhazardous, nonleachable material and would be marketed and sold for various off-site commercial uses. Water produced in this slag handling system would be collected and routed to the black-water handling system for processing and reuse. Due to the wet nature of the slag and processes, potential emissions of PM from the system would be negligible.

Syngas Scrubbing and Cooling Systems

The raw, hot syngas from the gasifier, which usually contains entrained solids or fine slag particles, would be routed to the separate CGCU and demonstration HGCU systems for appropriate treatment. The CGCU system will be designed to treat 100 percent of the syngas flows for the unit, while the HGCU system will be capable of treating approximately 50 percent of the syngas when the unit is operating at full capacity.

The initial treatment process for the raw syngas within the CGCU system would include the syngas scrubbing and cooling systems. The raw, hot syngas from the gasifier would be fed through the high temperature syngas cooling system to the syngas scrubber, where entrained solids are removed, and then would be routed to the low-temperature gas cooling section and cooled by recovering the useful heat. Meanwhile, much of the water from the syngas would be condensed out prior to routing the syngas to the acid gas removal system. The syngas scrubber bottoms stream would contain all the solids that were not removed in the radiant syngas cooler sump. The solids in the bottom stream would be routed to the black-water handling system.

All water used in the syngas scrubbing and cooling systems would be provided by recycled water streams and all process water streams would be sent to the black-water handling system and/or reused in other CG plant systems. The syngas scrubbing and cooling processes have no potential ambient air emissions.

Gasification Process Black-Water Handling and Brine Concentration System

In the gasification and slag handling systems, the process water would contain fine particles of slag and ungasified solids and is referred to as black water due to its coloration. The black water would also be generated from the syngas scrubber which removes fine particles entrained in the syngas exiting the gasifier.

All black water from the gasification and syngas cleanup processes would be collected, processed, recycled to the extent possible, and contained in its own system. No process water would be discharged to other systems or to the cooling reservoir. The effluent residual generated from processing the black water would be condensed and crystallized into a solid, which consists primarily of salt called brine. This solid waste would be stored in an on-site, appropriately designed, lined landfill with leachate collection and storm water runoff collection and treatment systems.

Acid Gas Removal Unit

After removal of the entrained solids, the syngas would still contain acid gases such as CO_2 and H_2S, which must be removed prior to firing the syngas in the advanced CT unit to control potential SO_2 air emissions. The process flow schematic for the acid gas removal unit in the CGCU system is shown in Figure 2.3.3-4.

In the acid-gas removal unit, the cooled syngas would be water-washed in a water-wash column. Wash water would be pumped to the column to remove contaminants that would potentially degrade the amine from the syngas, and it then would be sent to the NH_3 water stripper. Meanwhile, the washed syngas would flow through a liquid coalescer to collect entrained water droplets and then flow to the amine absorber where the syngas would be contacted by amine. The amine acts as a weak base to absorb acid gases such as CO_2 and

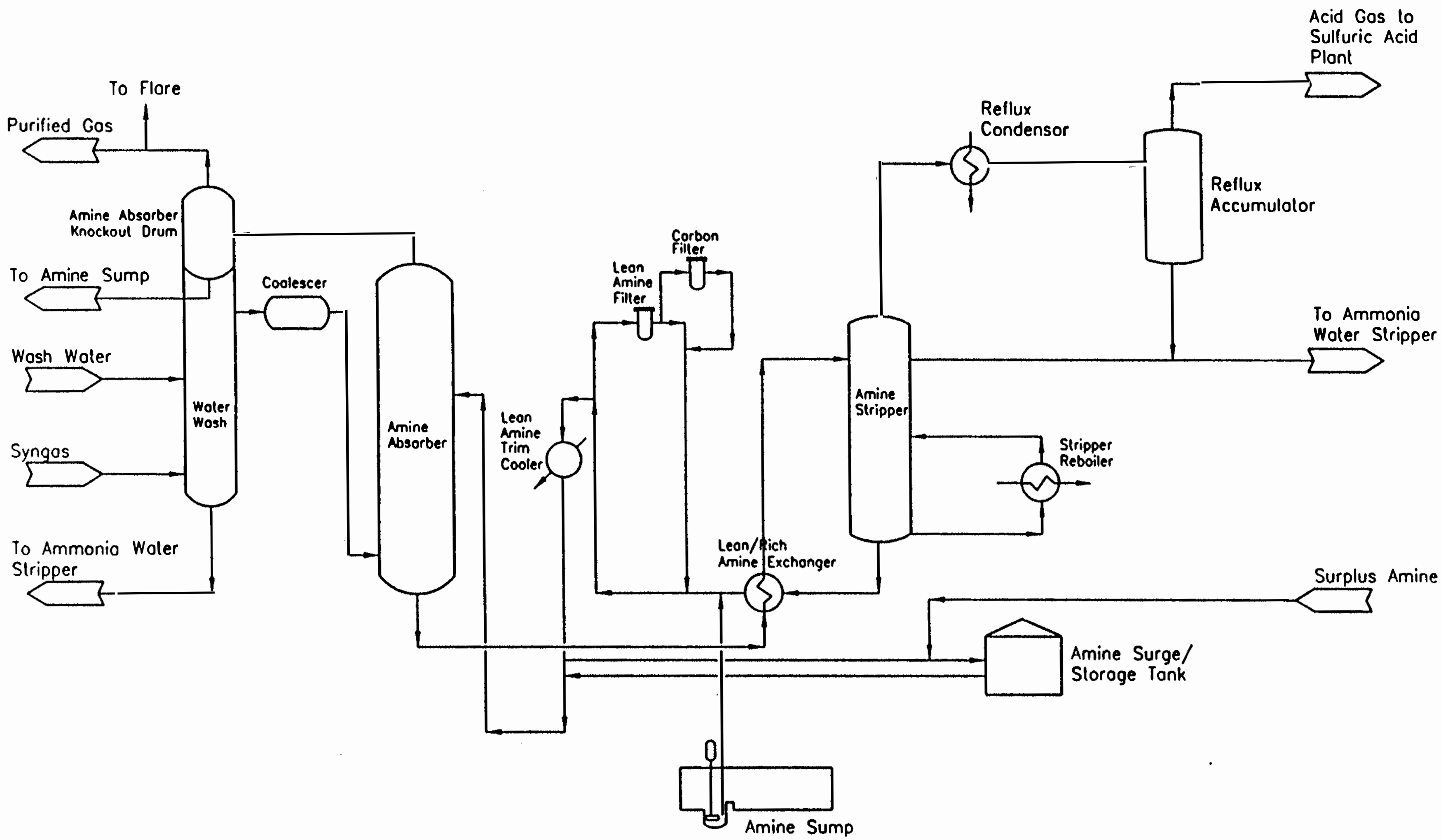

FIGURE 2.3.3-4.
Acid Gas Removal Unit Schematic.

SOURCES: Texaco, 1992; TEC, 1992a.

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H_2S by chemical reaction. After removal of the acid gases, the purified syngas then would flow through a knock-out drum located on top of the water-wash column for the removal of entrained amine, and the recovered liquid would return to the amine sump.

The rich amine would be stripped of the acid gas in the amine stripper by steam generated in the stripper reboiler. The acid gas overhead would be partially condensed by the reflux condenser and collected in the reflux accumulator. The acid gas, primarily H_2S and CO_2, from the reflux accumulator would go to the H_2SO_4 plant, and the condensed liquid reflux would be returned to the amine stripper.

Hot Gas Cleanup System

Figure 2.3.3-5 shows the schematic of the HGCU system. For the system demonstration purpose, a portion of the hot raw syngas would be routed from the gasifier to the HGCU system for cleanup prior to firing in the advanced CT. The description of HGCU and its major subsystems are presented below. The raw, hot syngas from the gasifier would contain entrained solids and/or fine slag particles that must be removed. In the HGCU system, the entrained fine particles in the raw syngas would be removed in the primary high-efficiency cyclone as shown in Figure 2.3.3-5 and recycled to the black-water handling system. The second high-efficiency cyclone would be used to remove the sodium bicarbonate ($NaHCO_3$) introduced upstream for halogen removal. The collected solids from the second high-efficiency cyclone would be sent to the on-site brine-storage area.

The syngas from the second high-efficiency cyclone would be routed to the absorber. A large fraction of the remaining PM entering the absorber would be captured by the bed, reducing the particle concentration to below 30 parts per million (ppm). A small amount of zinc titanate fines would be collected in a high efficiency barrier filter that would practically eliminate all fines larger than 5 micrometers (μm).

Solids from the barrier filter are nonhazardous and would be sent off site for disposal. Larger fines would be sieved on screens at the regenerator sorbent outlet. Fugitive fines from the screens would be collected in a small, low temperature bag filter. The sorbent fines from both collection points would be recycled to the catalyst supplier.

The sulfur-laden syngas from cyclones would enter the absorber through a gas manifold at its bottom and would flow upward, countercurrent to the moving bed of zinc titanate pellets. The sulfur compounds, mainly H_2S, in the syngas would react with the sorbent:

$$ZnO + H_2S \rightarrow ZnS + H_2O$$

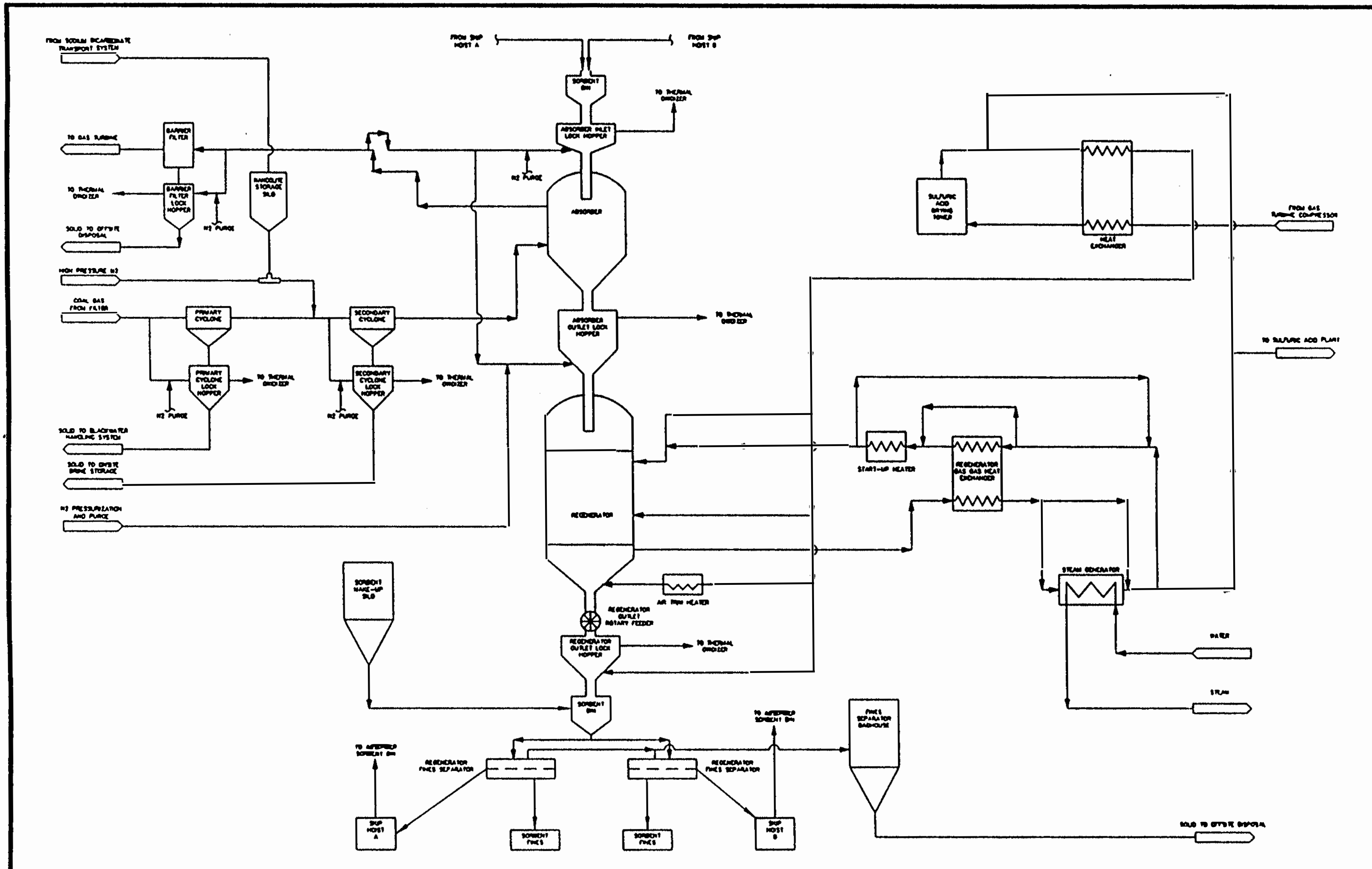

FIGURE 2.3.3-5.
Hot Gas Cleanup System.

SOURCES: GEESI, 1992; TEC, 1992a.

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The absorber bed is stationary at low H_2S outlet concentrations and would be moved upon H_2S breakthrough. The H_2S breakthrough control signal would activate solids flow from the bottom of the absorber into the absorber's outlet lockhopper, causing the bed and the reaction zone to move downward by gravity. The displaced sulfide zinc titanate would be replaced by regenerated sorbent from the absorber's inlet lockhopper. The syngas leaving the absorber is expected to contain less than 30 ppm of H_2S and COS.

The ability to regenerate and recycle the sorbent is essential for hot syngas desulfurization in the HGCU system. The regeneration step would be a highly exothermic oxidation process requiring careful temperature control. Too high a temperature would sinter and destroy the sorbent structure and reduce its capability to react with sulfur in consecutive absorption steps. Conversely, too low a temperature would result in sulfate formation and, again, the loss of reactive sorbent.

The reactor would comprise an upper stage and a lower stage. As the sorbent would move down the reactor, the reaction would proceed in a controlled atmosphere. The nearly continuous sorbent movement would be controlled by the rotary feeder at the bottom of the regenerator. The chemical reactions are:

$$ZnS + 1.5\ O_2 \rightarrow ZnO + SO_2$$

and

$$ZnO + SO_2 + 0.5\ O_2 \longleftrightarrow ZnSO_4$$

The sulfation reaction is reversible, favoring the formation of sulfate at low temperatures in the presence of oxygen at the lower oxidation stage. Sulfide zinc titanate would be fed from the absorber's outlet lockhopper to the top of the regenerator where oxidation of the sulfide sorbent would occur. The sorbent would move down the reactor in concurrent flow with the regeneration gas. The gas temperature would be controlled by adjusting the concentration of oxygen so that no thermal damage would occur to the sorbent in the bed. The control of the oxygen concentration could be achieved by regulating the air to recycled gas ratio. The final polishing phase of regeneration would be accomplished at the lower stage of the reactor where dry air flows countercurrent to the sorbent. This stream would cool the sorbent to a temperature acceptable for downstream equipment, purge the SO_2-rich gas, and ensure complete regeneration. The recycle gas stream would be obtained by mixing the concurrent and countercurrent gas flows.

The regeneration gas recycle would operate in a closed loop with dry air as an input and an SO_2-rich gas as a product output (Figure 2.3.3-5). The regeneration gas recycle loop would be designed as an internal diluent to reduce the oxygen concentration in the air to a desired level without using external diluents such as steam or nitrogen. The use of the recycled gas also would help to enrich the SO_2 concentration of the product stream. The heat exchanger in the recycle loop would be designed to control the stream's temperature at the regenerator inlet. The steam generator would remove the heat from the regeneration reaction by cooling the recycle gas stream. The recycle compressor would operate at a sufficient suction temperature to avoid H_2SO_4 condensation and a regenerative gas heat exchanger would reheat the compressed gas for recycle to the regeneration process. The heat created during the combustion of the sulfur would be transferred to the CC power block by generating steam prior to compression of the recycle gas stream.

Commercial grade $NaHCO_3$ would be used to remove chloride and fluoride species by a direct contact reaction, forming stable salts. These salts would be removed by the secondary cyclone and routed to the secondary cyclone hopper for disposal in the on-site brine disposal area. In operation, $NaHCO_3$ would be injected with a small quantity of high-pressure nitrogen upstream of the secondary cyclone.

During operation, vent gas streams from the HGCU system would be routed to the HGCU thermal oxidizer.

Sulfuric Acid Plant

In the HGCU process, acid gas of high SO_2 concentration would be produced. In the CGCU process, H_2S-containing gases from the acid gas removal unit and the NH_3 stripping unit would be routed through knock-out drums to remove any entrained water. These gases, along with air or oxygen, would be introduced into a combustion chamber for further reactions. Hot gases from the HGCU unit would be introduced into the system downstream of the combustion chamber and mixed with the combusted acid gas from the CGCU unit. Supplemental fuel may be added to maintain the proper operating temperature and the air also may be preheated to reduce the use of fuel and, thereby, the volume of combustion products.

The process described below, which converts these mixed gases into H_2SO_4, involves a multi-step catalytic process based on proven technology in widespread commercial use, especially within the chemical fertilizer industry in central Florida. The liquid H_2SO_4 produced by this process is commercial-grade and would be marketed and sold for off-site uses.

The mixed gases from the CGCU and HGCU systems would be cooled in a waste heat boiler, recovering as much usable energy as possible, and then be quenched (cooled) in a scrubbing tower with a circulating stream of water (i.e., a conventional open spray water tower). Air is added to the process stream to provide the required amount of oxygen for the SO_2 to sulfur trioxide (SO_3) reaction. The gas leaving the cleaning and cooling system and the reaction air would flow to a drying tower for water removal. The gases would then be routed to the main blower, which provides the necessary pressure for flow through the reactor beds and absorber towers.

The gases from the blower then would be heated in the reactor feed/effluent exchangers to achieve the proper reaction temperature and would be sent through catalytic reactor beds. There would be additional heat removal and recovery equipment in the reactor section. The SO_2 concentration would determine the exact location of the various heat exchangers and heaters. An indirect fuel gas heater may be used to supplement the reaction heat for start-up, turndown, or low SO_2 operation. The gases from the reactor would be cooled and sent to the absorber tower(s), where 93-percent acid would absorb the SO_3 from the process gas stream. The high concentration H_2SO_4 would be circulated from the bottom of the absorber tower(s), through the acid cooler(s), and then returned to the top of the absorber tower(s). The gases from the absorber tower(s) would pass through a mist eliminator to remove acid mist and then would be routed to the H_2SO_4 exhaust stack.

The H_2SO_4 unit would be constructed adjacent to the CG facilities on the site. The facilities would contain an aboveground tank to provide temporary storage for H_2SO_4 and appropriate handling and loading equipment. The H_2SO_4 would be transported off site in specially-designed rail cars or trucks. It is estimated that about 77,000 tons per year (tpy) of liquid H_2SO_4 by-product would be produced when the HGCU system is operated to clean up approximately 10 to 15 percent of the syngas for the IGCC unit and the CGCU system is used to clean up the other 85 to 90 percent or when the CGCU system is utilized to clean up 100 percent of the syngas at 100 percent generating capacity.

Power Production

Figures 2.3.3-6 and 2.3.3-7 show the Polk Unit 1 power production system with the advanced CT, HRSG, ST generator, and other key components. In power generation processes, the HRSG would be employed to recover the CT exhaust heat and to generate steam to power the ST. The three-pressure level, reheat, natural-circulation HRSG is designed to produce high-pressure superheated steam for the ST and to reheat the high-pressure turbine exhaust steam for admission into the intermediate-pressure ST. The HRSG also produces intermediate-pressure steam that is combined with high-pressure turbine exhaust steam (cold reheat steam). Low-pressure steam would be generated to supply the CG facilities for process use. The HRSG would receive additional high-energy, high-pressure steam from the CG facilities to supplement the steam cycle power output. No auxiliary firing is proposed in the HRSG system.

The ST would be designed as a double-flow reheat, specifically designed for highly efficient CC operation with nominal turbine inlet throttle steam conditions of 1,450 pounds per square inch gauge (psig) pressure and 1,000°F, with 1,000°F reheat inlet temperature. The initial start-up of the power plant would be carried out on low-sulfur distillate fuel oil and transfer to the use of syngas would occur upon establishment of fuel production from the CG plant.

Under normal operation, syngas and nitrogen obtained from the air separation unit would be fed to the CT. The syngas/nitrogen mixture in the CT combustion chamber would be regulated by the CT control system to limit the NO_x emission levels from the unit. Hot exhaust from the CT would be channeled through the HRSG for heat recovery. The HRSG high-pressure steam production would be augmented by the high-pressure steam

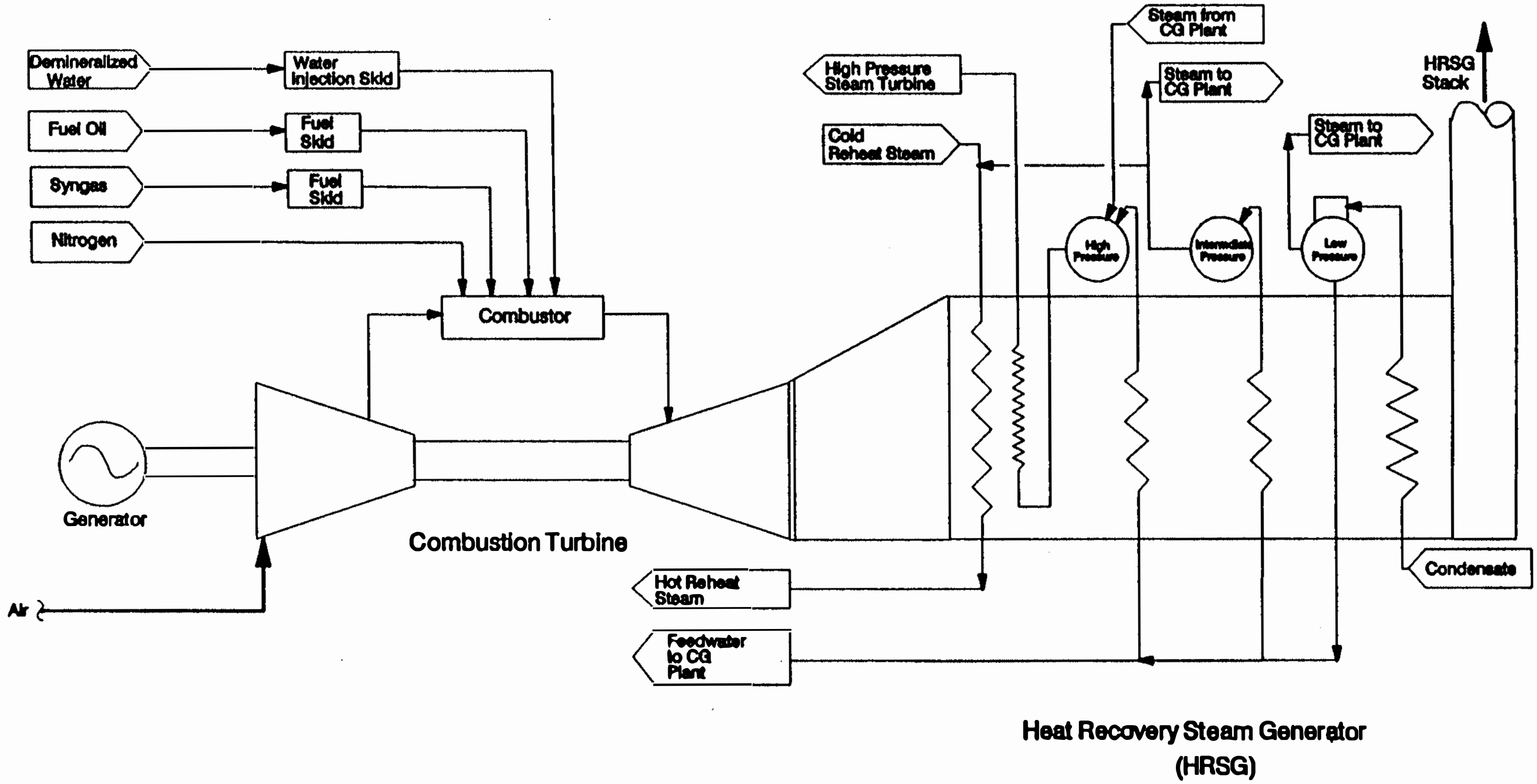

FIGURE 2.3.3-6.
Combustion Turbine Process Flow Schematic.

SOURCE: GE, 1992; TEC, 1992a.

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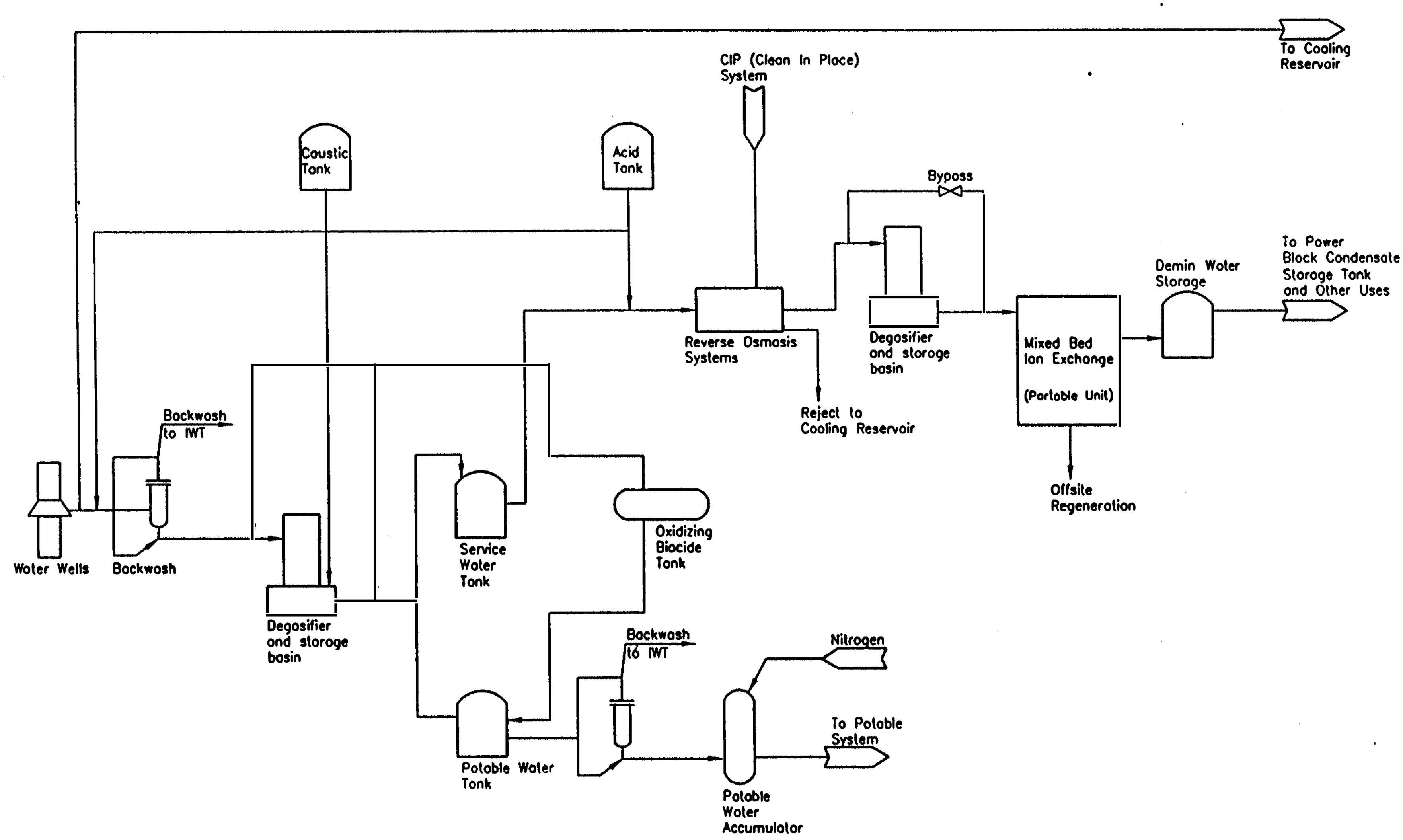

FIGURE 2.3.3-7.
Steam Turbine Process Flow Schematic.

SOURCES: GE, 1992; TEC, 1992a.

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production from the CG plant, and the high-pressure steam would be superheated in the HRSG before being delivered to the high-pressure ST.

Cold reheat steam from the high-pressure ST exhaust and HRSG intermediate-pressure steam would be combined before reheating in the HRSG and subsequent admission to the intermediate-pressure ST. Additional low-level energy integration would occur between the HRSG and the CG plant. Low-pressure steam generated at the HRSG would be routed to the CG facilities for process use, and some low-level waste heat in the CG facilities would be used for condensate heating for the HRSG. Extraction steam from the low-pressure crossover would be available to supplement the HRSG low-pressure steam production for the CG facilities when necessary. The low-pressure turbine would exhaust to a water-cooled condenser that would receive cooling water from the cooling reservoir. Condensate from the ST condenser would be returned to the HRSG/integral deaerator by way of the CG facilities, where some condensate preheating would occur.

Emissions from power production would result from the combustion of fuels in the advanced 7F CT.

2.3.3.3 Combined Cycle Unit Descriptions

As shown in Table 1.2.2-2, the proposed Polk Power Station would include two 220-MW CC units. Each of the CC units is expected to be composed of two 75-MW CTs, two HRSGs, and one ST generator.

Natural gas would be used as the primary fuel for the units. The CTs would be designed with dry, low-NO_x combustors to control NO_x air emissions when firing natural gas. However, NO_x emissions would be controlled by water injection when firing the backup low-sulfur distillate No. 2 fuel oil. SO_2 air emissions from the units would be controlled by the use of fuels with low-sulfur contents (i.e., natural gas with trace sulfur content and/or fuel oil with a maximum sulfur content of 0.05 weight percent). The CTs would also be designed with bypass exhaust stacks to be capable of operating in both CC and simple-cycle modes.

For each CC unit, two HRSGs (one per CT) would be employed to recover exhaust heat from the CTs. The recovered heat would be utilized to produce steam, which would be used to drive the ST generator. The HRSG/ST generator facilities would have a 70-MW generating capacity. The two CC units would be capable (of operating) up to a 100-percent capacity factor annually when fired on natural gas, and up to a 25-percent annual capacity factor when fired on the backup low-sulfur distillate No. 2 fuel oil.

In the CC units, water is required for the steam generating cycle (i.e., boiler makeup and condenser cooling), other plant uses, and air emissions control when fired on backup fuel oil. Water for HRSG boiler makeup, emission control, and other plant processes would be supplied by the treated groundwater withdrawn from the

Floridan aquifer, while water used for condenser cooling would be supplied from and returned to the cooling reservoir.

When fired on backup fuel oil, water would be entirely evaporated when injected into the CTs for NO_x emission control and no wastewater would be created. All process wastewaters from the facilities would be treated, as appropriate, in the on-site IWT system and routed to the cooling reservoir for reuse.

2.3.3.4 Combustion Turbine Unit Descriptions

The proposed Polk Power Station also would include six stand-alone, simple-cycle CT units. The generating capacity of each CT would be 75 MW. Similar to the CTs contained in the CC units, the NO_x emissions for the stand-alone CTs would be controlled by using dry, low-NO_x combustors when firing natural gas, the proposed primary fuel for the units, and by water injection when firing the backup low-sulfur distillate No. 2 fuel oil. SO_2 air emissions from the CTs would be controlled by using low-sulfur fuels (i.e., natural gas with only trace sulfur content and distillate fuel oil with a maximum sulfur content of 0.05 weight percent).

The CT units would be capable of operating up to a 50-percent annual capacity factor when fired on natural gas, and 10 percent when fired on the backup fuel oil. When fired with fuel oil, demineralized water is required for NO_x emission control. Since the injected water would be entirely evaporated in the control process, no wastewater would be generated. Water also is needed in these units for periodic, low-volume uses such as nonchemical cleaning, washdowns, pump and equipment gland seals, and flushes. Wastewaters generated from these uses would be collected and appropriately treated in the IWT system.

2.3.4 Fuel Delivery, Handling, and Storage Facilities

Natural gas, fuel oil, and coal are proposed as the primary fuels to be utilized for operating on-site electric generating facilities. Gasoline and diesel fuels would also be employed to run vehicles and certain other equipment on the site. Propane or liquid natural gas fuel may also be used, but the usage would be small and will not be discussed further.

2.3.4.1 Coal Delivery, Handling, and Storage Facilities

In accordance with its cooperative agreement with DOE under the CCT Demonstration Program, Tampa Electric Company would be required, within a two-year period, to use coal from various sources for Polk Unit 1 and to gather extensive information on the performance of the overall IGCC plant and HGCU system when using various coals. The information would include data on the overall plant efficiency and cost effectiveness in generating electricity as well as environmental data on emission rates and characteristics.

The potential coal supply sources during the demonstration period are expected to be coal seams in the eastern and midwestern United States. Tampa Electric Company will consider and evaluate various sources based on economic, engineering, and environmental factors. Based on its current analyses of potential coal source seams, Tampa Electric Company has determined that coal supplied from the Illinois No. 6 seam that was most representative of coal properties, with margins added for certain properties (i.e., heat content, chlorine, and certain trace elements) to encompass the range of properties expected in other potential coal supply sources. Table 2.3.4-1 shows maximum content analyses for the modified Illinois No. 6 coal that would be used as the assumed coal for the Polk Unit 1 for environmental licensing perspective in terms of potential SO_2 air emissions, amount of coal delivered and used, and by-product volumes. The key properties of coal are the heat content, sulfur content, and ash content. For the assumed coal, on an as-received basis, these parameters are the heat content of 11,035 Btu/lb, sulfur content of 3.05 percent, and ash content of 11 percent. With this assumed coal, the proposed IGCC unit would require nearly 2,325 tpd of coal on a dry basis when operating at full capacity.

Coal Delivery Facilities

Coal would be delivered to the site initially by trucks, with rail delivery by unit trains as a future delivery option. The designed unit trains would include approximately 70 to 100 rapid discharge, bottom dump rail cars, each with a 100-ton capacity. Coal unloading would be implemented when the train moved over an enclosed track hopper. Two unit trains per week would be needed to meet the IGCC's fuel requirements if all coal was delivered by train. Train delivery also would make it possible to deliver coal using the back-haul availability of the various trains that currently transport phosphate from Polk County to terminals on Tampa Bay. Approximately 18 to 22 rail cars dedicated to back-haul coal would be needed for the site on a daily basis.

For the proposed coal delivery by truck only, 80 to 100 truckloads in specialized bottom-dump trucks, each with a 28-ton payload capacity, would be needed each day. To minimize fugitive dust emissions, trucks would be equipped with covers. Coal would be unloaded utilizing the enclosed, abovegrade unloading hopper when the trucks are used.

Coal Handling Facilities

The coal handling system would be designed to receive and transport coal from unit train railroad cars and/or from trucks to the coal preparation system. The major components of the coal handling system are the unloading hopper, the transfer conveyor, the storage silos, and the dust-collection system.

The unloading hopper would be equipped with two outlets with rack-and-pinion slide gates. In operation, the belt feeders would transfer the coal from the hopper feeder to the enclosed unloading conveyor. The enclosed unloading conveyor would transport coal from the unloading structure to one of two storage silos. Coal would be transported from the silos by enclosed conveyors to the coal grinding and slurry preparation facilities.

Table 2.3.4-1. Assumed Properties of Modified Illinois No. 6 Coal

Property	Maximum Content (on as-received basis)
<u>Proximate Analysis</u>	
Moisture	15.00 percent*
Ash	11.00 percent
Sulfur	3.05 percent
Volatile matter	32.20 percent
Fixed carbon	42.20 percent
Heating value	11,035 Btu/lb (minimum)
<u>Ultimate Analysis</u>	
Moisture	15.00 percent
Carbon	58.70 percent
Hydrogen	4.00 percent
Nitrogen	1.11 percent
Chlorine	0.20 percent
Sulfur	3.05 percent
Ash	11.00 percent
Oxygen	7.90 percent
<u>Trace Elements</u>	
Arsenic (As)	12.59 ppm
Beryllium (Be)	4.73 ppm
Cadmium (Cd)	1.93 ppm
Chromium (Cr)	28.00 ppm
Fluoride (F)	81.00 ppm
Mercury (Hg)	0.28 ppm
Lead (Pb)	4.70 ppm

* Minimum moisture content is 7 percent on an as-received basis.

Note: Percentages for proximate and ultimate analyses do not add to 100 percent since assumed properties are based on a combination of contents for several coals.

Sources: TEC, 1992; TEC, 1992a.

Control of particulate emissions from coal-handling operations is essential and would be achieved by a combination of wet dust suppression, equipment enclosures, and dry dust collection systems at all the major dust-emissions sources.

The dust collection systems would be designed to collect coal dust from all coal silo feed and transfer points. Water sprays would be used at the top of the unloading hopper to restrain coal dust. The dust collection equipment would include pulse-jet baghouses, rotary air lock valves, dust return chutes, centrifugal exhaust fans, and control devices. The baghouses would be sized for a maximum air-to-cloth ratio of 6 to 1 at the design air-flow rate and would have a removal efficiency of no less than 99.9 percent.

Coal Storage Silos

An enclosed unloading conveyor would transport coal from the unloading structure up and into one of the two storage silos. A diverter gate and a silo feed conveyor would feed coal to the second, adjacent silo. A dust collection system would be provided at the top of the silos at the conveyor/feeder/silo transfer points.

Each of the two silos would be approximately 55 ft in diameter and 150 ft high and would have a nominal storage capacity of 5,000 tons of coal. The silos would be equipped with explosion panels, N_2 inerting facilities, fire protection systems, and emergency dump gates. The reclaim area between the bases of the two silos would be enclosed and covered to prevent storm water contamination.

Coal would flow from the bottom of the silos and would be transferred by reclaim belt feeders onto one of two enclosed reclaim conveyors. The reclaim conveyors would transport the coal up to the top of the grinding building and into the storage bin with dual outlets. Belt feeders would transfer coal from the storage bin outlets down into the rod mills for wet grinding. Dust collection facilities would be provided at both the bottom of the silos and at the top of the grinding building.

Water from the dust suppression sprays in the unloading structure and any water used for housekeeping wash downs in the unloading structure and silo area would be collected in a separate sump for each area. The water from these sumps would be pumped to the grinding sump in the grinding building and used for makeup water in the grinding and slurry preparation operation.

2.3.4.2 Natural Gas Delivery and Handling Facilities

Natural gas is the primary fuel for the stand-alone CT and CC units. It is estimated that the CC and stand-alone CT units would consume a total of about 11 million cubic feet per hour (ft^3/hr) of natural gas fuel if all units were operating at full load and at a worst-case ambient temperature of 20°F. Natural gas would be delivered to the site via a pipeline from the existing or future natural gas transmission system in the region; thus, on-site natural gas storage would not be needed.

Florida Gas Transmission (FGT) Company has existing gas transmission pipelines in the vicinity of and crossing the western tract of the site. FGT also currently is proposing certain additions to and expansions of its system in the vicinity of the site, and the FEIS for the proposed FGT Phase III pipeline is presently under preparation by Federal Energy Regulatory Commission (FERC). Other pipeline companies (e.g., Sunshine) are also proposing new networks in the area. The proposed pipeline route or alternative routes to the Polk Power Station site have not been determined at this time, since the natural gas supply is not projected to be needed until 1999. Tampa Electric Company is currently evaluating the alternatives for supplying natural gas to the Polk Power Station. Thus, the pipeline route and its impacts on the environment cannot be projected at this time. This issue will be re-examined when permission to build these units is received from FPSC. Once the proposed pipeline route has been determined, Tampa Electric Company will submit appropriate applications and supporting information for agency review and approvals.

2.3.4.3 Fuel Oil Delivery, Handling, and Storage Facilities

Delivering fuel oil to the proposed site via pipelines may be feasible in the future, but it is currently assumed that fuel oil would be delivered to the site by tanker truck and/or railcar. Fuel oil primarily would serve as a backup fuel for the stand-alone CT and CC units and for the advanced CT of Polk Unit 1 in CC mode. It is estimated that a total of 77,000 gallons per hour of No. 2 fuel oil would be consumed by the stand-alone CC and CT units if all units were operated at full load with the worst-case ambient temperature condition (20°F). If the syngas produced from the CG facilities were unavailable and if the CC component of the Polk Unit 1 were fired on backup fuel oil, an additional 13,500 gallons of No. 2 fuel oil would be needed per hour under the same assumed conditions. A typical fuel analysis for the low-sulfur No. 2 fuel oil is given in Table 2.3.4-2.

To ensure the continuous availability of the power generating units, the Polk Power Station would have the capability to receive fuel oil delivered to the site by tanker truck and/or rail. In addition, General American Transportation Corporation currently is proposing to construct a new fuel oil pipeline in or near the site region. The new pipeline would lay parallel to Fort Green Road and the CSX Railroad, adjacent to the eastern boundary of the site. If constructed, fuel oil could be delivered to the on-site fuel oil storage tanks via a pipeline from General American Transportation Corporation's pipeline network. The corridor for this supply pipeline would be located within the boundaries of the Polk Power Station property site and, therefore would not affect off-site land uses or resources.

After the full build-out of the Polk Power Station, the required fuel oil would be stored in three on-site aboveground steel storage tanks. Each tank would be 100 ft in diameter and 57 ft in height and would have a storage capacity of 3 million gallons of fuel oil. The construction of these three tanks would be phased over time to match the demand for fuel oil as additional generating units are developed on site. One tank would be constructed to support the first phase of plant development.

Table 2.3.4-2. Typical No. 2 Fuel Oil Analysis

Parameter	Value
Specific gravity at 60°F (maximum)	0.876
Viscosity, saybolt (SUS*) at 100°F	
Minimum	40.2
Maximum	32.6
Flash point, °F (minimum)	100
Pour point, °F (minimum)	0
Minimum gross heating value, Btu/gal†	
LHV‡	129,811
HHV§	137,600
Approximate Composition	
Normal/iso hydrocarbons, percent by volume	75
predominantly C_{10} to C_{16}	
Aromatic hydrocarbons, percent by volume	15
Phenanthrene	0.26 to 0.3
Naphthalene	0.14 to 0.11
Fluorene	0.07 to 0.10
Anthracene	0.013 to 0.02
1,3,5-5 trimethylbenzene	trace
N-propylbenzene	trace
Ethylbenzene	trace
Xylenes	trace
Toluene	trace
Benzene	trace
Water and sediment, percent by volume (maximum)	0.05
Ash, percent by weight (maximum)	0.01
Sulfur, percent by weight (maximum)	0.05
Fuel-bound nitrogen, percent by weight (maximum)	0.015
Trace constituents, ppm (maximum)	
Lead (Pb)	1.0
Sodium (Na)	1.0
Vanadium (V)	0.5

Note:
* Saybolt Universal Seconds.
† British thermal units per gallon.
‡ lower heating value.
§ higher heating value.

Source: Modified from TEC, 1992a.

To minimize the possible contamination of the area in an event of oil spill accident, an impervious secondary containment system around and under the tank storage area also would be furnished. The storage tank area would be surrounded by a berm to contain any oil spills from the tanks. The berm would be built of earthen materials and would be covered with sealed asphalt or other comparable sealer materials to prevent any spilled fuel oil from penetrating the berm. Moreover, appropriate safeguards and systems to prevent, control, and recover potential spills also would be installed in accordance with federal and state regulatory requirements for aboveground storage tanks.

Storm water runoff from the planned fuel oil storage tank area would be collected and routed to an oil/water separation system designed to reduce any potential oil and grease content in water to a level not exceeding 15 milligrams per liter (mg/L). The removed oil and grease and other sediment would be collected and hauled off site by a licensed contractor for appropriate disposal, and the treated effluent from the oil/water separation system would be routed into the wastewater equalization basin for further treatment.

2.3.5 Air Emission and Control Systems

This section describes the types and sources of air pollutants that would be emitted from the Polk Power Station. Air emissions associated with the proposed facility fall into three categories: combustion emissions, process emissions, and fugitive emissions. The following section also provides descriptions of the planned air emission controls and related systems.

2.3.5.1 Air Emission Sources

Table 2.3.5-1 lists possible pollutant emissions from the proposed facility after the demonstration period. The table includes both pollutant emissions subject to PSD review and pollutant emissions that are a concern because they are either on the Hazardous Air Pollutant list in the 1990 CAA or on the Florida Air Toxics List.

Combustion Emissions

At the proposed Polk Power Station site, the combustion-related air emission sources associated with the IGCC unit (Polk Unit 1) would be the following:

- Advanced CT (GE 7F)
- Auxiliary boiler
- Flare
- HGCU thermal oxidizer

In addition to the Polk Unit 1, the four CTs associated with the two CC units and six stand-alone simple cycle CTs would be combustion sources.

Table 2.3.5-1. Projected Facility Emissions (Page 1 of 2)

Pollutant	Post-Demonstration Emissions (tpy)
PSD Related:	
Particulate matter (TSP/PM_{10})*	519
Sulfur dioxide (SO_2)	3,147
Nitrogen oxides (NO_x)	3,421
Carbon monoxide (CO)	2,541
Ozone/Volatile Organic Compounds (VOC)	399
Lead (Pb)	0.57
Sulfuric Acid (H_2SO_4)	401
Fluorides (F)	1.2
Mercury (Hg)	0.5
Beryllium (Be)	0.03
Total Reduced Sulfur	6.2
Reduced Sulfur Compounds	6.2
Air Toxics:	
†‡Hydrofluoric Acid	1.2§
†‡Hydrogen Sulfide (H_2S)	6.09
†‡Arsenic (As)	0.184
†‡Beryllium (Be)	0.031
†‡Cadmium (Cd)	0.107
†‡Chromium (Cr) (Total)	1.316
†‡Lead (Pb)	0.54
†‡Mercury (Hg)	0.5
†‡Radionuclides	0.004
†‡Nickel (Total)	11.69
†‡Naphthalene	0.301

Table 2.3.5-1. Projected Facility Emissions (Page 2 of 2)

Pollutant	Post-Demonstration Emissions (tpy)
‡Benzo (a) pyrene	0.301
†‡Formaldehyde	2.602
†‡Acetaldehyde	0.301
‡Vanadium	0.043
†‡Selenium	0.050
†‡Manganese	3.259
†‡Cobalt	0.081
†‡Antimony	0.180
†‡Benzene	0.113
‡Ammonia	9.469

* Excludes H_2SO_4. All TSP is assumed to be PM_{10}.

† Included on the 1990 CAA Amendment, List of Hazardous Air Pollutants

‡ Included on the list of Florida Air Toxics

§ Assumed all fluorides converted to hydrofluoric acid

NOTE: This table has changed from the DEIS because of modifications to the design of the proposed facility. See following tables for more detail.

Sources: TEC, 1992a; Bechtel, 1994.

Emissions from the Polk Unit 1 Advanced CT

The primary emission source from the Polk Unit 1 is the combustion of syngas in the advanced CT (GE 7F). In operation, the exhaust gas from the CT would be emitted to the atmosphere via the HRSG stack. Emissions from the HRSG stack are primarily NO_x and SO_2, with lesser quantities of CO, VOCs, PM, and other trace constituents present in the fuel. Table 2.3.5-2 lists the estimated maximum hourly emission rates for this source during the 2-year demonstration and after the demonstration period when fired by syngas and when fired by No. 2 fuel oil.

Emissions from the HGCU Thermal Oxidizer

Vent and purge gas streams from the HGCU system would be routed to and combusted in the HGCU thermal oxidizer. The predicted maximum emissions from the HGCU thermal oxidizer are shown in Table 2.3.5-3.

Emissions from the Auxiliary Boiler and Flare

The oil-fired auxiliary boiler would be operated only during start-up and shutdown of Polk Unit 1, aspiration of the start-up and process burners, and when adequate steam from the HRSG is not available. The boiler would run in a standby mode when steam production is not necessary. The computed maximum emissions from this source are shown in Table 2.3.5-4. Similarly, the emergency flare would be in operation only during gasifier start-up and shutdown or during infrequent, unanticipated interruptions of the gasifier's operating cycles. Emissions from the flare are negligible.

Emissions from the CC and CT Associated Stack

Stack gases resulting from the combustion of natural gas or backup fuel oil would be emitted when the stand-alone CC and CT units are in operation. The principal pollutants in stack gases are NO_x, SO_2, and relatively small amounts of CO, VOC, PM, and other trace elements. The computed maximum hourly emissions rate from each CT when operated in either CC or simple-cycle mode are tabulated in Table 2.3.5-5.

Fugitive Emissions

Fugitive particulate emissions would be generated by materials handling and storage, principally coal and slag. The coal handling and slag systems would be designed to control effectively any fugitive emissions of PM.

Process Emissions

Sulfur compounds present in the syngas would be removed and converted to a salable H_2SO_4 by-product in the H_2SO_4 plant. Exhaust gas from the H_2SO_4 plant is consistent with currently accepted technology, which is used in plants in the Central Florida Phosphate District. The predicted maximum emissions from the H_2SO_4 plant stack are shown in Table 2.3.5-6.

Table 2.3.5-2. Maximum Emissions from the IGCC Unit's CT (all values lb/hr)

Pollutant	Syngas		No. 2 Fuel Oil
	Post-Demonstration*	Demonstration†	
Particulate matter (PM)‡	17	17	17
Sulfur dioxide (SO_2)	357	518	92
Nitrogen oxides (NO_x)	220.25	664	311
Carbon monoxide (CO)	98	99	99
Volatile organic compounds (VOC)	3	3	32
Lead (Pb)	0.0035	0.023	0.10
Sulfuric acid mist (H_2SO_4)	55	55	9.7
Fluorides (F)	0.21	0.21	0.062
Mercury (Hg)	0.0034	0.025	0.0057
Beryllium (Be)	0.0001	0.0001	0.0048
Arsenic (As)	0.0006	0.080	0.31
Cadmium (Cd)	0.0009	0.020	0.020
Chromium (Cr)	0.0004	0.0005	0.17

* Maximum emissions after the 2-year demonstration period, based on emissions achievable with CGCU. Utilization of HGCU to be based on ability to achieve maximum post-demonstration emission rates.

† Maximum emissions during the 2-year demonstration period, based on up to 50-percent utilization of HGCU. Maximum post-demonstration emission rates to be achieved thereafter.

‡ Excludes H_2SO_4 mist.

NOTES: Emission rates of other air toxics for the Post-Demonstration Period are presented in Tables 4.12.2-5 and 4.12.2-6 in Section 4.12.2.
This table has changed significantly from the DEIS because of minor changes in design operating conditions.

Sources: GE, 1992.
Texaco, 1992.
ECT, 1992.

Table 2.3.5-3. Maximum Expected Emissions from the HGCU Thermal Oxidizer

Pollutant	Emissions (lb/hr)
Particulate matter (PM)	1.0
Sulfur dioxides (SO_2)	10.1
Nitrogen oxides (NO_x)	1.8
Carbon monoxide (CO)	1.4
Volatile organic compounds (VOC)	0.8
Lead (Pb)	0.002
Sulfuric acid mist (H_2SO_4)	0.4
Fluorides (F)	0.001
Mercury (Hg)	0.002
Beryllium (Be)	0.001
Arsenic (As)	0.001
Cadmium (Cd)	0.001
Chromium (Cr)	0.105
Hydrogen sulfide (H_2S)	0.4

NOTES: Emission rates of other air toxics are presented in Tables 4.12.2-4 through 4.12.2-7 in Section 4.12.2.
This table has changed from the DEIS because of the 70% to 80% decrease in time use of HGCU system in final design and separation from the H_2SO_4 plant stack.

Sources: Texaco, 1992.
TEC, 1992a.
Bechtel, 1993a.
Bechtel, 1994.

Table 2.3.5-4. Maximum Auxiliary Boiler Emissions

Pollutant	Emissions (lb/hr)
Particulate matter (PM)	7.0
Sulfur dioxide (SO_2)	6.4
Nitrogen oxides (NO_x)	8.6
Carbon monoxide (CO)	5.3
Volatile organic compounds (VOC)	2.6
Lead (Pb)	0.007

NOTES: Emission rates of air toxics are presented in Tables 4.12.2-4 through 4.12.2-7 in Section 4.12.2.
This table has changed significantly from the DEIS because of the increased size of the auxiliary boiler.

Sources: Texaco, 1992; TEC, 1992a; Bechtel, 1994.

Table 2.3.5-5. Maximum Emissions from Individual Stand-Alone CT and CC Units (all values lb/hr)*

Pollutant	Fuel: Natural Gas	Fuel: Fuel Oil
Particulate matter (PM)†	7	15
Sulfuric dioxide (SO_2)	36	53
Nitrogen oxides (NO_x)	35	181
Carbon monoxide (CO)	59	71
Volatile organic compounds (VOC)	10	10
Lead (Pb)	0	0.059
Sulfuric acid mist (H_2SO_4)	4	6
Fluorides (F)	0	0.036
Mercury (Hg)	0.012	0.0033
Beryllium (Be)	0	0.0028
Arsenic (As)	0	0.18
Cadmium (Cd)	0	0.012
Chromium (Cr)	0	0.10

* Emission rates given are for an individual CT in either CC or simple-cycle mode.
† Excludes H_2SO_4 mist.

NOTE: Emission rates of other air toxics are presented in Tables 4.12.2-5 and 4.12.2-6 in Section 4.12.2.

Sources: GE, 1992.
ECT, 1992.
TEC, 1992a.

Table 2.3.5-6. Maximum Expected Emissions from the H_2SO_4 Plant

Pollutant	Emissions (lb/hr)
Particulate matter (PM)	12.8
Sulfur dioxides (SO_2)	45.3*
Nitrogen oxides (NO_x)	9.5
Carbon monoxide (CO)	1.4
Volatile organic compounds (VOC)	0.8
Lead (Pb)	0.002
Sulfuric acid mist (H_2SO_4)	1.3

NOTES: Emission rates of other air toxics are presented in Tables 4.12.2-4 through 4.12.2-7 in Section 4.12.2.

This is a new table not found in the DEIS. It reflects the segregation of the H_2SO_4 plant stack from the HGCU thermal oxidizer.

* Assumes only the CGCU system is operating. When the HGCU and CGCU systems are operating, the maximum emission will be 35.2 lb/hr.

Sources: Texaco, 1992.
TEC, 1992a.
Bechtel, 1993a.
Bechtel, 1994.

Minor, intermittent emissions of gaseous-phase pollutants may also be generated in the gasification plant. The potential sources would be process vents and leaks (fugitive emissions) from equipment such as valves, compressor seals, and flanges. The predominant gaseous pollutants are H_2S and NH_3; however, a small amount of PM may be also emitted from process vents. These emissions would be minimized or eliminated by good operational and maintenance practices.

2.3.5.2 Air Emission Controls

Air emission controls planned for the Polk Power Station are summarized in Tables 2.3.5-7 and 2.3.5-8 for the Polk Unit 1 facility and stand-alone CTs (CC or simple-cycle mode), respectively. Brief descriptions of these are provided below.

<u>**PM and Heavy Metals Emission Controls**</u>

PM and trace heavy metals, such as lead, mercury, and beryllium, potentially would be emitted from the Polk Unit 1 or via fugitive emissions. Controls of PM and heavy metals emissions for the Polk Unit 1 facility would include water scrubbing, use of clean fuels, and good operational practices to achieve efficient combustion.

Water Scrubber

In the CGCU system, a water scrubber to remove PM from the syngas stream would be an integral component of this IGCC process. The scrubbed syngas would be cooled before it entered the acid gas removal system, which would result in the condensation of trace volatile heavy metals and further reduction in syngas particulate levels. The demonstration HGCU technology employs a high temperature barrier filter to remove 99.5 percent or more of the PM contained in the treated syngas stream.

Use of Clean Fuel

The primary fuel for the IGCC unit's advanced CT would be syngas; distillate No. 2 fuel oil would serve as a secondary fuel source when operating in the CC mode. Both syngas and distillate fuel oil are low in ash and sulfur content, which would result in low PM emissions.

The stand-alone CCs and CTs would be fired primarily with natural gas with distillate No. 2 fuel oil as a backup fuel source. PM emissions from the CC and CT units would be negligible due to the low sulfur and ash contents in these fuels.

Fugitive PM Control

The potential fugitive PM emission sources would be the coal and slag handling and storage systems. The coal dust control system would be a combination of controls throughout the coal delivery, handling, and storage systems. The proposed control measures include railcar and truck coal unloading in an enclosed

Table 2.3.5-7. Summary of Air Emission Controls for the IGCC Facility

Pollutant	Fuel Type: Syngas	Fuel Type: Distillate Fuel Oil
Particulate matter (PM) and heavy metals	Low ash/sulfur fuel, efficient combustion--all combustion sources	Low ash/sulfur fuel, efficient combustion--all combustion sources
	Equipment enclosure, fabric filter dust collection, water/chemical dust suppression, paved roads--fugitive sources	
Carbon monoxide (CO) and volatile organic compounds (VOC)	Advanced combustion equipment and efficient combustion--all combustion sources	Advanced combustion equipment and efficient combustion--all combustion sources
Sulfur dioxide (SO_2) and sulfuric acid (H_2SO_4)	Acid gas removal/H_2SO_4 plant--CGCU	Low-sulfur (≤0.05 weight percent) fuel--all combustion sources
	Zinc titanate absorption/H_2SO_4 plant/thermal oxidation--HGCU	
	Low-sulfur (≤0.07 weight percent) fuel--all combustion sources	
Nitrogen oxides (NO_x)	Nitrogen injection--CT, low-NO_x burners/combustion practices--all other combustion sources	Wet injection--CT, low-NO_x burners/combustion techniques--all other combustion sources

Sources: GE, 1992.
Texaco, 1992.
ECT, 1992.
TEC, 1992a.

Table 2.3.5-8. Summary of Air Emission Controls for Stand-Alone CC and CT Units

	Fuel Type	
Pollutant	Natural Gas	Distillate Fuel Oil
Particulate matter (PM) and heavy metals	Low ash/sulfur fuel, efficient combustion	Low ash/sulfur fuel, efficient combustion
Carbon monoxide (CO) and volatile organic compounds (VOC)	Advanced combustion equipment and efficient combustion	Advanced combustion equipment and efficient combustion
Sulfur dioxide (SO_2) and sulfuric acid (H_2SO_4)	Low-sulfur (≤10 gb/scf) fuel	Low-sulfur (≤0.05 weight percent) fuel
Nitrogen oxides (NO_x)	Dry low-NO_x burners	Water injection

Sources: GE, 1992.
ECT, 1992.
TEC, 1992a.

building, coal storage in silos, baghouse particulate control at transfer points, enclosing certain coal conveyors, performing wet grinding in the rod mills, and paving roads within the Polk Power Station site. Moreover, slag would be transported wet in conveyors to minimize or eliminate potential fugitive dust emissions.

CO and VOC Emission Controls

CO and VOC emissions from Polk Unit 1 and the stand-alone CC and CT units would be controlled by using advanced combustion equipment and operational practices to obtain efficient combustion, resulting in low CO and VOC emission rates.

SO_x and H_2SO_4 Mist Emissions Controls

Control of SO_x and H_2SO_4 mist emission would be integrated in the IGCC unit. With the conventional CGCU technology, H_2S and COS present in the syngas as it leaves the gasifier would be removed by using a promoted amine process in the acid gas removal unit. The treated low-sulfur syngas stream, containing about 0.07 weight-percent sulfur compounds, then would be burned in the advanced CT for power production. The removed sulfur compounds would be stripped from the amine solution and converted to H_2SO_4 in the H_2SO_4 plant, which would recover over 99 percent of the plant's inlet sulfur.

Applying the demonstration HGCU technology, H_2S present in the syngas stream would be reacted with zinc titanate sorbent in a moving bed absorber. Regeneration of the absorber would yield a concentrated SO_2 stream, which then would be converted to H_2SO_4 in a H_2SO_4 plant. It is expected that the efficiency of the HGCU technology in removing sulfur would meet or exceed that of the conventional CGCU technology. Any remaining sulfur compounds from the HGCU vents and purges would be combusted to SO_2 in the HGCU thermal oxidizer.

Emissions of SO_2 and H_2SO_4 from the Polk Unit 1 combustion sources would be controlled by using low-sulfur fuels. Sulfur content of treated syngas and distillate fuel oil would be 0.07 and 0.05 weight percent, respectively. SO_2 emissions from the stand-alone CC and CT units would also be controlled by using low-sulfur natural gas and distillate fuel oil. Sulfur content in the natural gas would be less than 10 grains (gr) per 100 standard cubic feet (scf). Distillate fuel oil would contain less than 0.05 weight percent sulfur.

NO_x Emission Controls

The advanced CT in the Polk Unit 1 would add nitrogen produced from the air separation unit to control NO_x emissions during syngas firing. The added nitrogen would act as a diluent to lower peak flame temperatures and reduce NO_x formation. Nitrogen diluent would be injected at levels sufficient to minimize NO_x exhaust concentrations in a manner consistent with the safe and stable operation of the CT. By contrast, water injection would be employed to control NO_x emissions when backup distillate fuel oil is used while the unit is operated in CC mode. NO_x emissions from the remaining IGCC facility combustion sources would be controlled by using low-NO_x burners and/or good combustion practices that reduce NO_x formation.

The stand-alone CC and CT units would be equipped with dry, low-NO_x burners when fired on natural gas. Water injection would be used when the CC and CT units are being fired on backup distillate fuel oil.

2.3.6 Condenser Cooling Water System

The steam electric-generating components of Polk Unit 1 and two CC units require water to cool or condense the exhaust steam from the STs. The cooling water carrying the waste heat returns to the cooling water reservoir where waste heat is ultimately released into the air.

The proposed cooling reservoir would be constructed in areas previously mined for phosphate and currently filled with water. The total size of the reservoir, including the surrounding and internal earthen berms, would be approximately 860 acres. After final contouring and development of the site, the reservoir would be a primarily below-grade facility. The average and maximum elevations of the reservoir's bottom would be about 120 feet National Geodetic Vertical Datum (ft-NGVD) and 123 ft-NGVD, respectively. Under normal operations, the cooling reservoir water level would be approximately 136±0.5 ft-NGVD. The total water surface area is estimated to be 727 acres (3.46 acres/MW of ST generating capacity). The surrounding berms would be 145 ft-NGVD high with a width of 25 ft at the top to provide access for inspection and maintenance. The internal berms would have a top elevation of 141 ft-NGVD and a top width of 17 ft. The ratio of the berm slope is 1:4 (1 ft vertical to 4 ft horizontal) to minimize potential erosion and visual quality effects. Berms will be revegetated and maintained after construction to prevent future erosion.

Intake and discharge structures would be constructed to provide adequate flow channels to allow condenser cooling water to enter and/or leave the reservoir. The required circulating and condenser cooling water flows are nearly 115,800 gallons per minute (gpm) for the Polk Unit 1, including the air separation unit. A total flow rate of 247,000 gpm would be required after the two CC units are in operation.

A cooling water intake structure would be located in the northern portion of the reservoir to supply water to the condenser cooling systems of the ST generating units. The water would be warmed to about 20°F above its intake temperature due to heat exchange during the cooling process. This warmed water would be discharged back to the reservoir at a location south of the intake. The discharged warm water flow would meander through the channelized reservoir, mixing with the cooler water. Meanwhile, the waste heat would be convectively transferred to the surrounding cooler water, and it eventually would be released into the air through radiation, evaporation, and heat transfer between the water and the atmosphere. Therefore, the temperature of the water body at the intake of the cooling water reservoir would always be sufficiently low and ready for reuse.

The cooling reservoir would also be provided with an outfall control device for water quality and quantity management purposes. Surface water discharges from the reservoir are estimated to be 3.1 million gallons per day (mgd) on an annual average basis, which would be routed to the reclaimed lake on the eastern edge of the site and then off site to the Little Payne Creek system.

2.3.6.1 Cooling Water Source and Makeup Systems

Unavoidable water losses, resulting both from naturally occurring processes and from forced evaporative processes, would occur in the cooling water reservoir. Therefore, makeup water would be needed constantly to replenish the reservoir water to maintain it at a normal operating level for optimum cooling efficiency and water quality management purposes. According to the water budget analysis, an annual average makeup water supply of 4.7 mgd would be required to maintain the required water level and water quality conditions in the reservoir under average plant loads. The estimated maximum supply of makeup water required under full plant loads and dry season conditions would be 6.5 mgd. The plant could be operated at this maximum makeup rate for up to a two-month period, during which time the water level in the reservoir may fluctuate about 0.13 ft.

The most significant component of the cooling reservoir makeup water would be groundwater pumped from the Floridan aquifer through the on-site wellfield. To minimize groundwater withdrawals for makeup purposes, the water lost from the cooling reservoir also would be replenished from other water sources, such as: (1) rainfall directly to the reservoir surface; (2) runoff from the surrounding and internal berms; (3) treated wastewater from the sanitary and IWT systems; (4) treated runoff from process unit areas, power block areas, and slag storage area; and (5) groundwater seepage from the surficial aquifer. Table 2.3.6-1 shows the estimated quality of these cooling reservoir makeup water components. The long-term cooling reservoir water quality projections, based on the water quality and flow rates of the makeup streams and the predicted net groundwater seepage, are shown in Table 2.3.6-2. The quality of water in, and hence discharges from, the reservoir are predicted to meet all applicable Class III surface water quality standards. The reservoir water quality is predicted to meet all applicable groundwater quality standards with the exception of iron and color, which are secondary drinking water parameters. These groundwater parameters would cause no adverse impacts on the groundwater quality of the area.

2.3.6.2 Cooling Water Blowdown System

As discussed above, the cooling water reservoir is an important element in the closed loop cooling system. The cooling water reservoir is used for heat dissipation and condenser cooling, which is required in the three proposed generating ST systems (i.e., two 220-MW CC plants and one 260-MW Polk Unit 1). Cooling water from the reservoir also would be used in the air separation unit and other plant auxiliary equipment. As required, the cooling system with the least environmental impacts must be capable of ejecting about

Table 2.3.6-1. Water Quality of Supply Water to Cooling Reservoir (mg/L)

Parameter	Precipi-tation	Equali-zation/ Filtration	Sanitary Waste Treat-ment Plant	Netrali-zation Basin	Floridan Aquifer	Surficial Aquifer
Alkalinity		0	153	74	110	43.7
Aluminum		0	0.15			0
Ammonia		0	2			
Antimony		0				
Arsenic		0			0	0
Barium		0.058	0.092	0.206	0.092	0
Benzene					0	0
Beryllium		0			0	0
BOD_5	0	0	20		0	0
Cadmium		0			0	0.0019
Calcium		23.5	77	85.7	37.1	21.7
Chloride		15.0	76.3	60	13.4	10.4
Chlorine		0	0.2			0
Chromium, total		0				0
Chromium III		0			0	0
Color		13	20	44	20	193
Copper		0			0	0
Cyanide		0			0	0
Dissolved oxygen	8.2	0	0	0	0	0
Fecal coliform			100		0	0.67
Fluoride		0.279	0.44	0.91	0.44	0.67
Gross alpha		0	0	0	0	24.7
Iron		0.127	0.20	0.45	0.20	3.50
Lead		0			0	0.012
Magnesium		8.29	53.1	30.2	13.1	6.65
Manganese		0	0.400		0	0
Mercury		0			0	0
Nickel		0			0	0
Nitrate	0.81	1.717	30	0.582	0.26	0
Nitrite			<1			
Oil and grease		5				0
Organic nitrogen			<2			2.2
pH	5	2 to 6	6 to 8.5	7 to 8.5	7.7	7.7
Phosphorus		0.045	30.1	4.35	0.071	6.8
Potassium		2.71	15.3	9.82	4.28	0.944
Radium 226		0.77	1.4	3.13	1	6.5
Radium 228		0	0	0	0	1.1
Selenium		0			0	0
Silver					0	0
Sodium		14.7	80.1	58.8	15.7	8.3
Sulfate		380	155	288	39.5	10.7
Sulfide		1.19	1.88	4.21	0.186	0.63
Surfactants		0.04	0.060	0.134	0	2.2
TDS	2	477	602	580	237	119
TOC		10	17	37	19.6	9.8
TSS		15	20	5		
Zinc		0.009	0.014	0.031	0.0135	0
Flow rate (gpd)	3,190,163	399,445	10,434	647,535	4,709,196	281,712

Sources: ECT, 1992.
UE&C, 1992.
TEC, 1992a.

Table 2.3.6-2. Cooling Reservoir Discharge Water Quality Projections (mg/L) and Water Quality Standards

Parameter	Reservoir Blowdown Quality	FDEP Class III Surface Water Standard	FDEP Class G-11 Groundwater Standard
Alkalinity	162.7	>20.0	
Aluminum	0.0004		<0.2
Ammonia (unionized)	0	<0.02	
Antimony	0	<4.300	<0.006
Arsenic	0	<0.050	<0.05
Barium	0.165		<2.0
Benzene	0	<0.071	<0.001
Beryllium	0	<0.00013	<0.004
BOD	0.7		
Cadmium	0.000149	<0.00117	<0.005
Calcium	68.82		
Chloride	32.0		<250
Chlorine	0.0007	<0.010	
Chromium, total	0		<0.01
Chromium, VI	0	<0.011	
Chromium, III	0	<0.214	
Color	50.49*		15
Copper	0	<0.012	<1.0
Cyanide	0	<0.0052	<0.2
Dissolved oxygen	5.46	>5	
Fecal coliform	0.3	<200	
Fluoride	0.83	<10.00	<4.00
Gross alpha	1.94	<15	<15
Iron	0.627*	<1.000	<0.3
Lead	0.000944	<0.00334	<0.015
Magnesium	24.29		
Manganese	0.0012		<0.050
Mercury	0	<0.000012	<0.002
Nickel	0	<0.163	<0.1
Nitrate	1.53		<10.0
Nitrite	0		<1.0
Oil and grease	0.56	<5	
Organic nitrogen	0		
pH	7.8	6 to 8.5	6 to 8.5
Phosphorus	1.493		
Potassium	7.83		
Radium 226	2.48	<5	<5
Radium 228	0.09	<5	<5
Selenium	0	<0.005	<0.05
Silver	0	<0.00007	<0.1
Sodium	33.72		<160.0
Sulfate	146.03		<250.0
Sulfide	0.89		
Surfactants	0.202	<0.500	<0.5
TDS	478.1	<826.0†	<500.0
TOC	34.18		
TSS	10.90		
Zinc	0.024	<0.110	5.0

Note: Blowdown = 3.10 MGD.
Average makeup = 4.71 MGD.
Maximum makeup = 6.50 MGD.
Water level = 136 ft-NGVD.

Hardness = 104 mg/L.
Fecal coliform in MPN/100 mL.
Color in pt-co.
Radium 226, 228 and gross beta in pCi/L.

† TDS standard calculated from conductivity standard.
* Violation of secondary drinking water standard.

Source: Modified from TEC, 1992a

2.47×10^9 Btu/hr of thermal energy on a continuous basis and must be able to supply cooling water to the condenser at a temperature less than 95.6°F under worst-case conditions.

To maintain the reservoir water quality in compliance with Florida surface and groundwater standards and base flow in the Little Payne Creek system, an outfall control structure (Outfall 001) would be located at the northeast corner of the cooling water reservoir for blowdown discharges from the reservoir to the Little Payne Creek drainage system. The discharges would prevent trace metals, solids, and other constituents from accumulating in the reservoir. The continuous blowdown structure would be an orifice with an invert elevation of approximately 133.8 ft-NGVD. It would convey approximately 3.1 mgd of discharge water from the reservoir at the operational water level of 136.0 ft-NGVD.

In addition to the blowdown discharge control structure, a 10-ft wide rectangular weir and a 200-ft wide emergency spillway would be constructed to provide drainage control during extreme storm events in compliance with applicable FDEP and SWFWMD requirements. The 10-ft wide weir structure would allow storm water to overflow when a storm event is greater than 7.2 inches. The overflow elevation of the weir would be 136.6 ft-NGVD. The weir would not provide the function of reservoir water discharge under normal operation unless a rainfall event of greater than 7.2 inches occurred on site. The overflow elevation of the emergency spillway would be approximately 140.0 ft-NGVD.

2.3.7 <u>Potable/Process Water Systems</u>

Water for potable, process, and cooling reservoir makeup necessary to operate the proposed power station would be provided by withdrawing groundwater from the Floridan aquifer through on-site wells. It is estimated that the total groundwater withdrawals for potable, process, and cooling water makeup uses are about 9.3 mgd on a maximum daily basis and 6.6 mgd under average annual operation after full site build-out. The on-site wellfield would consist of two 10-inch and two 24-inch production wells that would be screened within the Floridan aquifer. Table 2.3.7-1 summarizes the major monthly average and maximum water demands for service water, demineralized process water, and cooling reservoir makeup water.

The estimation for the water demands mentioned above were based on the use of water injection for NO_x control in the stand-alone CC and CT units when they are being fired with the backup fuel oil. When the CC and CT units are being fired with natural gas, water injection for NO_x control is not needed and the daily water demands would be lower.

2.3.7.1 Potable Water Uses and Volumes

The potable water system at the proposed Polk Power Station would be designed to provide water for drinking, sanitary facilities, safety showers, and eyewash stations. Potable water needs are estimated to be

Table 2.3.7-1. Process Water Demands

Water Use	Monthly Average Water Demand (gpd)* IGCC Only	Monthly Average Water Demand (gpd)* Full Build-out	Monthly Maximum Water Demand at Full Build-out (gpd)†
Service Water			
Non-chemical cleaning	400	1,200	7,200
Low volume uses	72,000	108,000	108,000
Demineralized Water			
Advanced CT/CC components of IGCC unit	251,000	251,000	279,100
Gasification makeup	82,700	82,700	91,900
CC units	--	513,300	733,810
Simple cycle CTs	--	280,600	785,400
Water Treatment Units			
Water supply filter backwash	17,300	50,200	81,600
R.O. unit	111,300	375,900	630,000
Potable Water Use	6,500	10,500	10,500
Total Process/Potable Water Uses	541,200	1,673,400	2,727,500
Cooling Reservoir Makeup	4,700,000	4,700,000	6,500,000
Total Water Withdrawn	5,241,200	6,373,400	9,207,200

Note: These numbers are slightly different from those discussed in the text due to rounding and intermittent nonchemical cleanings.

* Assuming average load operating conditions for all units.

† Assuming 100-percent load operating conditions for all units.

Sources: UE&C, 1992; TEC, 1992a.

10,500 gallons per day (gpd) at full build-out for the 210 administrative, maintenance, and operating personnel.

2.3.7.2 Process Water Uses and Volumes

The Floridan aquifer also would provide water to meet process water and cooling reservoir makeup water needs. Process water uses generally fall under one of two categories: service water and demineralized water. Service water would be drawn primarily from the service water storage tank and secondarily from the cooling reservoir. Demineralized water would be drawn from the service water storage tank and would undergo treatment by activated carbon filtration, reverse osmosis (RO), decarbonation, and demineralization using mixed-bed ion exchangers before it is used. These process water streams would total approximately 2.7 mgd (monthly maximum) at full build-out and 100-percent load for all units.

Service Water Uses

The major service water demands would be for nonchemical cleaning of the CTs and low-volume uses. The monthly average service water demand is projected to be about 72,400 gpd for IGCC operation only, and 109,200 gpd at full build-out under average operating plant loads. The major service water uses are discussed in the following sections.

CT Water Washing

CTs can experience a loss of performance in operation as a result of deposits on internal components. A CT compressor wash would be needed up to six times per year to remove these accumulated deposits. The wash water system would consist of a 5,500-gallon water tank and a 60-gallon detergent tank, the volumes needed for each wash operation. The detergent would be used only if hydrocarbons in the inlet air have resulted in oily deposits on the compressor parts, and it would not contain chemicals listed in the Resource Conservation and Recovery Act (RCRA). After use, this wash water would be routed to the IWT system for treatment.

Miscellaneous Low-Volume Uses

Service water would be supplied throughout the facilities for washdown purposes, pump and equipment gland seals, and flushes. Designated hose stations would be located to allow convenient equipment and facility washdowns. Drainage from these uses would enter the IWT system for treatment.

Demineralized Water Uses

The average monthly demineralized water demand is projected to be approximately 0.33 mgd with the only IGCC unit in operation, and 1.13 mgd at full build-out. The demineralized water would be used primarily for the CT NO_x control, HRSG boiler makeup, HRSG chemical cleaning, and gasification syngas cooler water makeup as discussed below.

CT NO_x Control

The advanced GE 7F CT unit and the stand-alone CC and CT units would use No. 2 fuel oil as backup fuel. The primary method to control NO_x air emissions from these oil fired units would be water injection. With this control method, water would be injected into the primary combustion zone of the CTs to reduce the formation of thermal NO_x by controlling the peak combustion temperature. To prevent corrosion and solids deposition on the turbine blades, high purity water would be required. Because all the injected demineralized water would be evaporated in the process, no wastewater would be generated.

HRSG Boiler Makeup

To prevent corrosion or scaling when operating the HRSG boiler of the IGCC and CC units, steam cycle water would be treated with an oxygen scavenger for dissolved oxygen control and with amines or NH_3 for pH control. Trisodium phosphates and disodium phosphates also would be fed to the cycle to react with calcium hardness. The steam drums on the HRSGs would have intermittent and continuous blowdowns of up to 1.5 percent of the HRSGs feedwater to control the water chemistry. Thus, demineralized water is needed to replenish blowdown water loss.

HRSG Chemical Cleaning

The HRSG components of the Polk Unit 1 and CC plants would be chemically cleaned once at commissioning and then every 5 years, as necessary. The likely chemical cleaning procedure would be an alkaline cleaning followed by passivation and rinse. Each of the cleaning steps would involve the use of 1.5 times the HRSG water volume (filled to top of steam drum). The solutions would be dumped into a chemical cleaning water holding tank for subsequent transport to an off-site permitted disposal facility.

Gasification Process Water Makeup

Makeup water is needed to restore the water lost from various gasification process streams within the CG facilities, such as the water lost to grey water blowdown.

2.3.7.3 Fire Protection Water

The proposed fire protection water system is designed for 6,000-gpm flow. The main piping loops would be located around the gasification area, fuel oil storage area, fuel unloading areas, and coal storage area; the loops would extend in phases as additional CC and CT units are affixed.

Fire protection water would be drawn from the cooling reservoir, as needed. From the reservoir, the electric-driven pumps (or, for back-up or emergency, secondary diesel-driven pumps) would deliver the fire protection water. These pumps would use separate fuel sources and would have both manual and remote start options.

2.3.7.4 Potable/Process Water Treatment Systems

The cooling reservoir makeup water would be pumped from the Floridan aquifer directly to the cooling reservoir, which needs no treatment. Initial treatment of the potable water, service water, boiler feedwater, and process water would consist of degasification and filtration. The integrated potable water and process water treatment systems are illustrated in Figure 2.3.7-1.

To improve the efficiency of the degasifier, raw water from wells would be injected with H_2SO_4 to lower the pH, and if necessary, sodium hydroxide might be added to water in the degasifier surge well to return the water to the proper pH value (6 to 9). An oxidizing biocide would be added to the water to prevent biological growth and remove any residual H_2S prior to the water being pumped to a pressure filter skid, which is used to remove suspended solids from the total treated water supply stream.

After filtration, the water would be split into two streams: one for potable water and one for process water. The potable water stream would be directed to a storage tank possessing a one-day supply capacity of potable water (10,500 gallons). A 0.2-mg/L residual chlorine concentration would be maintained in the storage tank. Potable water would be pumped from the storage tank through an activated carbon filter and distributed for domestic uses.

Process water would be directed to the service water storage tank, which would be sized to provide eight hours of storage for service water and demineralized water uses. A residual chlorine concentration of 0.1 ppm would be maintained in the storage tank. The proposed demineralized water treatment system would consist of activated carbon filtration, RO for primary demineralization, common atmospheric decarbonation, and ion exchangers to meet the required high water quality requirements. The components of the demineralized water treatment system are described below.

Activated Carbon Filtration

Activated carbon filters would be used to dechlorinate the makeup water. The backwash water from the carbon filters would be routed to the wastewater equalization basin for treatment in the IWT system.

Reverse Osmosis

The primary function of RO would be to demineralize the filtered raw water. The RO unit would be designed to in lude per ent re overy of perme te flow nd per ent reje tion of solids to the on entr te stre m The RO reject water would be sent to the cooling reservoir.

Atmospheric Decarbonation

To remove carbonate from the primary demineralizer effluent, an atmospheric decarbonator would be used. The decarbonator is sized for a hydraulic loading of 25 gallons per minute per square foot (gpm/ft^2), plus a

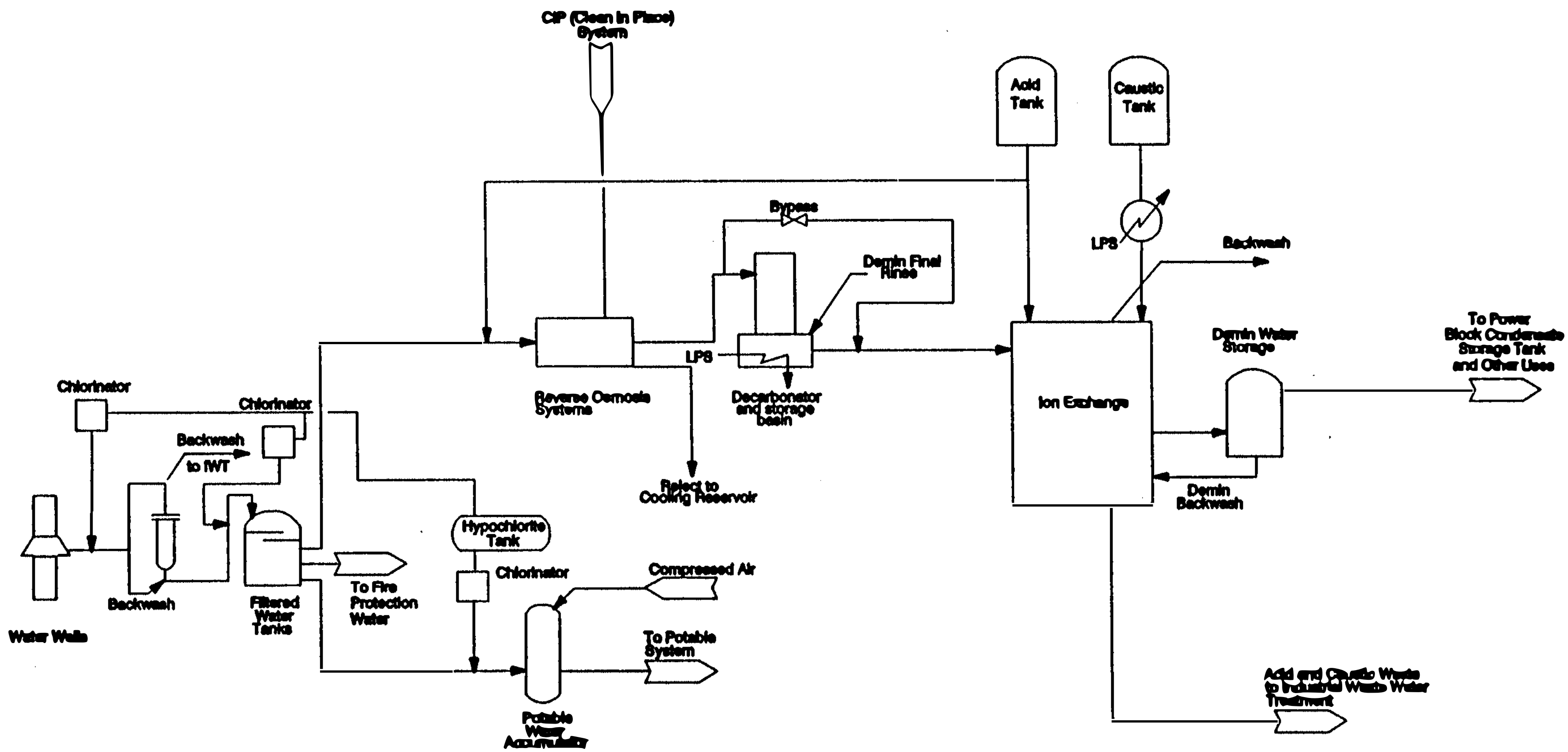

FIGURE 2.3.7-1.
Potable Water and Process Water Treatment Systems.

SOURCES: ECT, 1992; TEC, 1992a.

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minimum retention time in the clearwell of 5 minutes. From the decarbonator, the flow would be split to the two mixed-bed demineralizers for further demineralization.

Ion Exchange Demineralization

The mixed-bed ion exchange demineralizer would remove dissolved solids to achieve the required water specific conductivity of 0.1 micromhos per centimeter (μmhos/cm). The mixed-bed demineralizers would be portable units and regenerated off site.

2.3.8 Wastewater Treatment Systems

The proposed Polk Power Station project has been designed to maximize the recycling and reuse of water in order to minimize groundwater withdrawals and water discharges. Except for the CG process water, the treated wastewaters from other plant processes and systems would be routed to the cooling water reservoir for reuse in the recirculating water cooling system.

An IWT system would be constructed on site to collect and appropriately treat the process and service wastewater and storm water runoff and washdown from the equipment and materials storage areas. This wastewater is expected to be considered nonhazardous by either listing or characterization. The treatment strategy is to collect wastewater at its source, pretreat it if necessary, and direct it to the wastewater equalization basin and/or filtration system prior to discharge to the cooling reservoir and reuse. The proposed IWT system would include the following basins and units:

- Oil/water separation
- Neutralization
- Diversion box
- Slag runoff retention basin
- Filtration

Table 2.3.8-1 provides a summary of major process wastewater streams. The wastewater equalization basin serves as a collection point for industrial wastewaters in the plant, which would be used to settle any suspended solids and to provide equalization for filtration. The filters further reduce the total suspended solids (TSS) levels in the IWT system effluent to ensure compliance with TSS discharge limits. Table 2.3.8-2 lists effluent guidelines that apply to five categorized wastewaters for steam electric generation facilities.

2.3.8.1 Sanitary Wastewater Treatment

The sanitary wastewater treatment system would 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. Wastewater from the sanitary lift station(s) would flow to

Table 2.3.8-1. Process Wastewater Stream Flows

Wastewater Stream	Monthly Average Wastewater Flow (gpd) IGCC Only	Full Build-out	Discharge To
Switchyard runoff	40,500	40,500	Cooling reservoir
RO concentrate	111,300	375,900	Neutralization sump
Boiler blowdowns	172,000	271,600	Neutralization sump
Miscellaneous low-volume waste	35,000	82,000	Equalization basin
Fuel oil storage runoff	21,900	21,900	Oil/water separation
Transformer area runoff	2,300	2,300	Oil/water separation
Fuel oil unloading runoff	400	400	Spill control, oil/water separation
Process units, IGCC, and CC/CT runoff-washdown (oily-sewer)	72,000	108,000	Oil/water separation
Process units, IGCC, and CC/CT runoff-washdown	55,200	97,400	Diversion box, equalization basin or cooling reservoir
Nonchemical cleaning wastewater	400	1,200	Equalization basin
Makeup water filter backwash	17,300	50,200	Diversion box, equalization basin, or cooling reservoir
Slag pile runoff	37,500	37,500	Retention basin, filtration, cooling reservoir
Waste acid stream	11,520	11,520	Equalization basin
Mixed-bed regeneration waste	0	0	Off-site disposal
Chemical cleaning waste	0	600	Off-site disposal

Sources: UE&C, 1992.
ECT, 1992.
TEC, 1992a.

Table 2.3.8-2. Effluent Guidelines, NSPS Steam Electric Power Generation

Waste Type	Maximum (mg/L)	30-Day Average (mg/L)
Low Volume Waste		
TSS	100.0	30
Oil and grease	20.0	15
Chemical Metal Cleaning Waste		
TSS	100.0	30
Oil	20.0	15
Copper, total	1.0	1
Iron, total	1.0	1
Once-Through Cooling Water		
Total residual chlorine (discharge to maximum 2 hours per day)	0.2	
Cooling Tower Blowdown		
Free available total residual chlorine	0.5	0.2
Chromium, total	0.2	0.2
Zinc, total	1.0	1.0
Priority pollutants	No detectable amounts	
Coal Pile Runoff		
TSS	<50	
pH	6.0 to 9.0	

Sources: EPA NSPS, 40 CFR 423.15, TEC, 1992a.

an activated sludge package treatment unit. Aeration air would be supplied by blowers to provide oxygen and mixing of the activated sludge for biological metabolism of organic material. Activated sludge would flow by gravity from the aeration basin to the clarifier for solids separation. A portion of the settled solids would be recycled to the aeration basin to sustain the microorganism population. Excess activated sludge would be drawn off and sent to the sludge digester, providing the correct waste-to-recycle ratio.

After proper treatment, the effluent from the sanitary wastewater treatment system would comply with the applicable federal and state standards and would be discharged into the cooling reservoir for reuse. The system would also generate about 1,400 gallons per month of sewage sludge during the treatment process; the sludge would be periodically disposed of off site in a licensed sanitary landfill.

2.3.8.2 Low Volume Wastewater Treatment

The low-volume wastes at Polk Power Station would include equipment area drains, laboratory wastes, boiler blowdown, and makeup water treatment system waste (filter backwash, RO concentrate, and demineralizer regeneration wastes). The filter backwash, RO concentrate, and demineralizer regeneration wastes typically would contain high concentrations of TSS and total dissolved solids (TDS). Boiler blowdown water would contain an oxidizing biocide (e.g., sodium hypochlorite). Equipment area drains and laboratory wastes may contain minimal amounts of various plant chemicals from small leaks or spills.

Low-volume wastewaters would be treated according to the nature of the waste. Boiler blowdowns, laboratory wastes, and RO concentrate stream would be combined in the neutralization sump. The pH of the water would be adjusted to between 6 and 9 before it would be discharged to the cooling reservoir. Filter backwash water from the makeup water treatment unit would be directed to the equalization basin and subsequently filtered.

All oil and water from oil-bearing equipment would be segregated using a combination of curbed and sloped concrete areas with drains that would direct washdown, runoff, minor leaks, and spills into the oil/water separation system through an oily sewer. The oil/water separation system would be designed to reduce the oil and grease content of wastewater to a level that would not exceed 15 mg/L. The removed oil would be directed to a skimmed oil tank for further separation, and water would be returned to the oil/water separator. Sludge from the bottom of the separator and secondary treatment units would be collected periodically by a licensed contractor for appropriate off-site disposal.

2.3.8.3 Metal Cleaning Wastewater Handling

The nonchemical cleaning wastes associated with CT and compressor washing would contain dirt, organic matter, oil, and nonhazardous detergent. This wastewater, which might be generated up to six times per year, would be routed to the equalization basin for subsequent filtration treatment. Chemical metal cleaning would be conducted at plant start-up and infrequently thereafter. Pollutants in the metal cleaning wastes may include variable pH, high TSS, and trace metals such as copper and iron, depending on the boiler tube composition. Spent chemicals and metal cleaning wastes would be taken off site by a licensed contractor for disposal.

2.3.8.4 CG Process Wastewater Treatment

In the CG system, slag flushed from the gasifier to the slag sump tank would be dewatered and conveyed to the slag storage area. The water removed from the slag contains fine particles of slag and is referred to as black water. The syngas scrubber would also generate black water, which contains all the entrained solids not removed by the radiant syngas cooler sump in the gasifier.

Black water from both of these sources would be directed to a vacuum flash drum and a gravity settler, which together would remove nearly all of the suspended solids of black-water feed. The overflow from the gravity settler is referred to as grey water and would be directed to the grey water tank. The solids stream leaving the gravity settler would be routed to a plate/frame fines filter, and the filtrate, which is also referred to as grey water, would be routed to the grey water treatment system. The water in the grey water tank would contain approximately 200 ppm of fine slag solids. Most of the grey water would be reused in the gasification plant for syngas scrubbing or slag flushing; however, some of the grey water would be discharged to the grey water treatment system and processed.

In the treatment system, grey water from the grey water tank and filtrate from the filtrate tank would be preheated and subsequently fed to the grey water evaporator for evaporation. The vapor would then be compressed and used to heat the grey water. The condensed vapor would be stored in an evaporator condensate tank, and any noncondensables, would be sent to the black-water flash condenser.

Concentrated grey water or brine from the grey water evaporator would be pumped to the brine storage tank where it would be heated in the forced circulation evaporator heater and flashed in the evaporator. The overhead vapor from the forced circulation evaporator would be condensed and stored in an evaporator condensate storage tank. The concentrated brine from the evaporator bottom would be stored in a concentrated brine storage tank.

The concentrated brine would be fed into a drum dryer to produce a relatively dry product that would primarily consist of ammonium chloride, with some sodium chloride and ammonium formate. The brine solids would be stored in a secure, on-site solids storage area with a leachate collection system, synthetic liner, and other provisions to prevent the release of brine constituents to the environment.

2.3.8.5 Material Storage Area Runoff, Leachate Collection, and Treatment

Water from the dust suppression sprays in the coal unloading structure and water from housekeeping wash downs in the unloading structure and silo storage area would be collected in sumps in these areas. Water from these sumps would be pumped to the coal grinding sump and used as makeup water in the grinding and slurry preparation operation.

Slag pile runoff would be collected in a lined retention basin and pumped to the filtration system for filtering prior to discharge to the cooling reservoir. The slag pile storage area would be lined with a synthetic material or other low-permeability materials.

Potentially oil-contaminated streams are the fuel oil storage runoff, fuel oil unloading area runoff, transformer area runoff, and oil-bearing equipment area drainage. These waste streams would be collected using segregated diked areas and sumps. Oil-contaminated wastewater would be directed to an American Petroleum Institute (API) type oil/water separator, and the effluent from the separator would possibly be further treated by a dissolved air floatation (DAF) unit. Skimmed oil and froth from both the separator and secondary treatment are collected in a skimmed oil tank for future off-site disposal by an approved contractor or to be used as fuel. Treated effluent would have an oil and grease level not exceeding 15 mg/L, and the wastewater would be pumped to the equalization basin.

2.3.8.6 Condenser Cooling Water

Cooling of the facility's main condensers and miscellaneous components would be achieved by recirculating, noncontact cooling loops. Recirculating water for this application would be withdrawn and subsequently discharged to the on-site cooling reservoir. An oxidizing biocide (sodium hypochlorite or chlorine) would be used to protect the cooling water system from biological growths.

2.3.9 Solid Waste Handling and Disposal

Nonhazardous solid wastes generated by the Polk Power Station would include the following:

- Sanitary wastewater treatment sludge
- IWT sludge
- CG wastewater treatment brine solids
- Water treatment media
- HGCU system wastes
- General wastes and trash

2.3.9.1 Solid Waste Products and Volumes

It is estimated that approximately 1,400 gallons of sludge per month would be generated in the sanitary wastewater treatment plant, assuming 210 operating personnel at full build-out. Sludge from the sewage treatment package plant would be transported periodically off site for disposal.

Sludge and TSS from the IWT equalization and filtration system would be generated. The sludge is expected to be nonhazardous, which would be verified through testing.

CG wastewater treatment brine solids would be generated on site. The concentrated brine solids would be discharged from the brine concentrator at a rate of 26.5 ft^3/hr. The brine solids would be predominantly ammonium chloride, with some sodium chloride and ammonium formate. These three compounds are expected to represent 99 percent of the total brine solids makeup. The remaining 1 percent consists of trace elements present in the feed coal ash, such as aluminum, barium, cobalt, copper, vanadium, and zinc.

Water treatment media, filter media (such as sand), activated carbon, and RO cartridge filters require periodic replacement. Such replacements are not expected to occur more than once every 3 to 5 years. The used media would form another solid waste stream at the Polk Power Station and would be disposed of at an off-site permitted landfill.

The HGCU system is expected to generate sorbent fines from the regenerator, salt from the barrier filter, and solids from the cyclone unit. The approximate amounts of these materials that will be generated follows:

- Salt, 125 pounds per hour (lb/hr)
- Sorbent fines (zinc oxide and titanium dioxide), 25 lb/hr
- Cyclone solids (zinc sulfide, titanium dioxide, carbon), 25 lb/hr

Salt from the barrier filter would be sent to the brine storage area for disposal. The sorbent fines are expected to be reclaimed off-site. The nonhazardous cyclone solids would be transported off site for disposal in a permitted landfill.

General wastes would include miscellaneous plant trash and organic material collected from the cooling water reservoir intake screens. The nonhazardous plant trash would be transported off site for disposal in a sanitary landfill. Small quantities of predominately organic matter collected at the intake would be returned to the reservoir, and inorganic matter would be disposed of as trash.

2.3.9.2 Treatment, Handling, and Disposal Systems

Sludge from the sewage treatment package plant would be transported periodically off site to a permitted facility for disposal. The nonhazardous plant trash would be transported off site for disposal in a sanitary landfill.

Solid wastes generated from the IWT equalization and filtration system are expected to be nonhazardous (which would be verified by testing) and will consist primarily of slag runoff. These solids would be pumped to the slag runoff basin and would be periodically transported off site for disposal in a permitted disposal facility.

The brine concentrator solids and solids from the HGCU system would be deposited in a secure, on-site disposal area consisting of storage cells with a leachate collection system and impermeable liner, in accordance with Chapter 17-701, FAC. The cells would be divided into two categories: inactive and active. Inactive cells would be those in which brine concentrator solids have been placed and covered, in accordance with Chapter 17-701, FAC. The material would be vegetated to prevent erosion. Active cells would be those in which the brine solids are currently being deposited. The brine concentrator solids would be stored in covered roll-off bins until enough solids were collected for disposal. The active cells would be covered by temporary enclosures to prevent contact of the solids with storm water.

Water treatment media, filter media (e.g., sand, activated carbon), and RO cartridge filters would be transported to an off-site permitted landfill for disposal. Solid wastes generated from the HGCU system would be sent to the brine storage area for disposal, reclaimed, or transported off site for appropriate disposal in a permitted landfill.

2.3.9.3 Potentially Hazardous Wastes

As with many major industrial facilities, hazardous wastes would be among the solid wastes generated. Principal sources of hazardous wastes are residuals of maintenance activities and nonresiduals from the main power generation process. The operation of most power generation and ancillary equipment does not generate hazardous wastes, as regulated under Subtitle C of RCRA, although process-related chemicals and other materials containing (typically) small amounts of hazardous constituents are used at generation facilities. Several of the larger-quantity solid waste streams are discussed later in this subsection to explain the hazardous status.

Maintenance activities are expected to generate most hazardous waste requiring management at the proposed power plant. These may include waste oils containing solvent residuals, waste paint and paint thinner, solvents and degreasers, and some expendable components of machinery and equipment, such as batteries.

If the proposed project is implemented, Tampa Electric Company will take steps to minimize the amount of hazardous waste generated. For example, whenever possible, nonhazardous chemicals will be substituted for chemicals that would result in the generation of a waste that is a listed hazardous waste or that has the characteristic of a hazardous waste. Also, efforts will be made to minimize the contact of solid wastes with listed hazardous wastes, because any such mixture will be classified as hazardous wastes (unless it is listed as a hazardous waste exemption). For similar reasons, efforts will be made to minimize the contact of solid wastes with characteristic hazardous wastes. A mixture of a solid waste and one or more characteristic hazardous wastes is also classified as hazardous waste, unless the mixture does not exhibit a hazardous waste characteristic; however, any such nonwaste mixtures are still subject to the land disposal restrictions and documentation requirements of 40 CFR Part 268.

It should be noted that Tampa Electric Company has economic and liability incentives to minimize the generation of hazardous wastes. The disposal of hazardous wastes is costly and a facility can be held liable for the improper transportation, treatment, or disposal of hazardous wastes. Therefore, it is in Tampa Electric Company's best interest to keep hazardous waste generation to a minimum.

Despite the size of the facility, the routine hazardous waste generation rate is expected to be equivalent to a small quantity generator (i.e., between 100 to 1,000 kilograms [kg] per calendar month). However, during periods of shutdown or high maintenance, large quantities of hazardous wastes, i.e., greater than 1,000 kg per month, may be generated.

Container Storage of Hazardous Wastes

Management of hazardous wastes would be consistent with requirements of Title 40, Chapter 1, Subchapter I, CFR, specifically Parts 260, 261, 262, 265, and 268. State of Florida hazardous waste regulations essentially emulate the federal regulations, and the federal citations are used in the following paragraphs.

These wastes would be managed on the site in containers and shipped off site to a permitted waste disposal or recycling facility in accordance with local, state, and federal hazardous waste requirements. Some locations where hazardous wastes would be stored are expected to be fixed (e.g., maintenance shop, paint shop), while other locations may vary according to the need (e.g., pumps requiring degreasing and repair). Satellite storage areas would be selected near the most common hazardous waste generation points, and would be used to store up to 55 gallons of hazardous wastes in each designated drum. When the drum is full, the waste would be transferred to the hazardous waste container storage facility and shipped to a permitted RCRA facility within 90 days. The hazardous waste storage facility would be located near a site roadway to provide easy access to both off-site waste transporters and emergency response personnel.

Under RCRA, it is illegal for small- or large-quantity generators to store hazardous waste on site for more than a 90-day period without being a permitted storage facility. The minimum standards for the management of hazardous wastes at unpermitted storage facilities are outlined in 40 CFR 265. Because maximum accumulation time of hazardous waste should not exceed 90 days, no RCRA permit would be required for the hazardous waste storage facilities at the Polk Power Station. However, requirements of 40 CFR 262 would be applicable to the management of hazardous wastes and the design and operation of hazardous waste storage areas, including the hazardous waste container storage facility. In the unexpected event that storage of hazardous wastes exceeds 90 days at the facility, Tampa Electric Company would apply for an extension or a RCRA permit, as appropriate.

Most requirements applicable to management of hazardous wastes at the proposed plant are referenced in 40 CFR 262. The following referenced requirements from 40 CFR are among those applicable:

- Part 262, Subpart B, which addresses manifesting procedures
- Part 262, Subpart D, which specifies record-keeping and reporting requirements
- Part 265, Subpart C, which specifies preparedness and prevention measures
- Part 265, Subpart D, which specifies contingency planning requirements
- Part 265, Subpart I, which addresses management of containers and layout of storage areas
- Part 265.16, which addresses training requirements
- Parts 265.111 and 265.114, which require removal of all wastes as a closure performance standard

Several of the principal requirements are discussed in more detail in the following paragraphs. Those items included below are those that relate most directly to potential impacts on environmental quality.

Preparedness and Prevention

At the Polk Power Station, hazardous wastes would be managed in a manner that minimizes possibility of fire, explosion, and release of hazardous wastes by using specific equipment, implementing specific communication procedures, configuring storage areas properly, and making pre-arrangements with local authorities involved with responding to emergencies.

Relevant equipment would include alarms or signals at the storage facility and other accumulation locations to warn personnel in case of an emergency associated with hazardous wastes. Telephones would be available to summon on-site and off-site assistance. Fire-fighting equipment and a source of water would be readily available wherever hazardous wastes are stored or accumulated. This equipment would be periodically tested or inspected to ensure that they are in proper working condition. Aisle spacing at all storage areas would be sufficient to ensure access to all containers in emergency situations.

Agreements would be sought with local emergency response agencies to assure that needed assistance would be available if an emergency arose. Examples of such agencies are police, fire fighters, spill responders, and hospitals.

The above procedures would be accomplished to comply with requirements of 40 CFR 265, Subpart C.

Contingency Plan

A contingency plan would be developed to provide guidance on responding to emergencies that might arise involving hazardous waste. The plan would specify equipment and procedures needed to comply with provisions of 40 CFR 265, Subpart D. The following paragraphs indicate the types of information to be included in the Contingency Plan for Hazardous Waste Emergencies.

The following equipment would be available and in proper operating condition in the event of a fire, an explosion, or a release of hazardous wastes from any location within the facility:

- Telephone public address system and two-way hand-held radios for summoning in-plant assistance. Immediate access to all communications equipment would be ensured at all times.
- Telephone system for summoning assistance from state or local emergency response teams, local hospitals, and local police and fire departments, as necessary. Immediate access to all communications equipment would be ensured at all times.
- Fire extinguishers.
- Emergency water system.
- Spill containment and cleanup materials and equipment, including oil-absorbent pads and other oil-absorbing materials and personal protective equipment.

All communications and alarm systems, fire protection equipment, and spill control equipment would be inspected regularly to ensure proper operation in an emergency. In addition, sufficient aisle space and means of egress would be provided to allow for the movement of emergency equipment to and within the hazardous-waste storage areas.

In the event of a fire or explosion involving hazardous wastes, the Emergency Response Plan for the plant would be implemented to contain, control, and extinguish the fire. In the event of a spill or other release to the land or storm water drainage system, any employees who observe the event would take steps to contain or control the spill until additional assistance is obtained. The following sequence of actions are anticipated to be followed in response to a spill, fire, explosion, or other release of hazardous wastes:

- In all cases, the Plant Environmental Coordinator would be the primary Emergency Coordinator. The Emergency Coordinator would activate the on-site communications system in order to direct cleanup activities. In the absence of the Plant Environmental Coordinator, the Supervisor of Plant Operations would serve as Emergency Coordinator until the Plant Environmental Coordinator arrives at the release location.
- The Emergency Coordinator would identify the character, source, amount, and areal extent of released materials by any means appropriate.
- The Emergency Coordinator would determine whether any personnel are in immediate danger and would initiate measures to protect human health and safety.
- The Emergency Coordinator would make arrangements with emergency response teams, police, fire departments, and hospitals to obtain appropriate emergency services.
- The Emergency Coordinator would notify the Tampa Electric Company Environmental Department with information regarding the incident.
- The Emergency Coordinator would supervise cleanup activities at the site, ensuring that all hazardous wastes and contaminated materials are collected and disposed of properly. Emergency equipment would be properly cleaned and serviced before normal operations resume.
- The Environmental Department would notify appropriate local, state, and federal agencies with a written report within 15 days of the event.
- In the event that evacuation is required, an announcement would be made instructing personnel to leave the affected work areas. The routes of evacuation from the hazardous waste storage area would be posted at or near all entrances to the area.

Prior to operation of the Polk Power Station, the following also would be incorporated to develop the Contingency Plan:

- The final arrangements agreed upon with local police, fire departments, hospitals, and emergency response contractor.
- Names, addressees, and phone numbers of all personnel qualified to act as Primary Emergency Coordinators and, as needed, Secondary Emergency Coordinators.
- A readily available listing of emergency contacts that would include, as appropriate, emergency response contractors, police, fire fighters, hospitals or other medical facilities, and regulatory agency reporting contacts.
- List of available emergency equipment, including information regarding where equipment is to be stored or located in the hazardous storage area and, if used, various satellite collection points.
- Evacuation plan.

Copies of the Contingency Plan would be provided to the local authorities to familiarize them with the facility layout, the properties of the hazardous waste handled at the facilities, places where facility personnel would be working with hazardous wastes, entrances to roads inside the facility, and possible evacuation routes.

The plan would contain a procedure for amending the plan as required by 40 CFR 265.54 and guidance regarding reporting sufficient information, per requirements of 40 CFR 265.56(i) and 40 CFR 265.56(j).

Management of Containers

Requirements of 40 CFR 265, Subpart I, would be followed at the Polk Power Station. Among these are requirements that ensure that sound and appropriate containers are used to store hazardous wastes. Other requirements ensure that containers are stored in a manner that will prevent harmful conditions resulting from accidental mixing of leaked or spilled wastes. Periodic inspections would be performed to detect leakage and spillage.

Potentially Hazardous Wastes

Most of the solid waste streams generated at the proposed plant would not contain hazardous wastes. In accordance with 40 CFR 262.11 and 40 CFR 261, the hazardous status of various wastes must be determined. Certain wastes or waste streams may require testing according to the Toxicity Characteristic Leaching Procedure (TCLP).

Some of the waste streams expected at the power plant are described in the following paragraphs. Many wastes would be generated in large quantities and are not expected to be hazardous based on testing conducted on equivalent wastes. The *potentially* hazardous wastes to be generated by the Polk Power Station project include the following:

- Worn gasifier refractory
- Refractory backup brick
- Spent H_2SO_4 plant catalysts
- Rich acid gas removal solvent
- H_2SO_4 by-product
- Acid gas removal solvent filters
- De-activated carbon filter media
- Waste oil

As is noted in the following paragraphs, most wastes would be recycled. Those wastes transported for off-site disposal would be transported to respective hazardous and nonhazardous waste disposal facilities as appropriate.

Worn Gasifier Refractory

Gasifier refractory hot face is the innermost layer of brick in the gasifier. Following extensive use, the brick face would become impregnated with slag and would need to be replaced. The typical composition of the worn refractory material would contain various trace metals that are a potential concern; however, previous extraction-procedure toxicity testing of this material has indicated that the refractory is nonhazardous. Furthermore, the material may be reclaimed and its beneficial use removes it from consideration as a solid waste under RCRA and is therefore not a hazardous waste (40 CFR 261.3(c)(2)(i)).

The total weight of the refractory hot face is approximately 48 tons. The hot face would generally be replaced over a two-year cycle. Start-up conditions may force one early refractory repair or replacement after the first year of Polk Unit 1 operation. It is expected that the hot face refractory would be sold back to the manufacturer for reclamation. Because of its intrinsic value, waste refractory is not expected to be disposed of in off-site landfill facilities.

Refractory Backup Brick

Backup brick, the brick layers located behind the gasifier hot face, consist primarily of aluminum, silica, and iron oxide minerals. Under normal operating conditions, an estimated 27 tons of this material would be returned to the vendor for reclamation or transported every five years for off-site disposal.

Rich Acid Gas Removal Solvent

Amines from the acid gas removal unit, with an inventory of as much as 80,000 gallons, would be returned to the manufacturer for reclamation when replacement is required. Therefore, no waste amine solvent requiring off-site or on-site disposal would be produced.

Acid Gas Removal Solvent Filters

The acid gas removal solvent filters would be changed periodically based on differential pressure buildup. The filtrate would consist primarily of corrosion products and a small amount of degraded amine solvent.

Degraded amine solvent would collect immediately after any event that allows air into the acid gas removal system (e.g., major plant outages). During routine operations, approximately 70 lbs per week of wastes would be generated as a result of filter replacement. The waste filters would be characterized for hazardous constituents and accordingly disposed of at an off-site RCRA hazardous or sanitary waste disposal facility.

De-Activated Carbon Filter Media

De-activated carbon filter media would need to be replaced periodically. The waste filter media would either be transported off site for disposal in an approved facility or sent back to the vendor for reactivation.

Waste Oil

Waste oil would be generated from machinery leakage and from maintenance of machinery and equipment. Much of the leaked oil would be washed into drains connected to the IWT. This oil would be captured in oil/water separation devices and removed to containers. Waste oil generated when machinery is repaired or serviced would be collected in suitable containers and stored prior to recycling or burning on site per the requirements of 40 CFR 267, Subpart E. Oils removed from the power plant would be collected by licensed contractors.

There is potential for waste oil to become commingled with solvents. In this case, the waste would be transported off site for disposal at a facility permitted to accept it, or it would be collected by recyclers permitted to collect contaminated oils.

2.3.10 By-Product Handling Systems

By-products from the CG and syngas cleanup processes would include slag and H_2SO_4. Since the by-products are of commercial value and would be marketed and sold for off-site use, only temporary storage and facilities for handling, loading, and transporting these by-products from the site are needed.

2.3.10.1 Slag

Slag is produced in the CG process, while the fine slag filter cake material is generated in the water scrubbing process used to remove entrained solids from the syngas. Slag material is a vitrified or glass-like solid that is nonleachable.

Slag formed in the gasifier would consist of coal ash, unconverted carbon, and trace elements contained in the coal. This material would be generated at a maximum rate of 210 stpd, dry weight. The slag would contain approximately 25-percent moisture and have a density of 90 pounds per cubic foot lb/ft^3. The silt content of less than 200 mesh slag material is 1 to 8 percent. Fine slag produced by the syngas scrubbing system would be generated at the maximum rate of 60 stpd dry and would be approximately 50-percent moisture with a bulk density of approximately 70 lb/ft^3. The fine slag would have 80- to 90-percent silt content for the less than 200 mesh material.

The slag by-product is salable as an abrasive, a roofing material, an industrial filler, an aggregate for concrete, or a road base material. On-site temporary storage would be provided in the event the slag cannot be immediately sold.

Initially, an area would be developed with the capacity of storing slag generated from the operation of Polk Unit 1 at full capacity for 2.5 years. An additional 2.5-year-storage area would be developed adjacent to the initial area as needed. The temporary slag storage area indicated on the site layout in Figure 2.3.2-1 would provide sufficient capacity to allow the development of storage cells for slag produced from Polk Unit 1 operations at 100-percent capacity for up to five years.

The slag storage area would consist of a storm water runoff collection basin and a surrounding berm to prevent runoff from the area. Both the slag storage area and the runoff collection basin would be lined with a synthetic material or other materials with similar low-permeability features. The runoff basin would be designed to contain runoff water volumes equivalent to 1.5 times the 25-year, 24-hour storm event. Water collected in the runoff basin would be routed to the IWT system for filtration.

Tampa Electric Company has a contract in place for the sale of the slag, and will continue to actively market this by-product. There is no reason to expect a change in the market for slag in the foreseeable future because of its many commercial uses. Tampa Electric Company has historically been successful in selling all the slag it produces in its coal-fired power plants.

2.3.10.2 Sulfuric Acid

Treatment of the offgases from the HGCU and CGCU systems would involve the production of liquid H_2SO_4 in an on-site plant. The H_2SO_4 is a by-product that would be sold for off-site commercial uses. The H_2SO_4 by-product is used extensively by the nearby phosphate industry, primarily in the production of phosphoric acid. Tampa Electric Company has already secured a contract for the sale of the H_2SO_4. Operation of the acid plant may produce up to 77,000 tons of H_2SO_4 annually. The H_2SO_4 would be stored temporarily on site in an aboveground tank or in specially designed rail cars prior to off-site shipment. These tanks would provide for up to 5 days of temporary on-site storage capacity and would comply with applicable rules for mineral acids (Chapter 17-767, FAC). Storm water runoff from the H_2SO_4 storage, handling, and loading areas would be collected and directed to the IWT system for appropriate treatment prior to being routed to the cooling reservoir for reuse.

2.3.11 Site Drainage

The proposed project site, though significantly altered by the phosphate mining activities, is drained by three streams: the South Prong Alafia River, Payne Creek, and Little Payne Creek. The South Prong Alafia River is a tributary of the Alafia River, which flows into Hillsborough Bay; Payne Creek and Little Payne Creek are tributaries of the Peace River, which flows into Charlotte Harbor.

The proposed project development would restore the drainage basin boundaries and on-site basin acreage to premining conditions. The proposed post-reclamation/development drainage basin boundaries and topography are shown in Figure 2.3.11-1.

To alleviate the existing mining impacts and to minimize the potential hydrologic impact from the proposed project, the Polk Power Station on-site drainage plan is designed to detain at least the first inch of storm water runoff resulting from the 25-year, 24-hour storm event from areas on the plant site associated with industrial activity for appropriate water quality treatment. The drainage system would also provide sufficient storage and detention capacity for water quantity control.

2.3.11.1 Construction Drainage

Construction activities relating to surface water drainage would involve the construction of the cooling reservoir, plant facilities, and overall site reclamation activities. Construction of the reservoir would essentially involve moving the overburden piles between the mine cuts to form the surrounding and internal berms. The planned reservoir area would be divided into three subareas separated by temporary berms and would be constructed in phases. The water in the active subarea under construction would be pumped into the inactive subareas of the cooling reservoir that would have sufficient storage capacity to eliminate the need for off-site surface water discharges under normal rainfall conditions.

During construction, portions of the site would be dewatered to accommodate construction equipment. To minimize the hydrologic and water quality impacts, the construction would be conducted so that the dewatering activities would not cause any off-site surface water discharges. Storm water runoff from the site during construction would normally be retained in the on-site mine cuts and cooling water reservoir area under normal rainfall conditions. However, off-site storm water discharges may occur during construction under higher rainfall conditions or storm events. Swales would be constructed for directing runoff around the construction site to the cooling reservoir or to sedimentation basins. By capturing the dewatering water and storm water runoff, Tampa Electric Company would begin filling the cooling reservoir in order to minimize ground water withdrawals prior to operation.

2.3.11.2 Operational Site Drainage

South Prong Alafia River Basin

As shown in Table 2.3.11-1, the drainage basin boundary of South Prong Alafia River watershed within the project site would be restored approximately to its premining location. The total drainage area after reclamation would be 801 acres, compared to the premining drainage area of 816 acres.

Based on the on-site reclamation plan for this tract, nearly 214 acres of forested and nonforested wetland areas would be created. Since the western site tract would not include any power plant facilities, the runoff from the reclaimed upland forest and pasture would not be associated with industrial activity and would sheet flow into two separate wetland areas (east and west). The wetlands would have a large enough surface area to significantly suppress the peak discharge and allow for the settling and filtering of suspended material and removal of nutrients by plant uptake prior to off-site discharge.

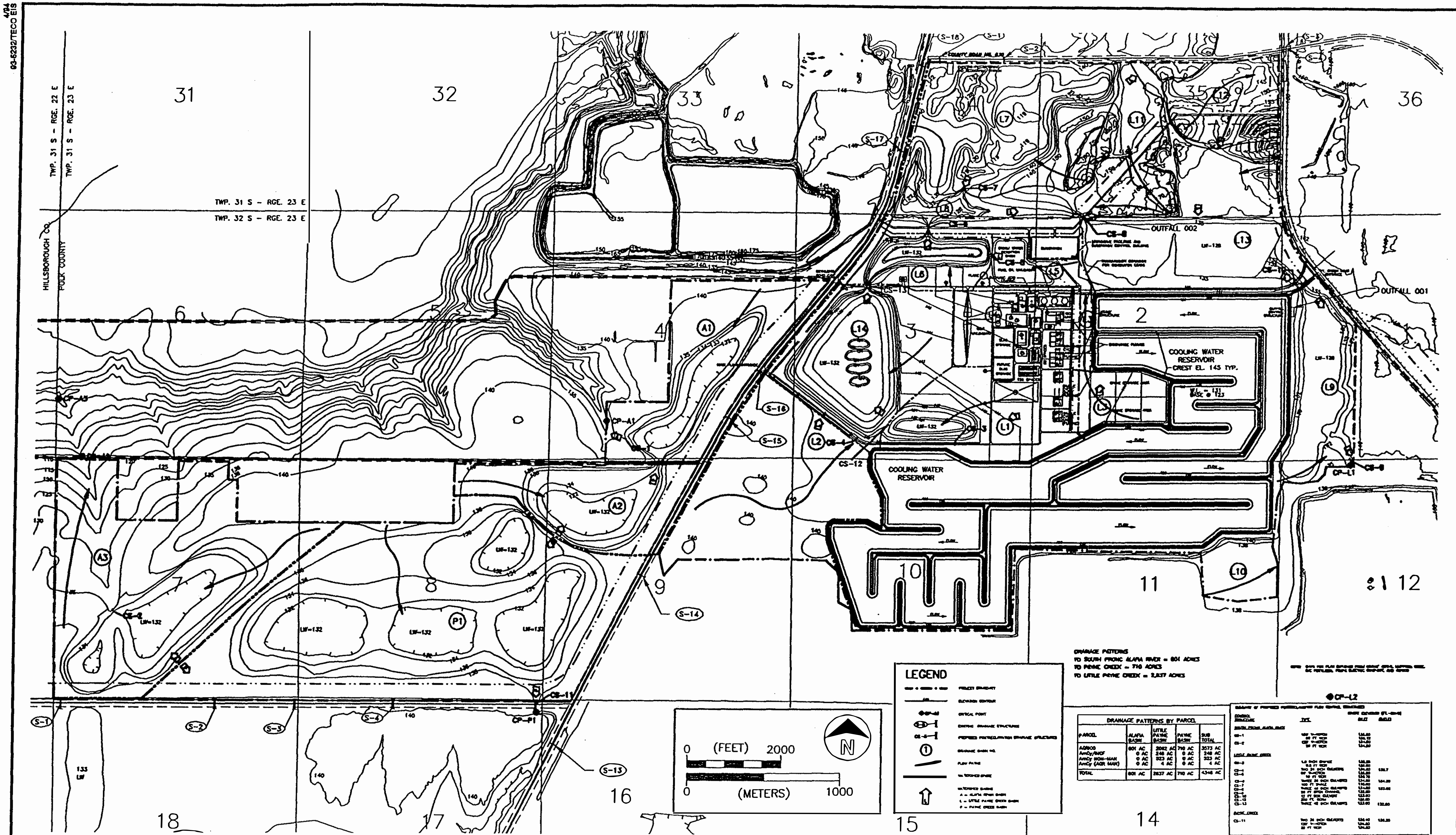

FIGURE 2.3.11-1.
Post-Reclamation/Development Drainage Basins and Topography: Western Site Tract.

SOURCES: ECT, 1992; TEC 1992a.

U.S. Environmental Protection Agency, Region IV

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Table 2.3.11-1. Premining and Post-Reclamation Drainage Areas

Watershed	Drainage Basin Size (acres)		Percent Change
	Premining	Post Reclamation	
South Prong Alafia River	816	801	-1.8
Payne Creek	716	710	-0.8
Little Payne Creek	2,816	2,837	0.7
TOTAL	4,348	4,348	

Sources: ECT, 1992; TEC, 1992a.

The storm water runoff from the wetlands in the eastern area in the South Prong Alafia River watershed would be routed to a tributary of the river via a vegetated swale. The storm water runoff from the western wetland areas also would be discharged into a small tributary of the South Prong Alafia River in the extreme northwestern corner of the site through a fixed hydraulic structure; this discharge would maintain the proper hydroperiod for the wetland.

Payne Creek Basin

The drainage basin boundary of the Payne Creek watershed within the project site would also be restored nearly to its premining position (Table 2.3.11-1). The total drainage area after reclamation would be 710 acres, compared to the premining drainage area of 716 acres. Similar to the South Prong Alafia River, the existing mined areas would be reclaimed to 242 acres of forested and nonforested wetlands. The runoff from the reclaimed uplands would flow into the wetlands prior to off-site discharge. The substantial wetland areas would have flood control functions and provide for water quality treatment. Any runoff discharges from the wetlands would drain southward across SR 674 through culverts similar to premining conditions. This discharge of storm water not associated with industrial activity would be routed to Payne Creek, which runs along the western side of SR 37.

Little Payne Creek Basin

As shown in Table 2.3.11-1, after the drainage basin boundary of the Little Payne Creek watershed within the project site is restored to about its premining position, the total drainage area would be 2,837 acres, compared to a premining drainage area of 2,816 acres. The power block and associated facilities, including the cooling reservoir for the Polk Power Station, would be located within the Little Payne Creek basin. Figure 2.3.11-1 presents the post-reclamation topography and drainage plan for the portion of Little Payne Creek basin that is within the site boundaries.

Storm water runoff associated with industrial activities from the H_2SO_4 handling and storage area, and from the immediate areas of the power block for all the proposed generating units and structure and equipment areas associated with the gasification and other process units would be collected and routed to the overall IWT system.

Runoff associated with industrial activities from the fuel oil storage and unloading area, the transformer area, and the oil-bearing equipment areas would be collected, treated in an oil/water separation system, and then directed to the equalization basin. Runoff from the switchyard area would be directed to the storm water detention basin. The runoff from the slag storage area would be collected in a detention basin to allow settling of the suspended solids and routed to the IWT system for further treatment. Runoff from the active brine solids storage cells would be prevented by use of temporary enclosures over the active cells.

The total drainage area associated with industrial activities that ultimately discharge to the cooling reservoir is approximately 65 acres. The cooling water reservoir would receive direct rainfall and runoff from its 835-acre area, including 727 acres of water surface area and 108 acres of interior berms and the inside slope of the exterior berm. Blowdown from the cooling reservoir would be discharged via Outfall 001 to a reclaimed lake along the eastern edge of the cooling reservoir (see Figure 2.3.11-1).

A detention basin would be constructed to collect storm water runoff from other plant site areas not described previously. The detention basin would provide water quantity and water quality treatment as required by SWFWMD. A 21-acre detention basin would be constructed north of the power block. This basin would receive storm water runoff from upland plant site areas. This detention basin would detain in excess of 1 inch of runoff prior to discharging into a wetland area that would be reclaimed west of the basin and northwest of the main plant facilities (Figure 2.3.11-1).

The runoff from the detention basin and other site areas west of the power block and east of SR 37 also would be drained into a wetland area west of the detention basin. The discharge from this wetland would be routed north and then east via swales and Outfall 002 into the old mine-cut lake, which also receives runoff from the northern portion of the project site. The total drainage area that discharges to the old mine-cut lake is approximately 1,994 acres. The discharge from the old mine-cut lake would be drained southward into an existing reclaimed lake located along the eastern edge of the proposed cooling water reservoir.

2.3.12 Associated Facilities Descriptions

To support the normal operations of the proposed power generating units, various associated facilities and reclaimed areas would be constructed and operated on site, and some associated facilities would be developed off site. The directly associated proposed facilities would include the following:

- Transmission line corridors
- Natural gas pipeline
- Fuel oil pipeline
- Railroad spur
- Roadways
- Substation

2.3.12.1 Transmission Line Corridors and Substation

To link the proposed Polk Power Station with the Tampa Electric Company and the Florida electric transmission grid, an on-site substation and four 230-kilovolt (kV) transmission line circuits are needed. The on-site substation would be constructed within a 1,000-ft by 500-ft (about 11.5 acres) area, north of the main power plant facilities.

Two of the 230-kV circuits from the substation would be constructed within a 400-ft wide transmission line corridor that is located entirely within the Polk Power Station property. These two 230-kV circuits would interconnect with the existing Tampa Electric Company 230-kV Hardee-Pebbledale transmission line that runs along the eastern border of the site. Another two circuits would be built within a corridor that runs west on the site from the substation to SR 37, then north along SR 37 approximately five miles, and interconnects with Tampa Electric Company's existing Mines-Pebbledale 230-kV transmission line at a point west of the Bradley Junction community.

Final right-of-way alignments would be selected by Tampa Electric Company after the requested receipt of the state site certification of the proposed power station. After the right-of-way is determined, Tampa Electric Company would coordinate final plans with appropriate federal, state, and local agencies and would apply for appropriate permits/approvals.

2.3.12.2 Natural Gas Pipeline

Natural gas is to be used as the primary fuel for the stand-alone CT and CC units in the proposed plant. As described in Section 2.3.4.2, natural gas would be delivered to the site via a pipeline from either the existing or the future natural gas transmission system in the region and would not be stored on site. A gas supply would not be needed until 1999, and Tampa Electric Company is currently evaluating the alternatives for natural gas supply. When a satisfactory supplier is identified, specific interconnection points would be designated. Tampa Electric Company then would coordinate plans for any new pipelines with appropriate federal, state, and local agencies and apply for applicable permits/approvals.

2.3.12.3 Fuel Oil Pipeline

Fuel oil would be delivered to the site by tanker truck and/or rail. Based on current fuel cost forecasts, it is expected that fuel oil would serve primarily as a backup fuel for the stand-alone CT and CC units and Polk Unit 1 in CC mode.

General American Transportation Corporation is currently considering construction of a new fuel oil pipeline near the site. The new pipeline likely would parallel Fort Green Road and the CSX Railroad adjacent to the eastern boundary of the site. If constructed, fuel oil could be delivered to the site fuel oil storage tanks via a pipeline from the General American Transportation Corporation's pipeline network. The corridor for this supply pipeline could be located within the boundaries of the Polk Power Station property and, therefore, would not affect off-site land uses or resources. If this pipeline becomes a reality, Tampa Electric Company would determine whether it would be economical to interconnect. Any connection plans would be coordinated with appropriate federal, state, and local agencies and the proper permits/approvals would be sought. On-site impacts, such as potential additional wetland impacts, would also be addressed.

2.3.12.4 Railroad Spur

A railroad spur would be constructed from the existing CSX Railroad line that runs along the east side of Fort Green Road (i.e., the eastern boundary of the proposed site as shown in Figure 2.3.11-1). The 1.5-mile-long rail spur would be constructed on site with an exception of a nearly 200-ft-long segment crossing the rights-of-way and drainage way associated with Fort Green Road and the CSX railway to connect to the existing CSX rail system. On the site, the rail spur would potentially include a loop at the end to provide for turning and storing the trains for future coal delivery by train. The rail spur access to the site would initially be used for delivering equipment and other materials to the site during construction and operation and for conveying by-products off site. The plans for this spur have been reviewed as part of the state site certification process.

2.3.12.5 Roadway

Roadway access to the main power plant facilities would be provided by two entrances on SR 37 and another entrance on Fort Green Road as shown in Figure 1.1.3-2. In order to maintain acceptable level of service (LOS) standards of Level D or better along the existing roadway network, all entrance roads would include appropriate geometric improvements at the intersections with the existing roadways. The south entrance on SR 37 would be the main and employee entrance to the facilities. The north entrance on SR 37 and the entrance on Fort Green Road would be used primarily for deliveries and for construction and operational contractor access to the site. The plans for these entrances have been reviewed by FDOT as part of the site certification process.

2.3.13 Summary of Post-DEIS Design Changes Proposed by Tampa Electric Company

Project design modifications and improvements proposed by Tampa Electric Company for the preferred alternative, i.e., Tampa Electric Company's proposed project (Preferred Alternative With DOE Financial Assistance), occurred during the EIS process. Relevant design aspects not documented in the published DEIS are incorporated in this FEIS and specifically summarized in this section. The preferred alternative documented in this FEIS essentially constitutes Tampa Electric Company's final design proposal, although this remains a somewhat ongoing and dynamic process. The design modifications have resulted in overall design improvements, cost reductions, and general environmental impact reductions. For the purposes of this EIS, the most significant design changes are (1) the proposed use of coal storage silos instead of an on-site coal pile and (2) the increase in size and hours of operation of the auxiliary boiler.

The shift from an on-site coal pile to the use of coal storage silos caused several changes in the proposed layout of the proposed plant:

- Use of silos for coal storage instead of open piles requires a much smaller area
- Deletion of the on-site rail loop for Phase I and a change of the truck coal delivery system to allow placement of coal in silos. The proposed on-site rail spur would be maintained for other deliveries.
- Deletion of the coal pile mobile equipment maintenance shop
- Deletion of the coal pile runoff treatment package plant

- Routing of runoff water to sumps in the coal unloading and silo storage areas for use in coal grinding
- Routing of the wastewater filter backwash to the equalization basin instead of the coal pile detention basin

Engineering design considerations and the elimination of the coal pile caused an increase in the size and operation of the auxiliary boiler and a reconfiguration of the layout. Some alterations, such as the size of the on-site subarea drainage basins, are attributable to one or more changes in the location and size of several components of the proposed facility:

- Increasing the size (49.5 to 120 MMBtu/hr), normal operating hours (1,000 to 3,000 hr/yr), and standby operating hours (0 to 8,760 hr/yr) for the auxiliary boiler
- Deleting the administration/visitor building, the parking lot, and the associated 0.2-acre storm water detention basin
- Adding 60 operational parking spaces near the general services building, but maintaining the total of 210 parking spaces by reducing other areas
- Reducing the size of the southern construction lay-down area from over 20 acres to approximately 9 acres
- Deleting the brine storage area runoff basin by constructing a cover over the brine storage area
- Revising the structure dimensions for the 7F HRSG enclosure, SG-C wings 1 and 2, the gasifier, the cold box, the coal-grinding day bin, coal-storage silos 1 and 2, oil tanks 1, 2, and 3, and the coal delivery enclosure (see Figure 1.1.3-2)
- Revising the locations of the IGCC HRSG, the auxiliary boiler, and the thermal oxidizer stacks
- Routing runoff from the substation area to the storm water detention basin instead of the cooling reservoir
- Increasing the diameter of the discharge pipe from 10 to 18 inches in diameter
- Changing the initial storage cell from a 1-year to a 2.5-year storage capacity
- Increasing the fire water system capacity from 3,000 to 6,000 gpm and changing the primary source of system water from the service water tank to the cooling reservoir
- Changing the on-site subarea drainage basin sizes
- Routing a small (less than 40 gpm) waste stream from the sulfuric acid plant to the equalization basin
- Decreasing the use of the HGCU system for treatment of syngas by 70% to 80 %
- Providing separate stacks for the sulfuric acid plant and the thermal oxidizer and decreasing the size of the thermal oxidizer for the HGCU unit (see Figure 1.1.3-2)

2.4 ALTERNATIVES TO TAMPA ELECTRIC COMPANY'S PROPOSED PROJECT (PREFERRED ALTERNATIVE WITH DOE FINANCIAL ASSISTANCE)

Several nonconstruction and technological alternatives to the Tampa Electric Company's preferred alternative are considered as alternative ways of implementing the project. These alternatives include: alternatives to constructing new generating facilities, alternative generating technologies, and the Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance).

2.4.1 Alternatives to Constructing New Generating Facilities

Tampa Electric Company has initiated a mixture of programs designed to defer or avoid construction of new generating facilities. These initiatives combine customer education with conservation, load management, and power purchasing concepts.

These projected energy savings are included in Tampa Electric Company's planning for future energy requirements. Approximately 1,000 MW of the 2,100 MW of customer demand that is projected for the year 2010 is expected to be met by these conservation, load management, and power purchasing programs. The remaining 1,100 MW customer demand must be met by other means.

These efforts are centered around ten Tampa Electric Company programs:

- Heating and Cooling—a program encouraging the installation of high-efficiency heating and cooling equipment.
- Load Management—a residential program to reduce weather-sensitive heating, cooling, water heating, and pool-pump loads through a radio signal control mechanism. At the end of the year end 1992, 66,908 customers were participating. In addition, a commercial/industrial program is in effect.
- Energy Audits—currently four audits are available to Tampa Electric Customers; two are for the residential class and two for commercial/industrial customers. The program is a "how to" information and analysis guide for customers.
- Ceiling Insulation—an incentive program for existing homeowners that will help to supplement the cost of adding additional insulation.
- Commercial Indoor Lighting—an incentive program to encourage investment in more efficient lighting technologies in existing commercial facilities.
- Standby Generator—a program designed to utilize the emergency generation capacity of commercial/industrial facilities in order to reduce weather-sensitive peak demand.
- Conservation Peak Value—another program for commercial/industrial customers that encourages additional investments in substantial demand shifting or demand reduction measures.

- Duct Repair - an incentive program for existing residential structures that encourages repair of air distribution systems.
- Cogeneration—a program whereby large industrial customers with waste heat or fuel resources may install electric generating equipment, produce their own electrical requirements, and/or sell their surplus to the company.
- Street and Outdoor Lighting Program—completed in 1990, is anticipated to continue to provide energy reductions. The program provides for the replacement of mercury vapor lighting with the more efficient high-pressure sodium lighting.

In its need determination proceedings, FPSC concluded that Tampa Electric Company had considered and implemented (in these ten programs) all the reasonably available conservation and other nongenerating alternatives available to avoid construction of new generating facilities (i.e., Polk Unit 1) in the 1995 to 1996 timeframe. More information on these programs can be found in Section 1.2.2.3.

2.4.2 Alternative Generating Technologies

An integral step in Tampa Electric Company's integrated resource planning process is the identification and consideration of alternative generation technologies that could be constructed to meet future customer demands. The objective of the alternative generation technology study is to identify the most reliable, technically feasible, environmentally acceptable, and cost-effective generating facilities for consideration in a comprehensive power resource plan.

2.4.2.1 Preliminary Screening of 46 Technologies

The alternative technology study conducted by Tampa Electric Company in 1991 involved a systematic review and assessment of a wide variety of conventional and nonconventional energy generation technologies. Initially, 46 technologies were identified for evaluation. These alternative technologies were screened in a two-step process: preliminary and economic screening analyses.

In step one, a preliminary screening analysis was conducted to eliminate those technologies that could not be used because regional geography/weather were not suitable, costs were higher when compared to similar technology alternatives, proven demonstration of the technology had not been performed, public opposition to technology existed, and/or questions existed regarding the technology's safety. Table 2.4.2-1 lists each technology that was assessed, the technology assumptions, and the reasons that each type of technology was eliminated from consideration.

Table 2.4.2-1. Alternative Technology Preliminary Screening Analysis (Page 1 of 4)

Technology	Plant Size (MW)	Total Plant Cost (91 $/kw)	Average Annual Heat Rate (Btu/kwh)	Commercial Availability	Technology Development	Retain for Economic Screening
Pulverized coal-wet limestone FGD						
Subcritical	300	1,533	10,044	1989	Mature	Better economics exist for similar unit types
Subcritical	500	1,274	9,829	1989	Mature	Yes
Supercritical	300	1,517	9,644	1989	Mature	Yes
Pulverized coal-spray dryer FGD						
Subcritical	300	1,438	10,370	1989	Mature	Better economics exist for similar unit types
Pulverized coal-regenerable FGD						
Subcritical	300	1,756	10,183	1989	Mature	Better economics exist for similar unit types
Pulverized coal (SOAPP)						
Subcritical advanced FGD	300	1,575	9,080	1989	Demonstration	Yes
Atmospheric fluidized bed						
Bubbling bed	200	1,757	9,960	1994	Demonstration	Better economics exist for similar unit types
Circulating bed	200	1,644	10,058	1994	Demonstration	Better economics exist for similar unit types
Pressurized fluidized bed						
CC	340	1,545	8,980	1996	Pilot	Yes
Pressurized fluidized bed turbo-charged boiler						
Circulating bed	250	1,610	9,703	1996	Laboratory	Technical development only laboratory

Table 2.4.2-1. Alternative Technology Preliminary Screening Analysis (Page 2 of 4)

Technology	Plant Size (MW)	Total Plant Cost (91 $/kw)	Average Annual Heat Rate (Btu/kwh)	Commercial Availability	Technology Development	Retain for Economic Screening
Bubbling bed	250	1,500	10,278	1996	Laboratory	Technical development only laboratory
IGCC	200	1,933	9,320	1994	Demonstration	Yes
	400	1,597	9,220	1994	Demonstration	Yes
Non-integrated gasification combined cycle						
Gasification onsite	200	1,933	9,600	1994	Demonstration	Technical development only laboratory
	400	1,694	9,510	1994	Demonstration	Technical development only laboratory
Gasification offsite	400	1,905	9,625	1994	Demonstration	Technical development only laboratory
CT-natural gas/distillate fuel						
Conventional	80	433	14,020	1989	Mature	Yes
Advanced	140	418	13,210	1991	Demonstration	To reduce analysis time, only the conventional CT was evaluated
CT-steam injection						
Steam injected	150	941	9,425	1989	Demonstration	Yes
CT-CC-natural gas/distillate fuel						
Conventional	120	595	8,055	1989	Mature	Yes
Advanced	210	561	7,580	1991	Demonstration	To reduce analysis time, only the conventional CC was evaluated
Fuel cells-phosphoric acid						
Centralized	100	1,172	8,549	1998	Pilot	Yes

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Table 2.4.2-1. Alternative Technology Preliminary Screening Analysis (Page 3 of 4)

Technology	Plant Size (MW)	Total Plant Cost (91 $/kw)	Average Annual Heat Rate (Btu/kwh)	Commercial Availability	Technology Development	Retain for Economic Screening
Geothermal						
Binary	54	1,917	29,000	1992	Demonstration	Not feasible for Florida
Dry steam	113	1,065	21,868	1989	Mature	Not feasible for Florida
Solar parabolic through gas hybrid	80	3,016	24,391	1989	Mature	Yes
Solar photovoltaic-central station						
Flat plate	99	2,630	22,765	1995	Pilot	Yes
Wind turbines-high production volume	75	1,101	0	1990	Mature	Not feasible for Florida
Municipal solid waste-mass burn and refuse derived fuel (RDF)						
Mass burn	40	4,741	17,040	1989	Mature	Yes
RDF	24	4,985	15,450	1989	Mature	Yes
Nuclear-advanced light water reactor (evolutionary)	1,200	1,470	10,530	2000	Pilot	Commercial availability after 1999
Nuclear-advanced light water reactor (passive safety)	600	1,667	10,530	2002	Pilot	Commercial availability after 1999
Nuclear-light metal/high temperature gas cooled	1,350	1,947	9,000	2006	Pilot	Commercial availability after 1999

Table 2.4.2-1. Alternative Technology Preliminary Screening Analysis (Page 4 of 4)

Technology	Plant Size (MW)	Total Plant Cost (91 $/kw)	Average Annual Heat Rate (Btu/kwh)	Commercial Availability	Technology Development	Retain for Economic Screening
Advanced battery energy storage						
3-Hour	20	474	11,400	1997	Pilot	High-scale production of batteries were not considered realistic to meet Tampa Electric Company's early peaking needs
5-Hour	20	614	11,000	1997	Pilot	High-scale production of batteries were not considered realistic to meet Tampa Electric Company's early peaking needs
Lead acid battery energy storage						
3-Hour	20	707	13,500	1989	Mature	High-scale production of batteries were not considered realistic to meet Tampa Electric Company's early peaking needs
5-Hour	20	948	13,100	1992	Mature	High-scale production of batteries were not considered realistic to meet Tampa Electric Company's early peaking needs
Pumped hydro energy storage						
Conventional	1,050	918	13,600	1989	Mature	Limited feasibility for Florida
Compressed air energy storage						
Rock	110	574	11,640	1993	Demonstration	Not feasible for Florida
Salt	110	447	11,640	1991	Demonstration	Not feasible for Florida
Aquifer	110	438	11,640	1992	Demonstration	Not feasible for Florida

Note: All data developed from the September 1989 EPRI TAG.

Sources: TEE, 1991; TEE, ad.

The types of technology that passed the preliminary screening were:

- Conventional PC with FGD
- Advanced PC with FGD
- Pressurized fluidized bed
- IGCC
- CT
- CT with steam injection
- CC
- Phosphoric acid fuel cell
- Solar thermal
- Photovoltaic solar cell

2.4.2.2 Economic Screening

In step two of the screening analysis, the economics of the ten technologies that survived the preliminary screening were compared. The comparisons were made within similar service duty classes; all baseload, peaking, and intermediate technologies were compared. These economic screening curves reflected the levelized annual/lifecycle cost of various technologies at different capacity factors. Figures 2.4.2-1 through 2.4.2-3 represent the screening curves for baseload, intermediate load, and peaking load technologies, respectively. The baseload technologies were evaluated from 50- to 100-percent capacity factors, the intermediate technologies were evaluated from 15- to 50-percent capacity factors, and the peaking technologies from 0- to 15-percent capacity factors. The technologies that were selected for the economic optimization analysis follow:

<u>Baseload Technologies</u>

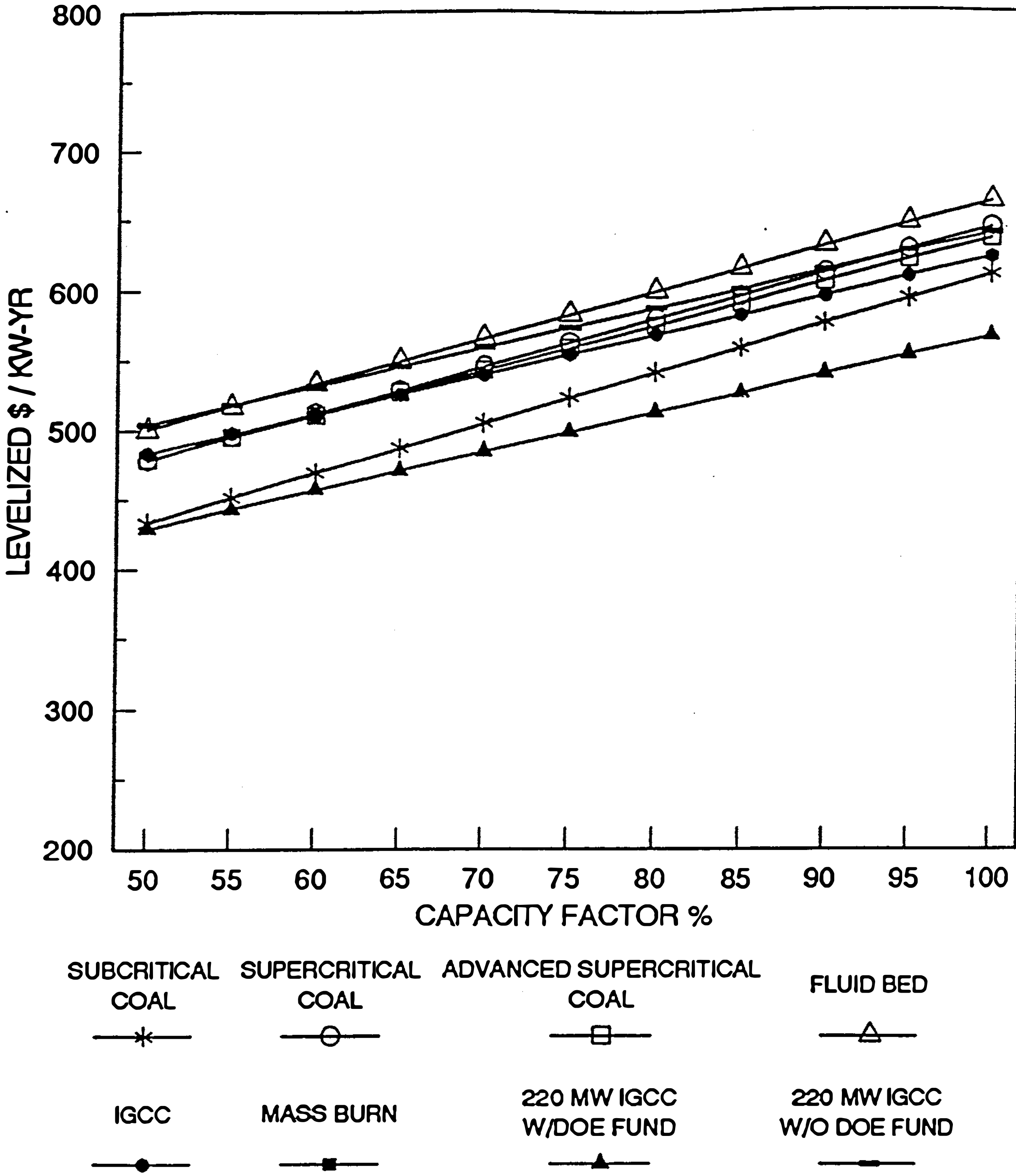
- Conventional PC with FGD
- IGCC

<u>Intermediate Load Technologies</u>

- IGCC
- CC
- Phosphoric acid fuel cell
- Photovoltaic solar cell
- Solar thermal

<u>Peaking Technologies</u>

- CT



NOTE: MSW-MASS BURN not pictured because the minimum Levelized Cost (Capacity = 0%) is greater than 800 $/KW-YR.

FIGURE 2.4.2-1. Economic Screening Curves - Baseload Units. SOURCE: TEC, 1992a.	**U.S. Environmental Protection Agency, Region IV** ***Environmental Impact Statement***	**Polk Power Station Polk County, Florida**

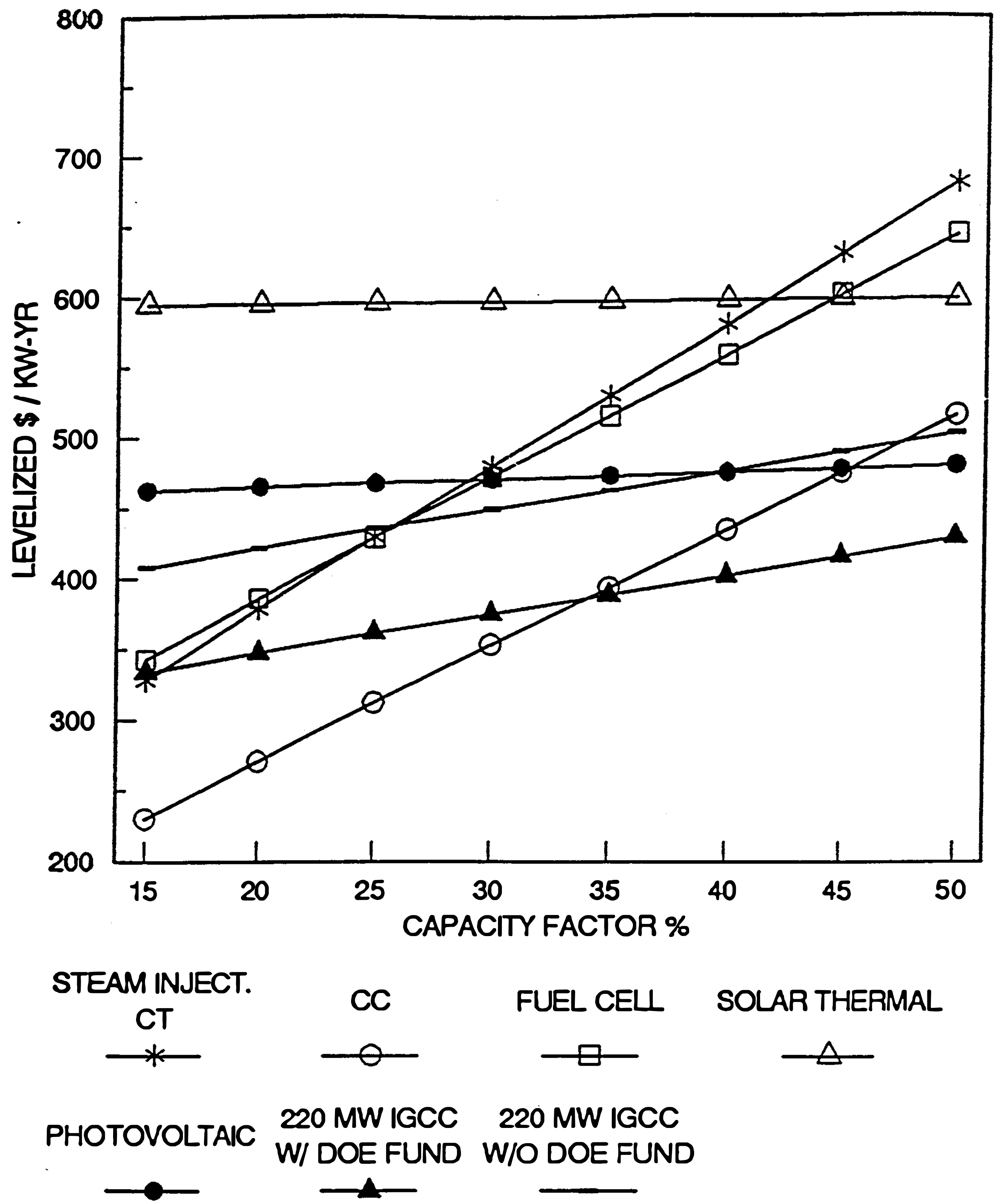


FIGURE 2.4.2-2.
Economic Screening Curves - Intermediate Units.
SOURCE: TEC, 1992a.

U.S. Environmental Protection Agency, Re ion IV
Environmental Impact Statement

Polk Power Station Polk County, Florida

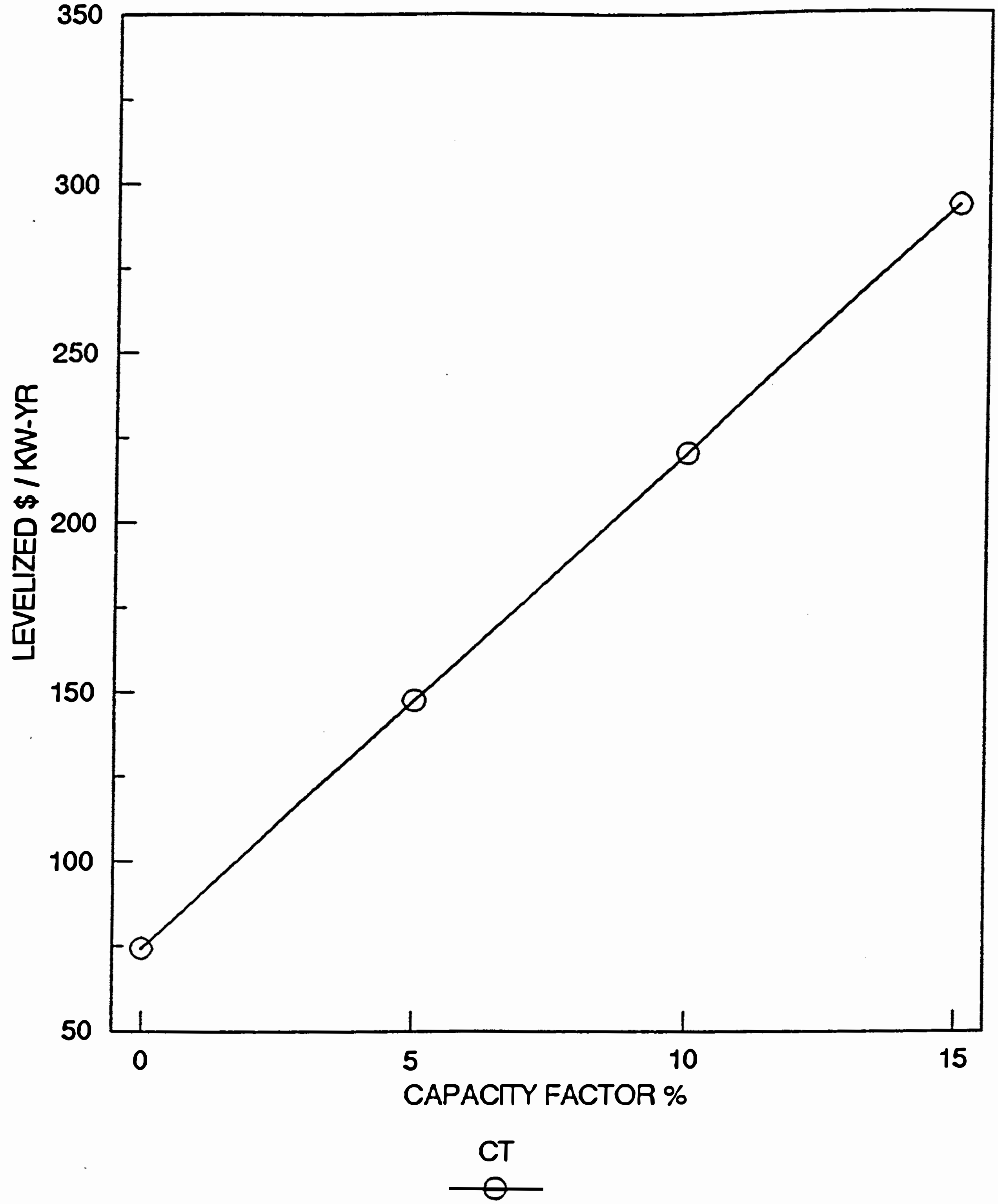


FIGURE 2.4.2-3.
Economic Screening Curves - Peaking Units.

SOURCE: TEC, 1992a.

U.S. Environmental Protection Agency, Region IV

Environmental Impact Statement

Polk Power Station
Polk County, Florida

The baseload conventional PC and IGCC technologies were maintained because of their relatively low-levelized costs, and, compared to other coal-fired baseload technologies, IGCC has favorable environmental performance. The CC unit had the best economics of all of the intermediate technologies, and the fuel cells and solar technologies were advanced into the economic analysis because of their exceptional environmental performance (low noise, extremely low or no emissions, possibility of siting in or close to load centers).

2.4.2.3 Economic Optimization

The goal of the economic optimization analysis was to identify the best resource plan for serving the forecasted energy requirements. The development of the supply-side plan involved the use of dynamic programming to optimize the mix of generating capacities on the system. The objective function of the optimization analysis was to minimize the present worth of revenue requirements for the Tampa Electric Company system.

The procedure used in the economic optimization analysis is described below (excerpted from TEC 1992a):

- First, various power resource scenarios (comprising a mixture of the remaining alternative generating technologies, joint participation, and purchased power generation) and Demand-Side Management (DSM) programs were developed.
- Next, these alternatives were analyzed, along with future system demand and energy requirements, future DSM programs, and existing generating capabilities, to arrive at a number of viable generating expansion scenarios involving combinations of the alternative generation technologies, conservation, DSM programs, and power purchases. Each alternative satisfied the established reliability criteria.
- The capital expenditures associated with each capacity addition were determined based on the alternative generation technology, fuel type, and in-service year. The fixed charges resulting from the capital expenditures were expressed in present-worth dollars for comparison. The fuel, the operation, and maintenance costs associated with each power resource scenario were projected based on estimated unit dispatch. The projections, also expressed in present-worth dollars, were combined with the fixed charges to obtain the total present worth of revenue requirements for each alternative power resource plan.
- The expansion plan that was initially identified by this analysis as having the lowest revenue requirements was then compared to other generation plans that would be strategically superior for Tampa Electric Company and its customers. These expansion plans were again compared on an economic basis, including an analysis of how sensitive the revenue requirement projections would be to changes in the base case assumptions regarding fuel availability, costs, and interest rates.

- Finally, a strategic issues/risk analysis was conducted to compare the overall performance of each generation expansion plan alternative under additional factors that were not easily quantified. These strategic issues could affect the type, capacity, and/or timing of Tampa Electric Company's future generation resource requirements. In this way, an economically sound expansion plan with the flexibility to respond to future technological and economical changes was selected.

2.4.2.4 Selection of Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

Tampa Electric Company's proposed power resource plan for generating capacity additions that Tampa Electric Company believes would best meet its customers needs during the 1996 through 2010 period is presented in Table 1.2.2-2. The proposed plan involves a combination of IGCC, CC, and CT generation technologies, three of the seven alternative generation technologies that were considered in the economic optimization analyses. The four technologies not included in the proposed plan were conventional PC with FGD units, phosphoric acid fuel cell, photovoltaic solar cell, and solar thermal. Despite their exceptional environmental performance, the latter three technologies were not included primarily due to the status of their technological development (i.e., pilot scale for the solar photovoltaic cell and phosphoric acid fuel cell which would reduce their reliability) and their relatively high costs.

As baseload technologies, IGCC and PC with FGD have relatively similar costs; however, IGCC technology was selected due to its better environmental performance. Further, Tampa Electric Company's opportunity for approximately $130 million (amended from $120 million because of additional costs of design changes and improvements) in cost-shared financial assistance proposed by DOE for the Polk Unit 1 under the CCT Demonstration Program (pending successful completion of the EIS process) makes the IGCC unit the most cost-effective generation alternative for its ratepayers.

2.4.3 Potential Alternative Technologies

The potential alternative technologies to the proposed Polk Power Station project follow:

- Three CC units without CG facilities
- Three IGCC units
- PC with FGD units

CT units are the most reliable, cost-effective, and environmentally acceptable technology for providing peak load needs; therefore, no alternatives for these units were considered to be reasonable for the proposed six stand-alone CT units for the Polk Power Station project.

2.4.3.1 Three CC Units Without CG Facilities

CC units using only natural gas or fuel oil would have certain environmental advantages compared to the proposed IGCC technology since CC units do not involve handling and storing coal or coal combustion by-products. However, natural gas and fuel oil can be subject to availability limits and significant changes in price in certain economic and political conditions, while coal prices and supplies are projected to be stable in the foreseeable future.

The capability of the proposed CC units to burn a combination of natural gas, fuel oil, or coal gas provides a high degree of fuel flexibility to maintain a reliable and cost-effective power supply. Therefore, the alternative of using three CC units without CG capabilities would not meet the overall objective of the project and may have an adverse effect on Tampa Electric Company's ability to supply reliable, cost-effective power to its customers in the future.

Three CC units without CG facilities also would not meet the objectives of DOE to conduct cost-shared projects to demonstrate innovative, energy-efficient, and environmentally acceptable generating technologies using coal under its CCT Demonstration Program. Since the proposed IGCC unit will include both the HGCU demonstration technology and the proven CGCU technology to control emissions of SO_2, Tampa Electric Company may ensure its customers of its ability to provide a reliable power supply. Since using all three CC units without CG capabilities would not meet the overall objectives of Tampa Electric Company and DOE, this alternative was not considered for further analysis.

2.4.3.2 Three IGCC Units

The two stand-alone CC units proposed for the Polk Power Station project would be designed, with some modifications, to be capable of using coal gas as well as the currently proposed primary natural gas and backup fuel oil fuels. However, the alternative of using three IGCC units would primarily involve constructing additional CG facilities at the site to provide coal gas for the two stand-alone CC units and expanding certain coal handling and storage facilities and, possibly, the temporary by-product (i.e., slag and H_2SO_4) storage areas. The proposed treatment system for CG wastewaters and the associated brine storage area would also need to be expanded. Therefore, the expansion of these facilities would involve a greater use of land resources on the site compared to the proposed project. Sufficient land area is available within the main plant site area to locate these additional and/or expanded facilities.

For this alternative, most of the other facilities proposed for the project, such as the rail spur, process water supply system, and cooling reservoir, would not require changes or expansions. Also, potential environmental issues such as air emissions and water uses and discharges would be relatively similar between the proposed project and the alternative of providing CG capabilities for the two other CC units.

Construction of the additional CG facilities would also involve the increase of capital expenditures. The two stand-alone CC units currently are proposed to meet future intermediate load power supply needs, while the proposed IGCC unit is proposed to meet baseload capacity needs. Thus, at this time, additional capital expenditures for the CC units with lower, intermediate loads would not be as cost effective as the proposed project. However, since natural gas and fuel oil can be subject to unanticipated, significant changes in price, providing additional CG facilities may become more cost effective in the future. Also, the alternative of providing CG capabilities for all three CC units would provide Tampa Electric Company with additional flexibility to respond to changes in prices and availability of natural gas, fuel oil, and coal.

Providing CC units with CG capabilities would meet the objectives of DOE since it would not affect the proposed project demonstrations of the integration of CG and CC technologies and the HGCU system. The possible addition of CG facilities for the two proposed stand-alone CC units may even further DOE's overall CCT Demonstration Program objectives for the commercialization of its demonstration projects.

Based on these facts, the alternative generation technology of providing CG facilities for the two proposed stand-alone CC units is considered a reasonable alternative. There is sufficient land area within the main plant site area to locate the additional CG facilities and to expand associated facilities such as coal, slag, and H_2SO_4 storage areas and CG wastewater treatment and brine storage areas. Most other facilities, such as the cooling reservoir, water supply and use, the rail spur, and access roads, would not require changes or expansions. Any potential environmental issues could be avoided or minimized by proper design and controls similar to those proposed for the IGCC unit.

Based on the above analysis, Tampa Electric Company could implement this alternative of adding CG facilities for one or two of the stand-alone CC units at the Polk Power Station at some time in the future. The future decision to implement this alternative would be based primarily on economic considerations regarding the level of additional capital expenditures, the relative prices of coal, natural gas, and fuel oil for the units, and Tampa Electric Company's obligation to implement the most cost-effective power resource plan to meet the electricity demands of its customers.

2.4.3.3 PC With FGD Units

Similar to the IGCC technology, the use of PC units with a FGD system was considered as a potential alternative based on potential uncertainties with future natural gas and fuel oil availability and price stability relative to coal fuel. This potential alternative would involve the use of PC unit(s) instead of the proposed IGCC unit and/or instead of one or both of the two proposed stand-alone CC units.

The use of the PC unit instead of the proposed IGCC unit would similarly avoid the price stability and availability concerns associated with natural gas and fuel oil. However, the alternative PC technology has the relative disadvantage compared to the IGCC technology in not allowing the flexibility to use these other fuels in the event of coal delivery disruptions and unforeseen coal price fluctuations. This lack of fuel flexibility could adversely impact Tampa Electric Company's objective and obligations.

Several potential environmental issues associated with proposed IGCC and alternative PC technologies are similar since both technologies involve coal delivery, handling, and storage, and since both generate solid by-products that may require the development of some on-site storage facilities. However, the PC technology also has certain environmental disadvantages relative to the proposed IGCC unit. Table 2.4.3-1 provides a comparison of key facility and environmental requirements for nominal 400-MW IGCC and PC with FGD power plants. The requirements were based on a study sponsored by Electric Power Research Institute (EPRI, 1988). Specific criteria and design assumptions were established to evaluate the IGCC and PC technologies on the most consistent basis possible. For example, the evaluations were based on units and systems that would provide similar generating capacities, and, they used a single design coal fuel, Illinois No. 6, which also is the coal, with certain modifications, considered for licensing purposes for the proposed IGCC unit for the Polk Power Station. Also, the sites for both units were assumed to be new locations where all generating unit and associated facilities (e.g., rail spur, access roads, fuel storage area, cooling system) would need to be developed.

As shown in Table 2.4.3-1, the PC unit requires slightly more land area for the main power plant facilities than an equivalent IGCC unit, primarily due to the need for a larger coal storage area to provide a similar time period of fuel supply based on its relatively higher coal consumption rate (i.e., higher net heat rate). The PC unit would require almost twice as much land area for permanent storage of solid by-products (i.e., bottom and fly ash and gypsum) primarily due to its higher production volume of gypsum from the FGD system to control SO_2 emissions relative to the sulfur by-product volumes from the IGCC unit syngas cleanup systems. A higher land area requirement would also be required to provide a similar period of storage for gypsum from the PC unit on a temporary basis relative to the sulfur (or H_2SO_4) from the IGCC unit, assuming that both by-products were marketable for off-site use. The PC unit with an FGD system also requires facilities for the delivery, handling, and storage of limestone that is not required for the assumed IGCC unit technology.

The alternative PC technology would require 60 percent more water for condenser cooling purposes as an equivalent IGCC unit since PC unit electricity generation is totally based on STs whereas only the HRSG/ST component of the IGCC unit requires cooling water. The EPRI study was based on the use of mechanical draft cooling towers as the heat dissipation system for both the IGCC and PC units. If a cooling reservoir was used as the proposed heat dissipation system, PC units would also involve significantly higher water volumes for circulating water, makeup water, and blowdown purposes than IGCC units. Therefore, if a PC unit was used instead of the proposed IGCC unit or the CC units for the Polk Power Station, the proposed cooling reservoir area would need to be increased and the proposed cooling water makeup from the Floridan aquifer

Table 2.4.3-1. Comparison of Key Facility and Environmental Requirements for Nominal 400-MW IGCC and PC Power Plants

Facility Requirement	IGCC Plant	PC Plant
Land area		
Power plant and fuel handling/storage facilities (acres)	190	215
Permanent solid waste/by-product disposal, if needed (acres)	100	180
Net heat rate (Btu/kwh)	9,132	9,737
Coal usage, as received, 100 percent load (tph)	153	176
Limestone usage (tph)	N/A	21
Water flows		
Condenser circulating water (gpm)	99,010	158,330
Cooling makeup water (gpm)	2,014	3,228
Process/service water supply (gpm)	875	519
Wastewater flows		
Cooling tower blowdown (gpm)	206	330
Boiler blowdown (gpm)	23	30
Demineralizer spent regenerant (gpm)	46	10
Other treated wastewater (gpm)	414	10
Air emissions, stacks only		
SO_2 (lb/hr)*	996	1,190
NO_x (lb/hr)*	345	790
Particulates (lb/hr)	†	33
Solids		
Sulfur (tpd)	119	
Gypsum, dry (tpd)		776
Slag/ash, dry (tpd)	345	383

Note: N/A = not applicable.

* Air emission rates from the PC plant have been modified from the EPRI study to reflect 95-percent sulfur removal efficiency versus 90-percent in the study, and NO_x emissions of 0.2 lb/MMBtu versus 0.5 lb/MMBtu in the study.

† Negligible.

Sources: EPRI, 1988.
ECT, 1992.
TEC, 1992a.

and discharge volumes would be significantly increased. However, the PC unit would require less process/service water than an equivalent IGCC unit and would require the treatment of significantly less wastewater than the IGCC unit, primarily due to water uses in the CG process.

The air pollutant emission rates presented in Table 2.4.3-1 reflect modifications of the rates contained in the EPRI study to represent similar sulfur removal efficiencies (i.e., 95 percent) for SO_2 emissions for both technologies and more current assumed performance standards for NO_x emissions from PC units. Even with these modifications to reflect better efficiency and performance of the PC unit, the use of the PC technology would still result in higher SO_2 emissions and more than two times higher NO_x emissions than from the equivalent IGCC unit. Also, particulate emissions from the exhaust stack would occur from the PC unit, while particulate emissions from the IGCC unit are negligible.

Noise is another environmental issue related to the IGCC and PC alternatives. Although during operation both alternatives would have similar levels of noise, the IGCC facility would require a flare stack that would operation infrequently. The flare stack single-event noise would be noticeable to residents within approximately 1 to 2 miles from the power block area. The PC alternative would not require a flare stack.

Finally, using conventional PC generation technology instead of the proposed IGCC unit would not meet DOE's objective to demonstrate CCTs and DOE would not be a cost-sharing participant in the project. Therefore, Tampa Electric Company and its customers would not have the financial benefit of DOE's proposed approximately $130 million (amended from $120 million because of additional costs of design changes and improvements) of cost-shared financial assistance for the proposed project, pending successful completion of the EIS process. Based on this fact and the relative environmental disadvantages of the PC technology in terms of land and water use requirements, the use of a PC unit instead of the proposed IGCC unit was not considered a reasonable alternative. However, in the event of denial of financial assistance by DOE for the construction of the IGCC unit, PC generation technology represents a reasonable alternative as a large baseload unit (see Section 2.7).

The use of PC units instead of one or two of the proposed stand-alone CC units would also involve limitations in future fuel use flexibility and additional land use and environmental acceptability issues compared to the proposed project. For example, even though not proposed at this time, use of PC units versus CC units would preclude the flexibility and possible cost effectiveness to use natural gas or fuel oil in addition to coal as fuel for the two CC units. Compared to the proposed stand-alone CC units, one or two PC units would involve the use of significantly more land area for the power block facilities, coal and by-product storage, and cooling reservoir areas; significantly increased groundwater withdrawals and cooling water blowdown; and increased NO_x and particulate air emissions.

Besides, the CC technology allows the development of generating capacity in phases to cost-effectively match the growth in electricity demands. On the other hand, PC units must be developed in total at one time and generally must be relatively larger (i.e., generating capacities of 300 MW or more) than CC units to be considered cost effective for electricity generation. Therefore, the PC technology requires that all capital investment be made at one time and may result in development of excess capacity for some time until demand growth catches up with the large capacity addition.

Finally, CC units have more operational flexibility than PC units in responding to and meeting the various types of demands and system needs (i.e., peaking, intermediate, and baseloads). CC units can start and stop generating electricity faster than PC units to meet peak and intermediate loads, particularly when the CT components are operated in simple-cycle mode using bypass exhaust stacks. PC units, on the other hand, can require up to 24 hours to begin generating electricity depending on their shutdown status and are generally used to meet only baseload demands. Based on Tampa Electric Company's power resource plan, the proposed CC units at the Polk Power Station are needed to meet future intermediate loads for which PC units are not considered operationally suitable.

Thus, the generation technology alternative of using PC instead of the proposed stand-alone CC units was not considered to offer any environmental, operational, or cost effectiveness advantages in meeting the objectives compared to the proposed project. This alternative generation technology was not considered as a reasonable alternative for the two stand-alone CC units for the proposed Polk Power Station project.

2.5 ALTERNATIVE SITE ANALYSIS

Between September 1989 and November 1990, Tampa Electric Company conducted a Power Plant Site Selection Assessment program to identify a suitable site for constructing and operating future power plant facilities. The power plant facilities considered during the site assessment were a 440-MW CC plant and a coal-fueled 500-MW baseload plant as well as associated facilities. An integral aspect of this site selection program by Tampa Electric Company was the formation and participation of a Siting Task Force. The Siting Task Force was formed in response to community concerns regarding the placement of additional power plant facilities at a coastal site on Tampa Bay that was identified as a suitable site for such facilities in previous site selection studies by Tampa Electric Company. The Siting Task Force was comprised of 17 private citizens from environmental groups, businesses, and universities in the Tampa Electric Company service area and throughout Florida (see DEIS, Appendix J). The Siting Task Force was selected by the nomination of two members by Tampa Electric Company. These individuals in turn selected the remainder of the Task Force with Tampa Electric Company's approval. Tampa Electric Company's objective in forming and committing to the Siting Task Force participation in the siting program was to ensure that local and statewide public issues and concerns relative to new power plant development were adequately and accurately considered in the process of selecting a site for the new power plants. The Siting Task Force provided input, guidance, and recommendations to Tampa Electric Company throughout the power plant site selection process.

2.5.1 Overall Siting Program Approach

The overall goal of the Tampa Electric Company Power Plant Site Selection Assessment program was to select a site or sites that were considered the most suitable for developing the needed electric generating facilities to meet Tampa Electric Company's future power supply demands. The first step in the program involved the detailed review and concurrence by the Siting Task Force that Tampa Electric Company needed the new facilities to meet future customer electricity demands. During this review, the Task Force considered Tampa Electric Company's programs to encourage energy conservation, DSM, and cogeneration to reduce future electricity demands.

In order to be located in proximity to its customers, Tampa Electric Company preferred that the new generating facilities be located within a six-county area that included its service territory and adjacent areas: Hillsborough, Pinellas, Pasco, Manatee, Polk, and Hardee Counties. Tampa Electric Company's service areas and the six-county study region are presented in Figure 1.1.1-1. Tampa Electric Company and the Siting Task Force concurred that, ideally, the two power plant facilities (i.e., CC and baseload facilities) should be located at one contiguous area; however, the siting program also evaluated the option of locating the CC and baseload power plants on separate sites.

The suitability and acceptability of potential sites for power plant development involved a combination of environmental, social, engineering, and economic/cost factors. Usually, any potential site will have certain advantages and disadvantages in relation to these factors (probably no site is perfect considering all siting factors). Therefore, the power plant site selection process involved systematic analyses and comparisons to evaluate the advantages and disadvantages of various areas in an attempt to locate potential sites that had the most suitable or acceptable balance of trade-offs among the environmental, social, and engineering/economic siting factors.

The overall approach for the Tampa Electric Company Power Plant Site Selection Assessment was based on a comprehensive, structured methodology that effectively integrated the multidisciplinary environmental and engineering/economic siting factors in the evaluation of potential areas for siting the new power plants. In addition, since the ultimate goal of the program was to identify sites that could be licensed or approved for power plant construction and operation, the program approach was designed to address and comply with applicable federal, state, and local regulatory requirements for siting new power plant facilities. The most comprehensive of these requirements at the federal and state regulatory agency levels are NEPA and PPSA.

The Tampa Electric Company Power Plant Site Selection Assessment was structured into three major, sequential phases:

- Phase I--Regional Screening
- Phase II--Intermediate Screening
- Phase III--Detailed Analyses

The primary objective of each phase was to identify those areas within the six-county study region that were considered more suitable for power plant development. As the siting process progressed through each phase, the number of potential siting areas under consideration was reduced and the level of detail involved in the environmental and engineering/economic evaluations of the remaining areas increased. The Siting Task Force actively participated throughout the siting process. The Task Force reviewed and provided inputs on the criteria and methods used for the evaluations and on the results of each phase. Figure 2.5.1-1 shows the general work flow of the site selection program and the key points of review and inputs from the Siting Task Force. The following summarizes the results of each phase of the siting program and the Siting Task Force recommendations on the preferred sites for Tampa Electric Company's future generation expansion.

2.5.2 Regional Screening

Regional screening involved an evaluation of the six-county study region based on various environmental criteria or constraints to power plant development. Based on this evaluation, the entire study area was screened and mapped into two ratings of potential suitability for power plant development: potentially favorable and potentially restricted.

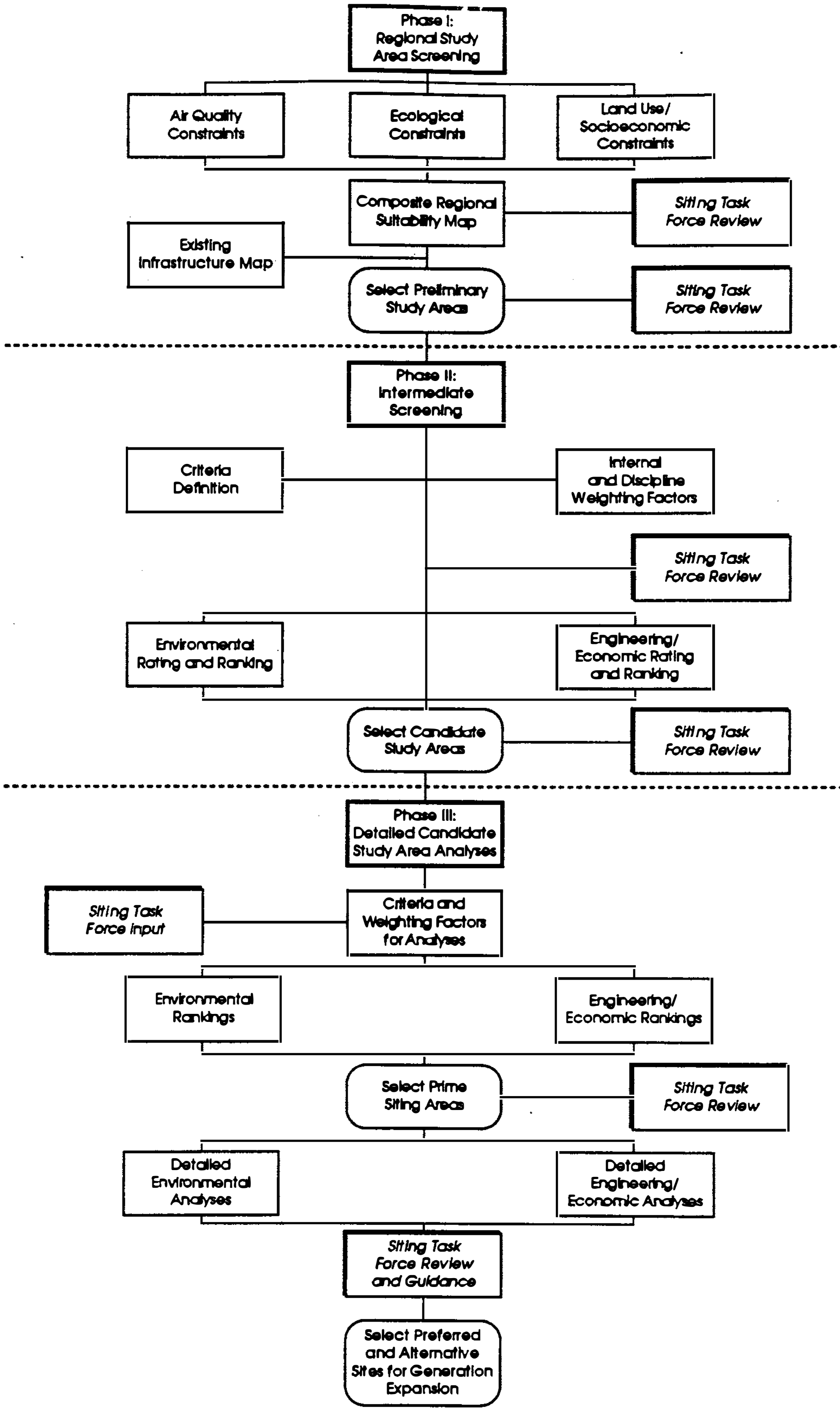


FIGURE 2.5.1-1.
Generalized Work Flow Diagram from Tampa Electric Company Site Selection Assessment Program.

SOURCES: ECT, 1992; TEC, 1992a.

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The two suitability ratings were defined as follows:

- Potentially Favorable--Areas that generally meet all requirements for siting the power plant facilities (i.e., areas where land use/socioeconomic, ecological systems, and air quality characteristics are expected to only minimally affect, or be affected by, power plant siting)
- Potentially Restricted--Areas where regulatory requirements or technological limitations would probably preclude the power plant siting: (a) without major modifications in standard plant design, (b) without significant mitigative actions, or (c) within a reasonable timeframe

As shown in Table 2.5.2-1, which outlines specific environmental criteria or constraints used for regional screening, the criteria were grouped into three environmental discipline categories: air quality, ecological systems, and land use/socioeconomics. In general, the regional screening criteria for the ecological systems and land use/socioeconomic disciplines were designed to avoid (i.e., rate as potentially restricted) areas that contained environmentally-sensitive lands such as major wetlands; aquatic preserves; national and state forests, preserves, parks, and wildlife refuges; and other government-controlled lands, as well as areas that were currently in or planned for intensive land uses such as cities, towns, communities, residential and commercial areas, and other urban and suburban land uses. The criteria for the air quality discipline were designed to avoid areas with restrictive regulations for maintaining high air quality conditions, areas with existing air quality problems, or in the immediate vicinity of major existing air emission sources.

The lands associated with the criteria for each discipline were mapped within the six-county study region and were rated as potentially restricted for power plant development. All areas outside of these lands were rated as potentially favorable for each environmental discipline. The three discipline-specific maps were then composited by overlay mapping techniques to develop a composite regional screening map of the study region. For the composite map, areas within the region were considered as potentially restricted if the area was rated as potentially restricted for any one criterion in the discipline maps. Figure 2.5.2-1 presents the composite map resulting from the regional screening based on the environmental discipline criteria.

The next step was the identification and mapping of existing and planned infrastructure systems that could be needed to support the planned facilities. These systems included arterial highways, active and abandoned railroads, natural gas and oil pipelines, and electric transmission lines with a capacity of 230 kV or larger. The suitability of potential siting areas for the planned power plant development would be enhanced (i.e., less potential environmental impacts and lower costs) by locating adjacent to or near existing infrastructure systems since the need to construct new support facilities would be reduced.

Table 2.5.2-1. Favorability Specifications for Regional Screening Criteria

Potentially Favorable	Potentially Restricted
<u>Air Quality</u>	
All other areas	Areas (other than nonattainment areas) within 5 kilometers (km) of ambient monitors showing maximum SO_2 or NO_x levels higher than 50 percent of NAAQS
	Areas designated as PM nonattainment areas
	Areas within 2.5 to 5 km of existing or proposed sources with SO_2 emissions of at least 5,000 tpy
<u>Ecological Systems</u>	
All other areas	Major wetlands as delineated on FWS National Wetland Inventory maps
<u>Land Use/Socioeconomics</u>	
All other areas	Aquatic preserves Areas of critical state concern Urban and suburban lands Non-industrial Developments of Regional Impact National and state forests Water conservation areas Indian reservations Military reserves National and state preserves National wildlife refuges Conservation and Recreation Lands Hillsborough County Environmental Lands Acquisition and Protection Program lands Save Our Rivers lands Save Our Coasts lands Outstanding Florida Waters National and state parks and recreation areas Watershed protection overlay district

Sources: ECT, 1992; TEC, 1992a.

Based on the composite screening map, all areas rated as potentially favorable or where no constraints had been identified were considered as potentially suitable for siting the planned power plant facilities. These areas were examined to delineate broad areas called preliminary study areas, which were further evaluated in the siting program.

Figure 2.5.2-2 shows the general location of the preliminary study areas identified during the regional screening process. As shown on this figure, preliminary study areas were identified for each of the power plant development options: 34 areas for CC only, 23 areas for CC or baseload, and 21 areas for both CC and baseload plants on one site.

2.5.3 Intermediate Screening

The overall objective of intermediate screening was to evaluate the preliminary study areas, based on environmental and engineering/economic criteria, and select a reasonable number of study areas for detailed, site-specific analyses. This objective was accomplished using a three-step process. First, the preliminary study areas were examined to identify the potential, conceptual development plan for each area. The conceptual plan identified the potential cooling water system (i.e., cooling towers, reservoirs, or once-through cooling); the potential source(s) of cooling water makeup and discharge; the potential fuel delivery system(s) (i.e., pipelines, trucking, railroad, and/or barge); and potential electrical transmission system. The conceptual plans served as the basis for evaluating the relative environmental and engineering/economic suitability of the preliminary study areas for each of the three power plant development options.

Second, the preliminary study areas were evaluated based on specific environmental and engineering/economic criteria. The environmental criteria measured the specific differences in site and facility requirements for the power plant development options.

Third, preliminary study areas were evaluated and rated using a five-level rating scale developed by Tampa Electric Company's consultant group and reviewed and approved by the Siting Task Force for each criterion presented in Table 2.5.3-1.

2.5.3.1 Environmental Evaluations

Within the environmental evaluation process, two types of weighting factors were developed and used to reflect the relative importance of the criteria and environmental disciplines in determining the overall siting suitability of the preliminary study areas. The first were called internal weighting factors, which indicated the relative importance of the criteria or associated environmental impacts within each of the four major disciplines. The second were called discipline weighting factors, which reflected the relative importance of the four major environmental disciplines to each other in evaluating the siting suitability of the preliminary study

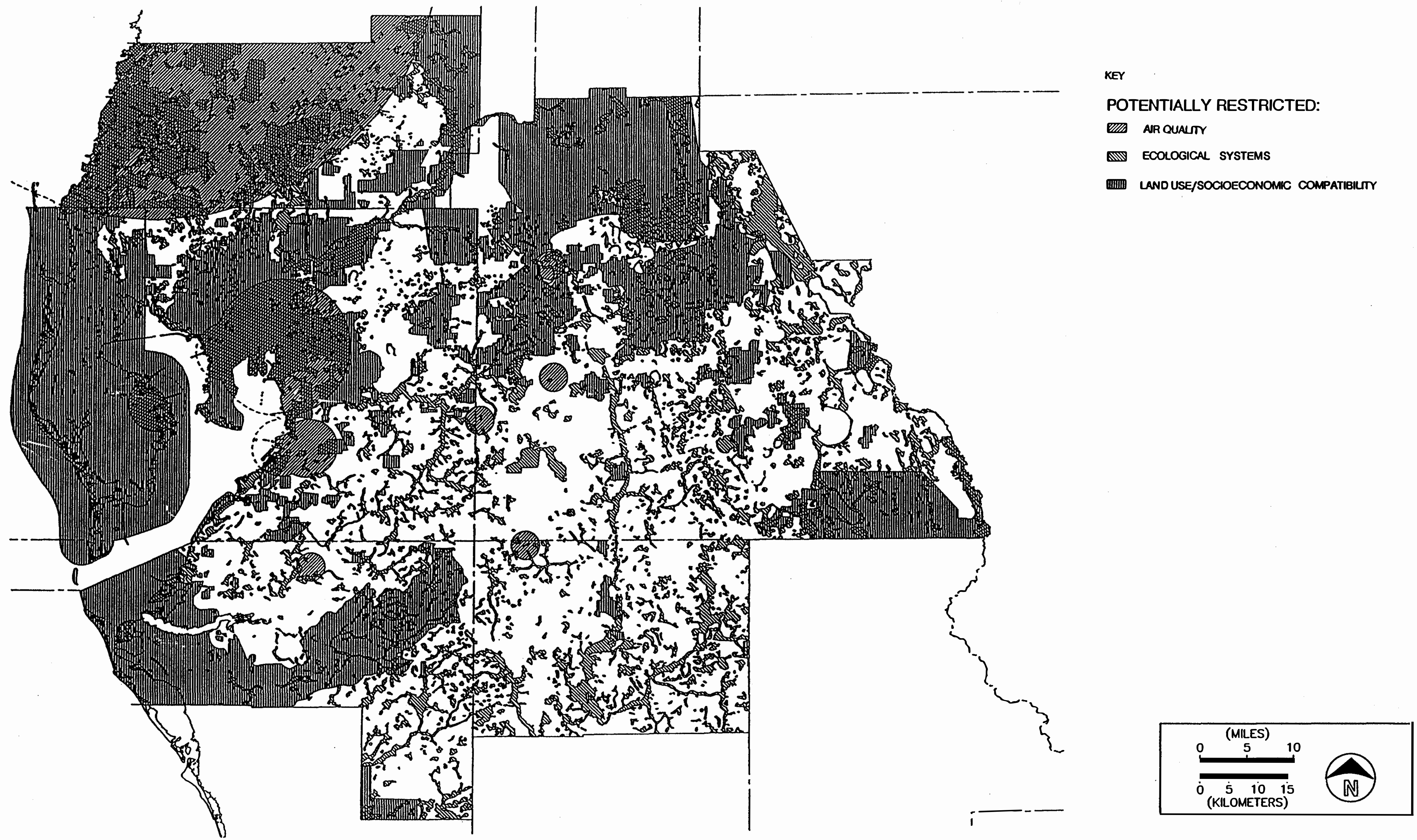

FIGURE 2.5.2-1.
Regional Screening Results - Composite Map.

SOURCES: TEC, 1990b; TEC, 1992a.

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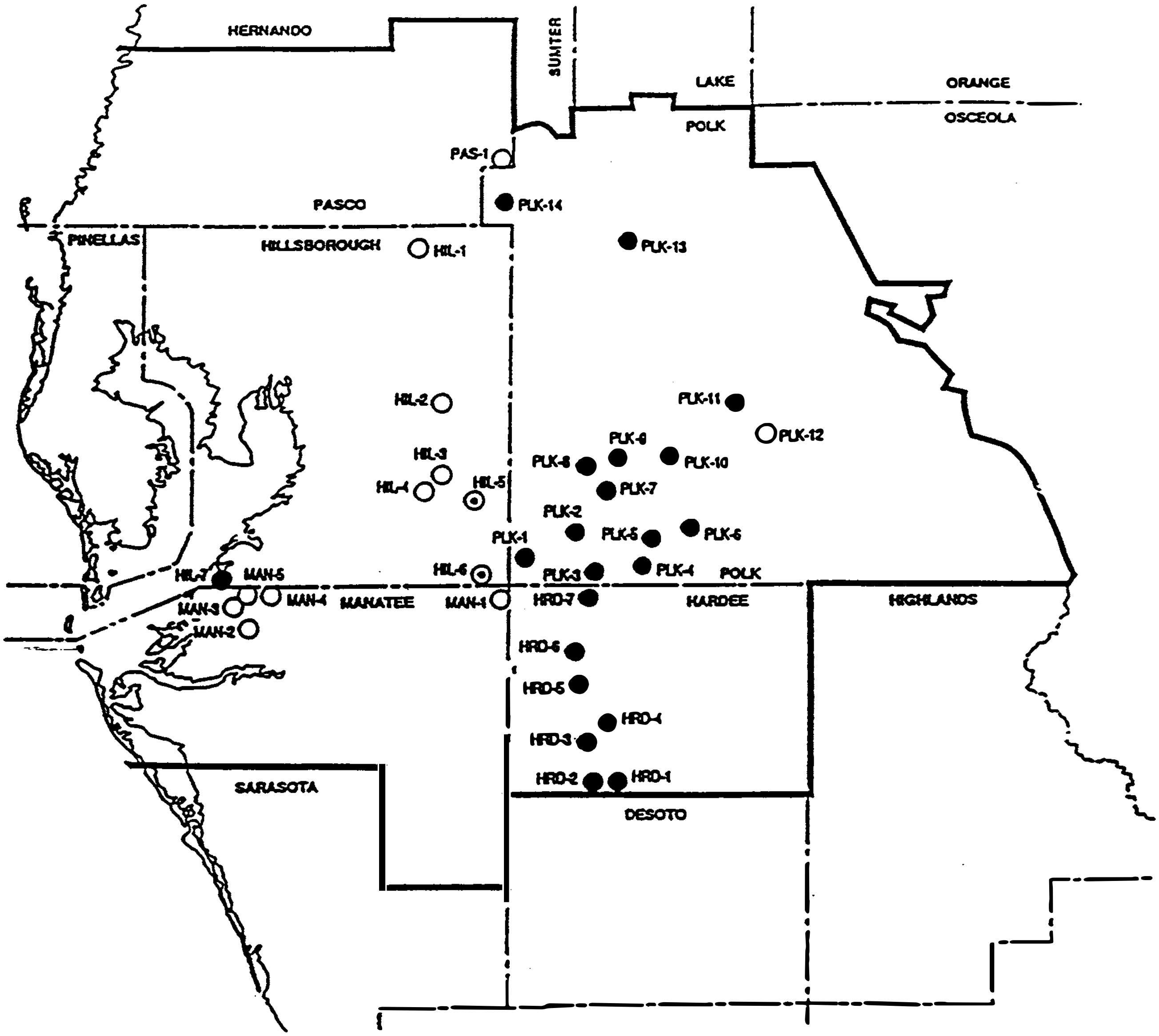

KEY

○ Combined Cycle

⊙ Combined Cycle or Baseload

● Combined Cycle and Baseload

FIGURE 2.5.2-2.
General Location of Preliminary Study Areas.

SOURCES: TEC, 1990a; TEC, 1992a.

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Table 2.5.3-1. Intermediate Screening Environmental Criteria and Internal Weighting Factors

Discipline	Criteria	Internal Weighting Factor
Air quality	AAQS	4
	PSD Class II increments	3 or 4*
Ecological resources	Diversity of area systems	4
	Value of habitat function	4
	Impact on protected species	5
Water resources/ area suitability	Advantages for cooling water makeup	5
	Advantages for cooling water discharge	5
	Area suitability advantages	3
Land use/socio-economics	Compatibility with existing land-use patterns	5
	Compatibility with planned land-use patterns	5
	Impact on archaeological/historical resources	3
	Community impact	4
	Agricultural impact	1

* An internal weighting factor of 3 was used for the CC and CC or baseload development options and a factor of 4 was used for the CC and baseload option.

Sources: TEC, 1990b; TEC, 1992a.

areas. The internal weighting factors for the various criteria are shown in Table 2.5.3-1. These factors ranged from 5 to 1, with 5 indicating the highest level of importance.

The discipline weighting factors were developed by the Siting Task Force using a pairwise comparison technique. In developing these factors, each task force member completed a pairwise comparison matrix within which the member rated the relative importance of the disciplines to power plant siting. The four disciplines were compared two at a time and assigned a score of 1.0 if the discipline was considered more important than the other, a score of 0.0 if the discipline was less important, and a score of 0.5 if the task force member felt that the disciplines were of equal importance in evaluating the suitability of potential power plant sites. The average scores of the Task Force member evaluations were used as the discipline weighting factors. Based on these results, water resources/area suitability and ecological systems, both with average scores of 2.92, were considered to be more important than the other two disciplines; the average air quality score was 2.15; and land use/socioeconomics had the lowest score with an average of 2.00.

Using these weighting factors, the discipline ratings were composited into an overall environmental ranking of the preliminary study areas. Table 2.5.3-2 presents the overall results of the environmental ratings and rankings of the preliminary study areas for the full development option (i.e., CC and baseload units). In this table, a higher weighted score indicates that the study area was considered more suitable environmentally for power plant development. Based on these rankings, preliminary study areas PLK-7, PLK-2, PLK-3, and PLK-1 were considered as the most suitable areas.

2.5.3.2 Engineering/Economic Evaluations

In conjunction with the environmental evaluations of the preliminary study areas, an engineering/economic evaluation of each area was conducted. The engineering/economic evaluation focused on the relative present worth cost differentials in developing the areas for the planned power plant facilities. The major siting area requirements that affect the relative costs of developing the areas are:

- Site access (e.g., road and railroad)
- Electrical transmission system
- Cooling water system
- Fuel delivery

The present worth costs for developing each of the preliminary study areas were estimated relative to these potential major improvements. The costing information was considered rather conceptual at this stage, but was of sufficient detail to allow for relative cost comparisons among the areas. The preliminary study areas were then ranked based on these development cost estimates using the study area with the lowest cost as the base case for ranking purposes.

Table 2.5.3-2. Summary of Phase II Environmental Ratings and Rankings for the CC and Baseload Development Option (Page 1 of 2)

	Air (2.15)			Ecology (2.92)				Water Resources (2.92)			
Study Area	Existing SO_2 Emiss. (4) +	Existing PSD SO_2 Sources (4) =	Wght Avg. (8)	System Diversity (4) +	Habitat Function (4) +	Protected Species (5) =	Wght Avg. (13)	Water Makeup Consid. (5) +	Discharge Consid. (5) +	Area Suitability (3) =	Wght Avg. (13)
PLK-7	5	5	10.75	5	5	5	14.60	3	4	3	9.88
PLK-2	4	5	9.68	4	4	4	11.68	3	4	4	10.56
PLK-3	4	5	9.68	4	4	4	11.68	3	4	4	10.56
PLK-1	4	5	9.68	4	4	4	11.68	3	4	3	9.88
PLK-8	4	5	9.68	4	4	4	11.68	3	4	3	9.88
PLK-9	2	5	7.53	4	5	4	12.58	3	4	4	10.56
PLK-10	2	5	7.53	4	5	4	12.58	3	4	4	10.56
PLK-5	2	5	7.53	4	4	4	11.68	3	4	4	10.56
PLK-4	2	5	7.53	4	4	4	11.68	3	4	4	10.56
PLK-6	2	2	4.30	4	4	4	11.68	3	4	4	10.56
HIL-7	4	2	6.45	3	3	2	7.64	4	3	5	11.23
HRD-7	2	2	4.30	4	4	4	11.68	3	3	4	9.43
PLK-14	5	3	7.53	3	2	3	7.86	3	3	3	8.76
PLK-13	2	2	4.30	4	4	3	10.56	3	4	3	9.88
PLK-11	2	2	4.30	4	4	4	11.68	2	3	2	6.96
HRD-5	2	2	4.30	3	3	3	8.76	3	3	4	9.43
HRD-4	2	1	3.23	3	3	3	8.76	3	3	5	10.11
HRD-3	2	1	3.23	3	3	3	8.76	3	3	4	9.43
HRD-6	2	2	4.30	2	3	2	6.74	3	3	4	9.43
HRD-1	1	1	2.15	3	3	3	8.76	2	3	5	8.98
HRD-2	1	1	2.15	4	3	3	9.66	1	3	5	7.86

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Table 2.5.3-2. Summary of Phase II Environmental Ratings and Rankings for the CC and Baseload Development Option (Page 2 of 2)

Study Area	Land Use/Socioeconomics (2.00) Existing Land Use (5)	+	Planned Land Use (5)	+	Cult. Res. (3)	+	Community Impact (4)	+	Agric. Impact (1)	=	Wght Avg. (18)	Total Weight Score	Rank
PLK-7	5		5		5		5		5		10.00	45.23	1
PLK-2	5		5		5		5		5		10.00	41.91	2
PLK-3	5		5		4		5		4		9.56	41.47	3
PLK-1	5		5		6		5		6		9.56	40.79	4
PLK-8	5		4		5		4		5		9.00	40.24	5
PLK-9	5		5		5		4		5		9.56	40.22	6
PLK-10	5		5		5		4		4		9.44	40.10	7
PLK-5	5		5		4		4		5		9.22	38.98	8
PLK-4	4		4		4		4		3		7.89	37.65	9
PLK-6	4		4		4		4		3		7.89	34.43	10
HIL-7	5		4		4		4		3		8.44	33.76	11
HRD-7	4		5		4		3		3		8.00	33.41	12
PLK-14	5		5		4		4		5		9.22	33.37	13
PLK-13	4		4		5		3		5		8.00	32.74	14
PLK-11	5		5		4		4		5		9.22	32.17	15
HRD-5	5		5		4		4		5		9.22	31.72	16
HRD-4	5		5		4		4		3		9.00	31.09	17
HRD-3	5		5		5		4		4		9.44	30.86	18
HRD-6	5		5		4		5		5		9.67	30.14	19
HRD-1	4		4		4		4		3		7.89	27.78	20.5
HRD-2	4		4		4		4		5		8.11	27.78	20.5

Sources: TEC, 1990b; TEC, 1992a.

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Table 2.5.3-3 shows the results of the engineering/economic evaluations of the preliminary study areas for the full development option. The initial estimated costs for all preliminary study areas for freshwater cooling towers using groundwater as the water source were less than cooling reservoirs; therefore, the costs for freshwater towers as the cooling system were used in developing the total cost estimates for the areas, except for HIL-7. As indicated in the table for HIL-7, the total costs were calculated based on the use of either saltwater cooling towers or once-through saltwater cooling since this study area was near enough to Tampa Bay to use saltwater versus freshwater from wells as a source of water for cooling purposes. Also, the total estimated costs included the costs for both the natural gas and fuel oil pipelines since both of these fuels are desired for a CC plant to maintain flexibility in fuels.

As shown in Table 2.5.3-3, the HIL-7 preliminary study area had the lowest estimated costs for the power plant development primarily due to the lower coal handling and delivery costs associated with this study area. The estimated costs for HIL-7 were approximately $14.5 million to $55.1 million less than the next most cost-effective study area, depending on the cooling system used.

2.5.3.3 Composite Results of Intermediate Screening

The environmental and engineering/economic rankings of the preliminary study areas were combined to provide decision-making tools to identify the areas that were more suitable for power plant development. The rankings were combined and displayed using both numerical indexing and graphical, frontier mapping techniques.

The frontier mapping method involved plotting the environmental rating scores for the preliminary study areas versus the relative cost savings for each area. The relative cost savings were computed by subtracting the estimated present worth costs for areas from the present worth cost for the area with the highest costs. Thus, the figures plotted on the frontier map represent the estimated cost savings relative to the study area with the highest costs. Based on the frontier maps, the more suitable study areas with a combination of the highest environmental scores and greatest relative cost savings would be plotted in the upper-right portion of the map, while less suitable study areas would be plotted in the lower-left portion of the map.

For the indexing method, the environmental rating scores and estimated present worth costs for the preliminary study areas were converted to figures indexed on a possible 0 to 100 scale and then added together to develop a composite environmental and economic score. The conversion of the environmental scores was accomplished by setting the highest environmental score for the study areas at 100 and then calculating the indexed scores for the remaining study areas using a technique which maintained the relative differences in the base scores to the highest score. To index the cost figures, the lowest cost was set at 100 and again the costs for the other study areas were converted to indexed costs that maintained the relative differences of the study area costs to the lowest cost.

Table 2.5.3-3. Present Worth Cost Estimates for Preliminary Study Areas for the CC and Baseload Development Option (in millions of 1990 dollars)

Preliminary Study Area	Road Access	Rail Access	Transmission Lines/ Substations	Cooling Towers	Natural Gas Pipeline	Fuel Oil Pipeline	Coal Handling Facilities	Coal Delivery*	Total
HIL-7†	0.285	0.401	6.517	85.250	16.705	0.456	71.416	0.000	181.030
HIL-7‡	0.285	0.401	6.517	125.929	16.705	0.456	71.416	0.000	221.709
PLK-11	0.285	0.401	4.139	65.258	8.270	4.708	108.616	44.500	236.177
PLK-13	0.570	2.003	11.226	67.045	0.662	1.975	108.616	44.500	236.597
PLK-8	0.285	0.401	0.690	66.366	9.923	6.227	108.616	44.500	237.008
PLK-9	0.285	0.401	0.690	67.697	9.262	5.620	108.616	44.500	237.071
PLK-14	1.142	0.801	11.092	65.660	2.812	4.101	108.616	44.500	238.724
PLK-7	0.285	0.401	2.760	65.923	11.743	7.139	108.616	44.500	241.367
PLK-2	0.285	0.401	1.380	68.584	13.231	6.987	108.616	44.500	243.984
PLK-3	1.993	1.202	2.760	65.923	14.389	10.328	108.616	44.500	249.711
PLK-10	0.854	7.362	9.659	65.479	8.766	5.164	108.616	44.500	250.400
PLK-1	0.285	0.801	9.315	66.366	13.231	8.354	108.616	44.500	251.468
PLK-4	0.854	0.401	8.969	66.810	13.066	9.113	108.616	44.500	252.329
PLK-5	0.570	0.401	13.798	66.810	11.743	7.898	108.616	44.500	254.336
HRD-7	1.424	2.003	9.030	66.366	15.878	11.695	108.616	44.500	259.512
HRD-5	0.285	0.401	3.953	69.206	18.524	14.125	108.616	44.500	259.610
HRD-6	2.563	0.801	3.953	69.471	17.531	13.214	108.616	44.500	260.649
HRD-4	0.854	1.202	5.185	66.366	19.516	15.037	108.616	44.500	261.276
HRD-3	0.570	0.801	5.493	69.206	20.178	15.644	108.616	44.500	265.008
PLK-6	0.285	8.313	18.628	65.923	12.570	8.658	108.616	44.500	267.493
HRD-1	0.854	0.801	9.190	66.810	22.163	17.467	108.616	44.500	270.401
HRD-2	0.854	0.801	8.573	69.915	22.163	17.467	108.616	44.500	272.889

Note: Assumes the use of freshwater cooling towers, except:
* Represents differential cost for rail delivery of coal from a terminal on Tampa Bay relative to the HIL-7 study area
† Saltwater cooling towers
‡ Once-through cooling.

Sources: TEC, 1990b; TEC, 1992a.

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When combining the environmental and engineering/economic indexed rankings at this phase of a typical siting study, the relative importance of each type of ranking to the overall suitability of the area can vary from a weighting factor of 3 to 1 in favor of the environmental ranking to an equivalent weighting factor of 1 to 1 for the environmental and engineering/economic rankings. The Siting Task Force recommended the use of a mid-range 2 to 1 weighting in favor of the environmental rankings for the indexed composite rankings.

Figure 2.5.3-1 presents the frontier map for the CC and baseload development option, and Table 2.5.3-4 presents the indexing method results.

2.5.3.4 Selection of Candidate Study Areas

The task force members reviewed these results and considered several other factors in selecting the candidate study areas. These other factors included:

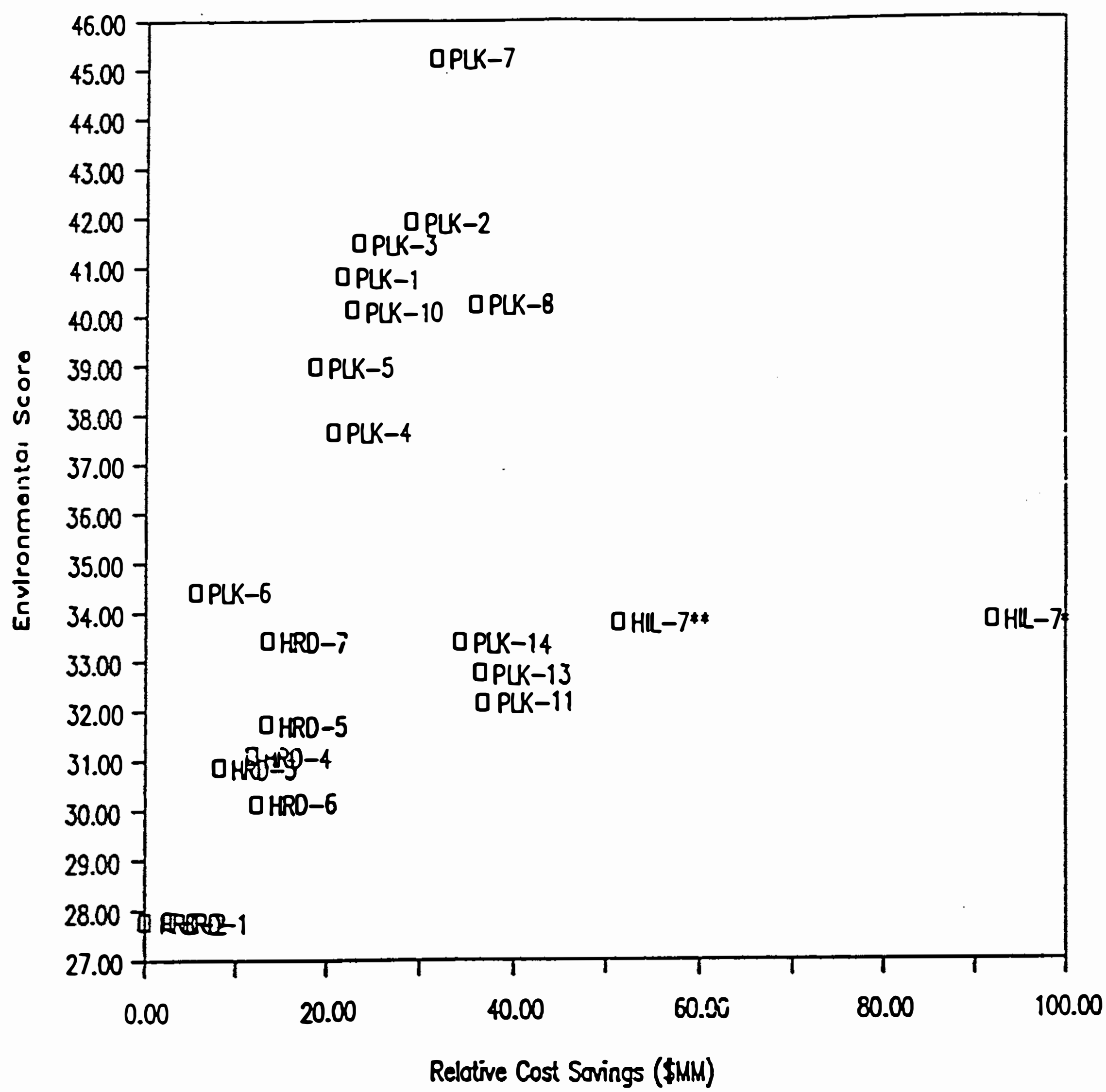
- Current information on the availability of land for Tampa Electric Company's use within the preliminary study areas
- Desire to maintain some geographical diversity in the locations of the remaining study areas
- Desire to carry forward only one area where study areas were in close proximity and had similar environmental characteristics

Based on the evaluation results and these other considerations, the Siting Task Force selected the candidate study areas shown in Figure 2.5.3-2 for more detailed analyses. Ten areas were selected for the CC and baseload development option, 11 areas for the baseload (or CC) option, and 15 areas for the CC only option. Also, as shown in Figure 2.5.3-2, ten of the areas were similar for the three development options.

2.5.4 Detailed Analyses

The overall objective of the detailed analyses was to select the preferred site(s) for Tampa Electric Company's future generation expansion from the areas remaining after the intermediate screening evaluations. The Phase III Detailed Analyses were performed in the following five steps:

1. Develop the environmental and engineering/economic criteria used to rate the suitability of the candidate study areas based on inputs from the Siting Task Force
2. Evaluate, rate, and rank the candidate study areas based on the environmental and engineering/economic criteria and weighting factors to select the prime siting areas that were considered most suitable for power plant siting
3. Perform detailed environmental and engineering/economic analyses of the advantages, disadvantages, and trade-offs associated with each prime siting area



Note: Assumes the use of freshwater cooling towers, except:
HIL-7*–Saltwater Cooling Towers
HIL-7**–Once Through Cooling

FIGURE 2.5.3-1.
Phase II Frontier Mapping Results for the CC and Baseload Development Option.

SOURCES: TEC, 1990b; TEC, 1992a.

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Table 2.5.3-4. Indexed Composite Rating Results for the CC and Baseload Development Option

Study Area	Environmental Base Score	Cost* CC Baseload FWT†	Indexed Environmental Score	Indexed Cost	Comparison (1:1)	Comparison (2:1)	Rank (1:1)	Rank (2:1)
PLK-7	45.23	241.367	100.00	76.75	176.75	276.75	1	1
PLK-2	41.91	243.984	92.66	75.74	168.41	261.07	3	2
PLK-3	41.47	249.711	91.68	73.53	165.22	256.90	6	3
PLK-8	40.24	237.008	88.96	78.43	167.39	256.36	4	4
PLK-9	40.22	237.071	88.91	78.41	167.32	256.23	5	5
PLK-1	40.79	251.468	90.19	72.86	163.05	253.24	7	6
PLK-10	40.10	250.400	88.67	73.27	161.94	250.61	8	7
HIL-7‡	33.76	181.030	74.65	100.00	174.65	249.29	2	8
PLK-5	38.98	254.336	86.19	71.75	157.94	244.13	10	9
PLK-4	37.65	252.329	83.24	72.53	155.77	239.01	11	10
HIL-7§	33.76	221.709	74.65	84.32	158.97	233.62	9	11
PLK-14	33.37	238.724	73.78	77.77	151.54	225.32	12	12
PLK-13	32.74	236.597	72.39	78.59	150.97	223.36	13	13
PLK-11	32.17	236.177	71.11	78.75	149.86	220.98	14	14
PLK-6	34.43	267.493	76.11	66.68	142.80	218.91	16	15
HRD-7	33.41	259.512	73.88	69.76	143.63	217.51	15	16
HRD-5	31.72	259.610	70.12	69.72	139.84	209.96	17	17
HRD-4	31.09	261.276	68.74	69.08	137.82	206.57	18	18
HRD-3	30.86	265.008	68.24	67.64	135.88	204.11	20	19
HRD-6	30.14	260.649	66.63	69.32	135.95	202.59	19	20
HRD-1	27.78	270.401	61.43	65.56	126.99	188.42	21	21
HRD-2	27.78	272.889	61.42	64.60	126.03	187.45	22	22

Note: Assumes the use of freshwater cooling towers, except:

* Shown in millions of 1990 dollars and assumes the use of freshwater cooling towers, except as noted.

† freshwater cooling tower.

‡ Saltwater cooling towers, and

§ Once-through cooling.

Sources: TEC, 1990b; TEC, 1992a.

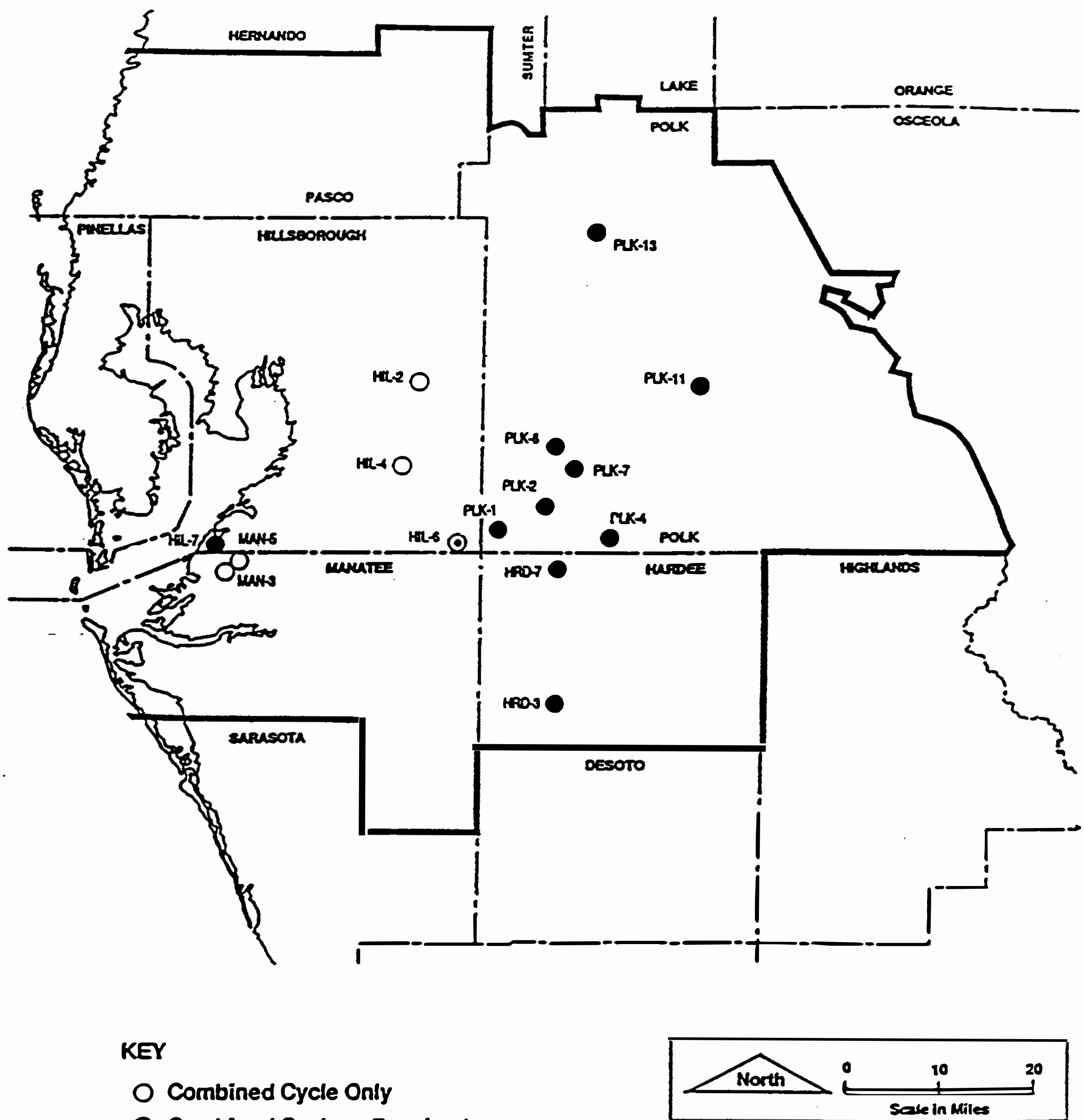

FIGURE 2.5.3-2.
General Locations of Candidate Study Areas.

SOURCES: TEC, 1990a; TEC, 1992a.

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4. Conduct a future scenario evaluation of the prime siting areas
5. Recommend the overall preferred site(s) for Tampa Electric Company's future generation expansion needs based on guidance from the Siting Task Force

2.5.4.1 Environmental Analyses of Candidate Study Areas

In the first step, a listing of concerns or issues associated with power plant development on the candidate study areas was developed. These concerns and issues were translated into environmental criteria that were used to evaluate the areas and discriminate among the study areas according to their advantages and disadvantages. Once the criteria were finalized, weighting factors that represented the relative importance of each criterion in power plant siting were developed.

The environmental evaluation was performed using the pairwise comparison technique. The technique involves comparing the study areas, two at a time, with respect to each criterion. For each pair of study areas, judgments were made as to whether one area was clearly better than the other area or if the study areas were roughly equivalent with regard to each criterion. When one study area was clearly better or more suitable for the criterion, it was given a score of 1.0 and the other area was given a score of zero. Where the two study areas were judged equivalent for a specific criterion, both areas were given a score of 0.5. The study area scores from each major environmental discipline area were tabulated using the weighting factors and the weighted scores of all disciplines were combined to obtain an overall environmental score for each candidate study area.

The following criteria in the four major environmental discipline areas were used in the evaluation.

Air Quality Analyses

- Maximum SO_2 impacts of existing sources
- Maximum total SO_2 impacts
- PSD Class I impacts

Ecological Systems Analyses

- System diversity
- Habitat function
- Rare, threatened, and endangered species

Water Resources and Area Suitability Analyses

- Cooling water makeup advantages
- Cooling water discharge advantages
- Area suitability advantages

Land-Use/Socioeconomic Analyses

- Existing land-use compatibility
- Consistency with land-use plans and zoning ordinances
- Landmarks/designated areas

Table 2.5.4-1 presents the overall results of the environmental ratings of the candidate study areas for the CC and baseload power plant development option. The total environmental scores for the areas were calculated based on the results of the pairwise comparisons for the areas and using the internal criteria and discipline weighting factors. As shown in this table, the PLK-1, PLK-2, PLK-4, and PLK-7 study areas rated as the most suitable areas for the proposed power plants. Also, the HIL-7 study area had the fifth highest environmental score for the full development option.

2.5.4.2 Engineering/Economic Evaluation of Candidate Study Areas

Concurrent with the environmental evaluation, an engineering/economic evaluation of the candidate study areas was conducted. This evaluation used the same present worth costing factors as were used in Intermediate Screening. The estimated present worth costs were refined to reflect more site-specific information regarding the power plant location within the study area. Again, these estimated costs involved those components of a power plant for which costs vary primarily based on the geographic location of the facilities, including road and rail access, transmission line and substation requirements, cooling system needs, and fuel delivery facilities. The estimated present worth costs for these components were summed to obtain a total cost for each candidate study area for each development option. Table 2.5.4-2 shows the estimates for the candidate study areas for the full development option. Based on these evaluations, HIL-7 was the most cost-effective study area for the CC and baseload power plants.

2.5.4.3 Composite Environmental and Economic Ratings

The environmental ratings of the candidate study areas and the engineering/economic evaluations were combined using two methods, frontier mapping and indexed scores and costs. The indexed environmental scores and costs were again composited on both a 2:1 ratio of the environmental versus cost figures and on a 1:1 ratio.

Figure 2.5.4-1 presents the results of the frontier mapping for the CC and baseload development option. HIL-7 was the most cost-effective study area, while the PLK-1, PLK-2, PLK-4, and PLK-7 study areas were the more environmentally-suitable areas. These five study areas also were rated the highest based on the indexed evaluation results shown in Table 2.5.4-3 for the CC and baseload development option.

Table 2.5.4-1. Phase III Environmental Ratings Results for the Candidate Study Areas for the CC and Baseload Development Option (Page 1 of 2)

Study Area	Air (2.15) Existing SO_2 Impacts (4)	+	Total SO_2 Impacts (5)	+	PSD Class I Impacts (4)	=	Wght Avg. (13)	Ecology (2.92) System Diversity (4)	+	Habitat Functn (4)	+	Protected Species (5)	=	Wght Avg. (13)
PLK-1	8.0		7.5		6.0		15.46	6.0		6.5		7.0		19.09
PLK-7	8.0		2.0		6.0		10.92	6.0		10.0		10.0		25.61
PLK-2	8.0		3.0		6.0		11.74	6.0		7.0		6.5		18.98
PLK-4	3.0		7.5		6.0		12.16	6.0		6.5		7.0		19.09
HIL-7	8.0		9.0		6.0		16.70	6.0		2.0		2.0		9.43
HRD-7	3.0		4.0		6.0		9.26	6.0		6.5		6.5		18.53
PLK-8	8.0		1.0		6.0		10.09	6.0		6.5		7.0		19.09
HRD-3	3.0		10.0		6.0		14.22	1.0		2.0		2.0		4.94
PLK-11	3.0		6.0		6.0		10.92	6.0		6.0		5.0		16.40
PLK-13	3.0		5.0		1.0		6.78	6.0		2.0		2.0		9.43

Table 2.5.4-1. Phase III Environmental Ratings Results for the Candidate Study Areas for the CC and Baseload Development Option (Page 2 of 2)

	Water Resources (2.92)							Land Use/Socioeconomics (2.00)							
Study Area	Water Makeup Consid. (5)	+	Discharge Consid. (3)	+	Area Suitability (1)	=	Wght Avg. (9)	Existing Land Use (5)	+	Land Use Plan/Zoning (4)	+	Landmark Designed Areas (3)	=	Wght Avg. (12)	Total Weight Score
PLK-1	6.5		8.5		3.0		19.79	8.0		6.5		8.0		15.00	69.35
PLK-7	6.5		8.5		3.0		19.79	8.0		6.5		4.0		13.00	69.31
PLK-2	6.5		8.5		7.5		21.25	8.0		6.5		8.0		15.00	66.97
PLK-4	6.5		8.5		7.5		21.25	7.0		6.5		8.0		14.17	66.67
HIL-7	10.0		4.0		7.5		22.55	8.0		9.5		1.0		13.50	62.19
HRD-7	6.5		4.0		7.5		16.87	4.5		3.5		8.0		10.08	54.75
PLK-8	6.5		4.0		3.0		15.41	2.5		9.5		2.5		9.67	54.26
HRD-3	2.0		4.0		7.5		9.57	4.5		3.5		8.0		10.08	38.82
PLK-11	2.0		1.0		1.0		4.54	2.5		1.5		5.0		5.58	37.44
PLK-13	2.0		4.0		7.5		9.57	2.0		1.5		2.5		3.92	29.70

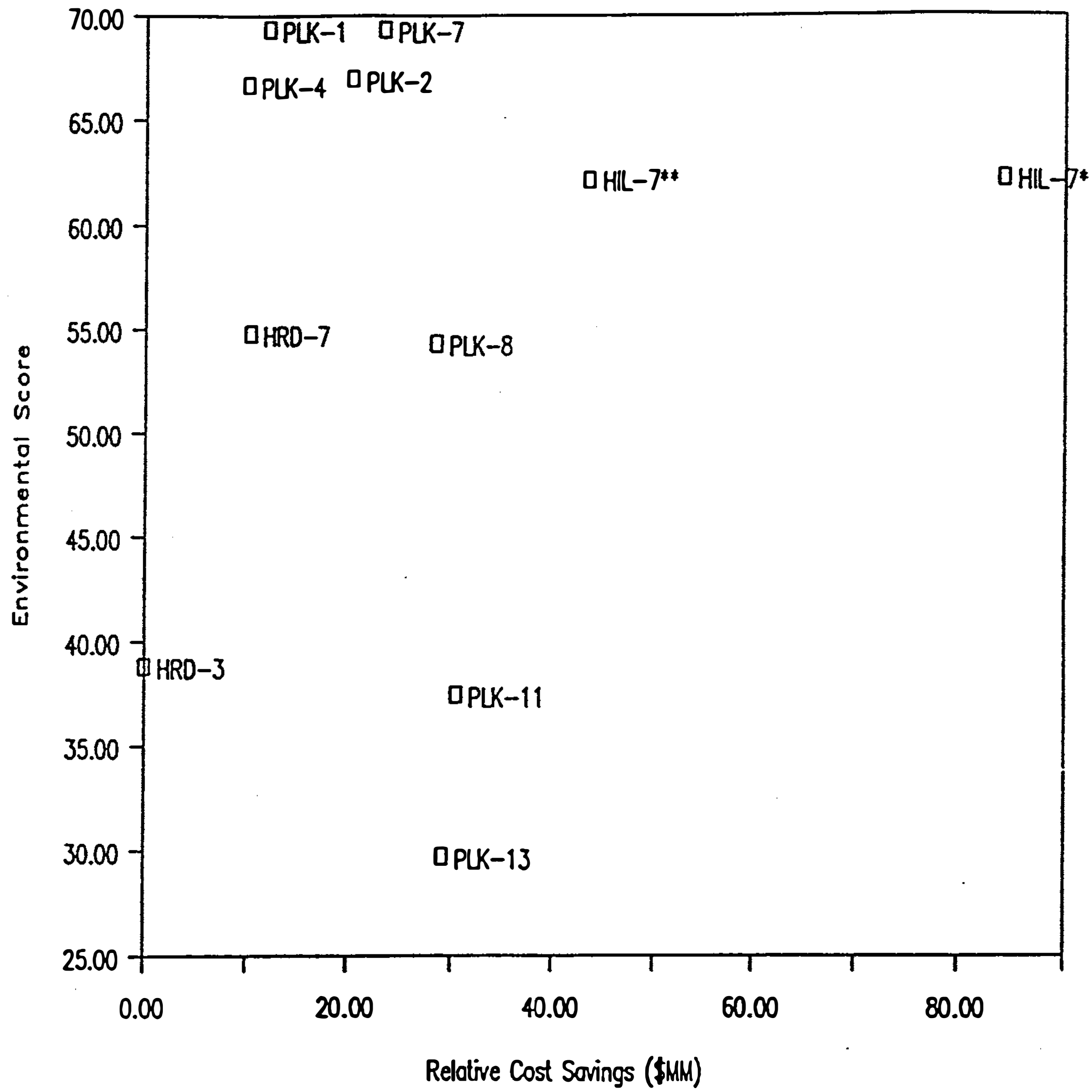
Sources: TEC, 1990b; TEC, 1992a.

Table 2.5.4-2. Present Worth Cost Estimates for the Candidate Study Areas for the CC and Baseload Development Option (in millions of 1990 dollars)

Preliminary Study Area	Road Access	Rail Access	Transmission Lines/ Substations	Cooling Towers	Natural Gas Pipeline	Fuel Oil Pipeline	Coal Handling Facilities	Coal Delivery	Total
HIL-7*	0.285	0.355	6.311	85.250	16.705	0.456	71.416	0.000	180.778
HIL-7†	0.285	0.355	6.311	125.929	16.705	0.456	71.416	0.000	221.457
PLK-11	0.285	0.801	2.334	65.120	8.270	4.708	108.616	44.500	234.634
PLK-13	0.285	1.603	11.248	67.045	0.662	1.975	108.616	44.500	235.934
PLK-8	0.285	0.401	0.345	66.366	9.923	6.227	108.616	44.500	236.663
PLK-7	0.142	0.200	3.450	65.923	11.743	7.139	108.616	44.500	241.713
PLK-2	0.57	0.200	2.070	68.584	13.231	6.987	108.616	44.500	244.758
PLK-1	0.285	0.801	10.842	66.366	13.231	8.354	108.616	44.500	252.995
HRD-1	0.57	2.003	4.249	67.253	15.878	11.695	108.616	44.500	254.764
PLK-4	0.854	0.401	11.729	66.810	13.066	9.113	108.616	44.500	255.089
HRD-3	0.285	0.819	7.342	67.697	20.178	15.644	108.616	44.500	265.081

Note: Assumes the use of freshwater cooling towers, except:
* Saltwater cooling towers
† Once-through cooling.

Sources: TEC, 1990b; TEC, 1992a.



Note: Assumes the use of freshwater cooling towers, except:
HIL-7*--Saltwater Cooling Towers
HIL-7**--Once Through Cooling

FIGURE 2.5.4-1.
Phase III Frontier Mapping Results for the CC and Baseload Development Option.

SOURCES: TEC, 1990a; TEC, 1992a.

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Table 2.5.4-3. Indexed Composite Evaluation Results for the CC and Baseload Development Option

Study Area	Environ-mental Base Score	Cost* CC Baseload FWT†	Indexed Environ-mental Score	Indexed Cost	Compar-ison (1:1)	Compar-ison (2:1)	Rank (1:1)	Rank (2:1)
HIL-7‡	62.19	108.778	89.68	100.00	279.35	189.68	1	1
PLK-7	69.31	241.713	99.94	77.01	276.90	176.96	2	2
HIL-7§	62.19	221.457	89.68	84.65	264.01	174.33	6	3
PLK-1	69.35	252.995	100.00	72.76	272.76	172.76	3	4
PLK-2	66.97	244.758	96.57	75.86	269.00	172.43	4	5
PLK-4	66.67	255.089	96.14	71.97	264.24	168.10	5	6
PLK-8	54.26	236.663	78.24	78.92	235.40	157.16	7	7
HRD-7	54.75	254.764	78.95	72.09	229.98	151.04	8	8
PLK-11	37.44	234.634	53.99	79.68	187.66	133.67	9	9
HRD-3	38.82	265.081	55.98	68.20	180.15	124.17	10	10
PLK-13	29.70	235.934	42.83	79.19	164.85	122.02	11	11

Note: Assumes the use of freshwater cooling towers, except:
- * Shown in millions of 1990 dollars and assumes use of freshwater cooling towers, except as noted.
- † freshwater cooling tower.
- ‡ Saltwater cooling towers, and
- § Once-through cooling.

Sources: TEC, 1990b; TEC, 1992a.

2.5.4.4 Prime Siting Area Selection

Based on the results of the composite environmental and economic evaluations, the Siting Task Force selected five of the study areas as prime siting areas for further evaluation. Four of these areas were located in southwestern Polk County, PLK-1, PLK-2, PLK-4, and PLK-7, and one area was located in the extreme southwestern corner of Hillsborough County and the northwestern corner of Manatee County, HIL-7. Figure 2.5.4-2 shows the general location of the five prime siting areas.

At this time in the siting process, another area in southwestern Polk County was brought to the attention of the Siting Task Force as a potential power plant site by the phosphate mining company that owned the site. This area had just recently been considered available for power plant use due to changes in the company's mining plans. The area was designated as PLK-A and its general location is shown on Figure 2.5.4-2. After review by the technical siting consultants and the Siting Task Force, the environmental characteristics of PLK-A were considered to be similar to the previously selected prime siting areas in southwestern Polk County. Also, the engineering/economic features of PLK-A were similar to the PLK-1 and PLK-2 siting areas due to its proximity to these areas. Based on these reviews and findings, the Siting Task Force recommended the inclusion of the PLK-A area as a prime siting area for further evaluation. All of the six prime siting areas appeared to be capable of supporting the full CC and baseload power plant development option. Therefore, the Siting Task Force recommended that further evaluations of these areas be based on locating both the CC and baseload plants at one site.

2.5.4.5 Site-Specific Environmental Evaluations of Prime Siting Areas

The prime siting areas were subjected to detailed, site-specific environmental evaluations. The environmental evaluations highlighted the advantages, disadvantages, and trade-offs associated with power plant development on each prime siting area. The analyses clearly identified the potential impacts, positive and adverse, which were expected from the development as well as potential measures to mitigate adverse impacts.

2.5.4.6 Engineering/Economic Evaluation of Prime Siting Areas

Engineering/economic evaluations were conducted for the six prime siting areas. These evaluations used the present worth costing factors similar to those used for the previous evaluations. However, several of the resulting cost estimates were revised based on the conceptual facility layouts for the siting areas. With these layouts, more detailed estimates were developed, particularly regarding the piping distances for recirculating, makeup, and discharge waters for the cooling systems. Also, based on the facility layout, additional present worth costs were developed for site preparation activities, such as the construction of cooling reservoir berms and filling and piling for foundations. For the HIL-7 siting area, the coal delivery cost estimates were revised to reflect the specific length of conveyors needed to transport coal from the port to the baseload plant site.

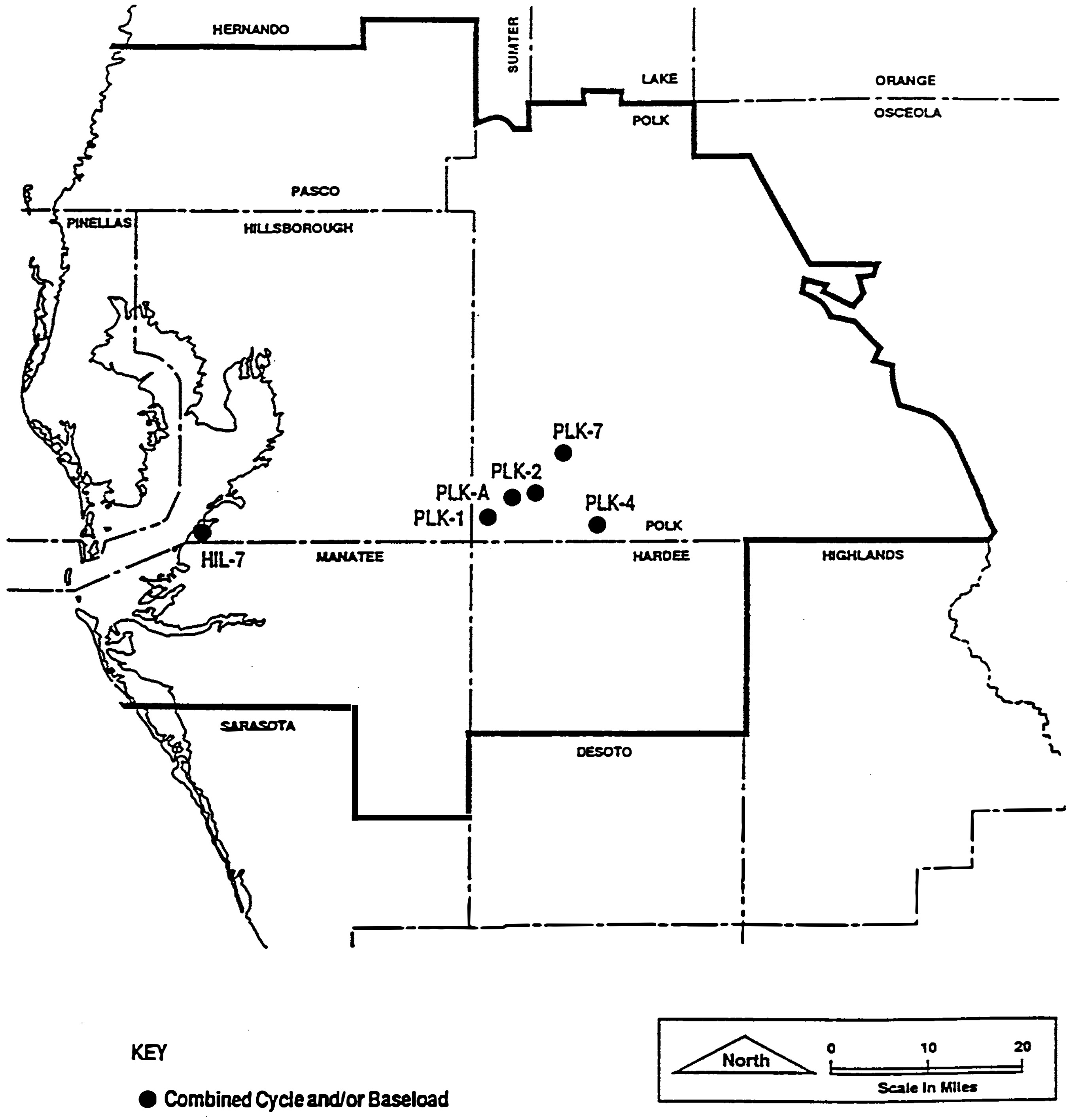

FIGURE 2.5.4-2.
General Location of Prime Siting Areas.

SOURCES: TEC, 1990a; TEC, 1992a.

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Table 2.5.4-4 presents the results of the present worth cost evaluations for developing the CC and baseload plants at the prime siting areas under the assumption that cooling reservoirs would be used, to the extent possible, at the siting area. As shown in this table, the HIL-7 siting area was estimated to be the most cost effective area, followed by the PLK-A and PLK-2 areas.

2.5.4.7 Recommendation of Preferred Sites

The Siting Task Force reviewed the results of the detailed analysis of environmental advantages and disadvantages of the six prime siting areas, the engineering/economic evaluations, and the future scenario analyses in developing their recommendations to Tampa Electric Company regarding the preferred sites for construction and operation of the power plant facilities. Based on these reviews, the Siting Task Force determined that the PLK-4, PLK-7, and HIL-7 areas, while suitable for power plant development, were not as suitable as the PLK-1, PLK-2, and PLK-A prime siting areas.

The primary concerns associated with the PLK-4 siting area involved potential air quality and groundwater impacts and limitations on the cooling water system alternatives. Also, the use of the PLK-4 area would involve locating the power plants in conjunction with ongoing phosphate processing operations. Although the siting area contains several large clay settling areas, these areas could not be used for power plant cooling reservoir purposes because of the suspended clay in the water and their commitment to the on-going mining activities. Thus, relative to the other Polk County siting areas, the use of cooling towers was considered to be the only cooling system alternative for the PLK-4 area. For the PLK-7 siting area, the primary concerns relative to the other areas were associated with the potential for existing groundwater quality problems at the site since the proposed location of the planned power plant facilities would be at the same location as the existing phosphate processing and shipping facilities on the siting area.

The primary concerns of the Siting Task Force associated with the HIL-7 siting area involved the potential impacts of the power plants on the fishery resources and other ecological systems of Tampa Bay and the Cockroach Bay areas, and on the natural resource and aesthetic qualities of the area due to changes in land use. The planned power plant facilities could be designed to avoid or minimize potential impacts to the sensitive resources of Tampa Bay and Cockroach Bay areas; however, some level of impact would occur. The Siting Task Force determined that the potential for impacts to the sensitive ecological systems of Tampa Bay and nearby estuarine systems made the HIL-7 siting area less suitable than other prime siting areas.
Based on these considerations, the Siting Task Force recommended the PLK-1, PLK-2, and PLK-A siting areas in southwestern Polk County as the preferred sites for locating the planned power plant facilities (see Figure 2.5.4-3). Each of these sites had certain environmental and engineering/economic advantages and disadvantages; however, the overall suitability of the sites for power plant development was considered to be relatively equivalent. Thus, the Siting Task Force recommended that Tampa Electric Company pursue site acquisition and environmental licensing efforts for any of the preferred sites, PLK-1, PLK-2, and PLK-A, in

Table 2.5.4-4. Present Worth Cost Estimates for Prime Siting Areas Using Cooling Reservoirs Where Possible (in millions of 1990 dollars)

Prime Siting Area	Road Access	Rail Access	Transmission Lines/ Substations	Cooling System*	Natural Gas Pipeline	Fuel Oil Pipeline	Coal Handling Facilities	Coal Delivery	Additional Foundation Costs	Total
HIL-7	0.853	0.932	6.246	85.594	16.705	0.161	71.416	12.569	4.715	199.191
PLK-A	0.587	1.114	1.485	60.978	12.579	6.379	108.616	44.500	3.897	240.135
PLK-2	0.683	0.861	3.004	80.042	13.231	6.987	108.616	44.500	2.860	260.784
PLK-4	0.107	0.331	9.801	70.366	13.066	9.113	108.616	44.500	9.937	265.837
PLK-7	0.766	1.363	5.882	84.160	11.743	7.138	108.616	44.500	2.860	267.028
PLK-1	0.107	0.943	8.279	115.503	13.231	8.354	108.616	44.500	4.164	303.697

* Cooling system assumptions: All sites cooling reservoirs, except PLK A = ponds and 220-MW CC freshwater towers; PLK-4 = freshwater towers; and HIL-7 = saltwater towers.

Sources: TEC, 1990b; TEC, 1992a.

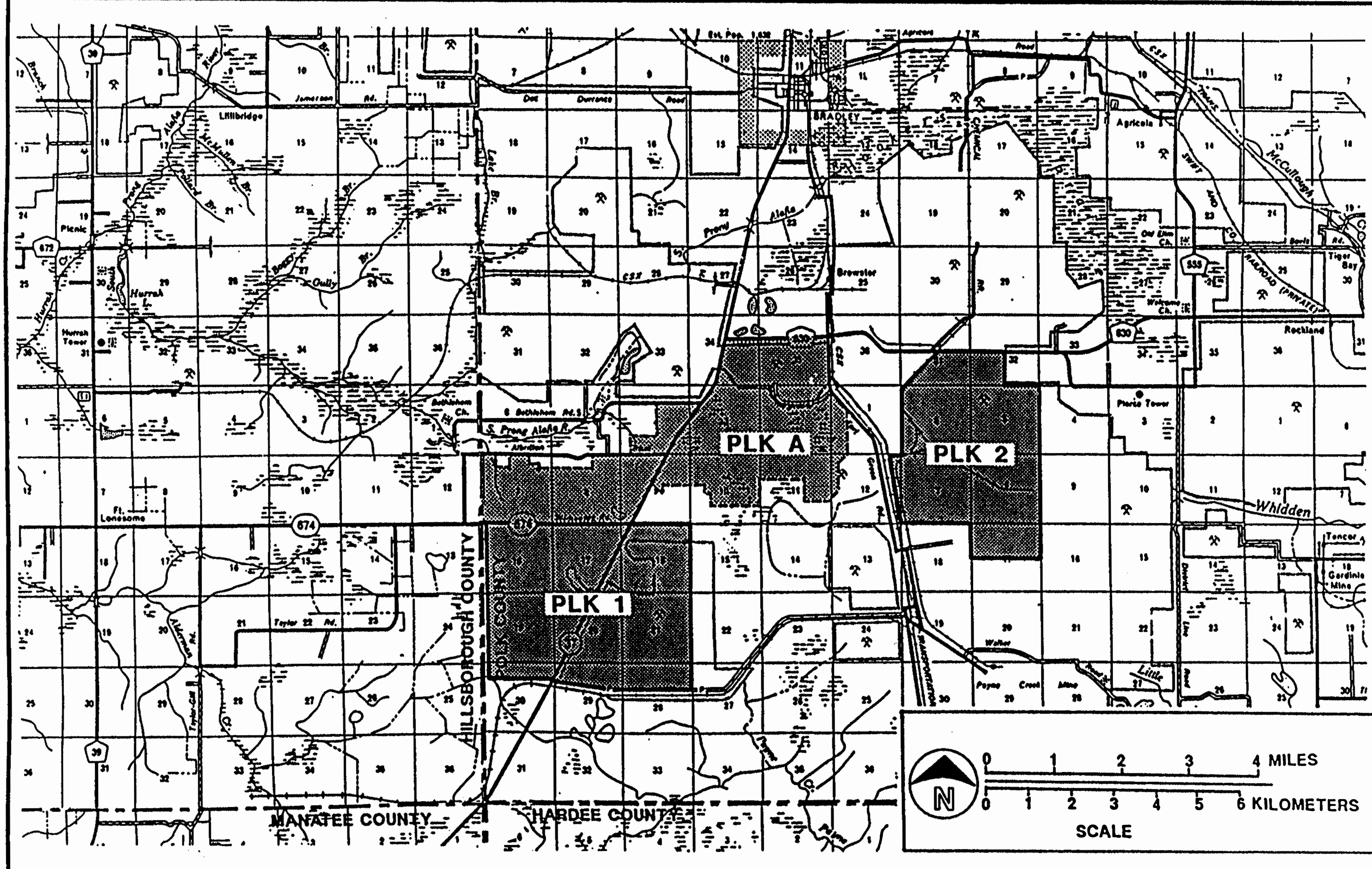

FIGURE 2.5.4-3.
Polk Power Station Preferred Site (PLK-A) and Alternative Sites (PLK-1 and PLK-2).

SOURCE: TEC, 1992a.

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order to meet the future generating capacity expansion needs determined by Tampa Electric Company. Tampa Electric Company concurred with the resulting recommendations and guidance from the Siting Task Force.

2.5.5 Tampa Electric Company's Selection of Preferred Site and Alternative Sites, Including Site-Specific Ecological Analyses

Based on the guidance from the Siting Task Force, Tampa Electric Company conducted additional investigations of the three recommended sites (PLK-1, PLK-2, and PLK-A) to select the final preferred site with the other two sites considered as alternative sites. All three sites are located in close proximity to each other in southwest Polk County. Therefore, certain environmental factors that could affect the suitability of sites were considered to be relatively equivalent on all three sites. For example, all three sites are located in an area designated as attainment for criteria air pollutants and are located approximately the same distance (120 kilometers [km]) from the nearest PSD Class I area, Chassahowitzka NWA. Further, all three sites have been or are currently being disturbed by phosphate mining activities and are remotely located relative to population centers and communities.

Table 2.5.5-1 presents a summary comparison developed by Tampa Electric Company of the three sites based on site-specific evaluations of potential impacts using criteria considered to represent environmental values by Tampa Electric Company (air quality, ecological systems, water resources, and socioeconomics/land use). The comparisons indicate the relative level of potential impact among the three sites for each criterion. As stated previously, differences in the levels of potential impacts among the sites for most criteria are small since the sites are located in proximity to each other. Also, even though some differences in impacts do exist, Tampa Electric Company considers all three sites suitable and potentially permittable as potential sites for the proposed facilities. As shown in Table 2.5.5-1, the relatively highest levels of potential impacts among the sites would occur at Sites PLK-1 and PLK-2, while relative impacts at PLK-A would be in the middle or low range compared to the other two sites.

Tampa Electric Company also conducted a site-specific engineering/economic evaluation to determine relative present worth cost estimates for developing the proposed facilities at each site. Based on this engineering/economic evaluation, the estimated costs for developing the proposed project would be lowest at PLK-A and highest at PLK-1.

2.5.5.1 Site-Specific Ecological Analysis of Recommended Sites

In addition to the preceding evaluations, at the request of EPA for EIS documentation and the dredge-and-fill (Section 404 of CWA) review process, Tampa Electric Company conducted site-specific biological investigations of the three sites to assess potential impacts to wetlands and threatened and endangered species that may be associated with development of the proposed project on each site. For these analyses, wetlands at each of the three sites were mapped using 1988 aerial photographs and the 1988 National Wetlands Inventory

Table 2.5.5-1. Comparison of Relative Levels of Potential Impacts Among Sites PLK-1, PLK-2, and PLK-A Based on Environmental Criteria

Environmental Criteria	PLK-1	PLK-2	PLK-A
Air Quality			
SO_2 impacts at the site relative to AAQS	Lowest	Highest	Moderate
SO_2 impacts at the site relative to PSD increment	Highest	Lowest	Moderate
SO_2 impacts at other sources relative to AAQS	Lowest	Moderate	Moderate
SO_2 impacts at other sources relative to PSD increment	Highest	Moderate	Moderate
Impacts on O_3 non-attainment area (i.e., Hillsborough County)	Highest	Lowest	Moderate
Ecological Systems			
Impacts to swamp and marsh areas (i.e., acres impacted)	Moderate	Highest	Lowest
Impacts to mine ponds and cuts (i.e., acres impacted)	Lowest	Moderate	Highest
Impacts to threatened/endangered species	Lowest	Moderate	Lowest
Water Resources			
Permitted water use on and in vicinity of site	Lowest	Highest	Moderate
Calculated groundwater drawdown impacts	Lowest	Highest	Moderate
Impacts to water use caution area	Highest	Moderate	Moderate
Socioeconomics/Land Use			
Compatibility impacts relative to existing and future land use	Same	Same	Same
Impacts to residential areas or communities	Same	Same	Same
Impacts to protected areas or cultural resources	Same	Same	Same

Note: Where differences in the relative level of impact among the three sites for a particular criterion are expected, the site with the highest level of impact is indicated as "highest," the site with the middle level of impact is indicated as "moderate," and the site with the lowest level of impact is indicated as "lowest." Where the relative level of impact is expected to be equivalent among two of the sites, the sites are indicated with the same relative level of impact, and if impacts are equivalent at all three sites, the sites are given a "same" rating.

Source: TEC, go.

(NWI) maps. These 1988 maps and aerials were used to generate the aquatic area information for sites PLK-1, PLK-2, and PLK-A in Table 2.5.5-2.

The 1976 Florida Land Uses and Cover Classification System (FLUCCS) was used to classify the wetlands and other aquatic resources on the sites. Wetland acreages were ascertained by community type for each site. In addition, the specific areas of aquatic resources that would be impacted by the power plant development were determined based on conceptual facility site layout plans on each site. The results of these efforts are presented in Figures 2.5.5-1 through 2.5.5-3 for the sites PLK-1, PLK-2, and PLK-A, respectively. Table 2.5.5-2 presents a comparison of the aquatic resources and potential impacts on these resources on the three sites. It should be noted that the wetland and surface water limits as depicted may not be currently accurate due to ongoing mining/reclamation activities. In addition, the wetland and surface water acreages do not necessarily reflect wetland regulatory jurisdictions. The following narrative provides a description of the upland and wetland habitats on the three sites recommended to Tampa Electric Company by the Siting Task Force, and an assessment of the potential for endangered and threatened species based upon current records on file at FGFWFC and the Florida Natural Areas Inventory (FNAI).

PLK-1 Site

The PLK-1 site is bordered on the west by the Hillsborough County line and on the south by the access road and railroad to the Agrico Fort Green Mine phosphate processing plant. SR 37 bisects the site, running in a southwest to northeast direction. In general, the PLK-1 site consists of mined-out lands with the portion of the site to the west of SR 37 reclaimed with sand tailings with pasture and citrus grove land uses. An unmined segment of the headwater areas of Little Payne Creek also runs through this western portion of the PLK-1 site. The portion of the PLK-1 site to the east of SR 37 consists primarily of active and inactive clay settling ponds. Several of the inactive ponds are currently under dewatering and reclamation. Since the majority of this 5,301-acre site has been disturbed by mining activities, most of the native flora has been drastically altered.

The NWI maps indicate a large amount of mining has occurred on the site as compared to other sites. Thus it is expected that only a limited amount of native but mostly disturbed uplands and wetlands still remain on the property. Remnant oak-pine woods/pine flatwoods occur as small scattered, isolated areas on the site. A few remnant hardwood swamp areas also exist in association with the relict upland forests. The majority of this site contains mined land, disturbed uplands (old fields, shrub and brushland, overgrown spoil), reclaimed agricultural land (planted pine, citrus grove, and improved pasture), and open water systems (ditches and canals).

Weedy, pioneer species of grasses, herbs, and shrubs quickly invade newly exposed areas formed through mining operations. Old fields and shrub and brushland are upland ruderal communities that developed

Table 2.5.5-2. Screening Comparison of the Aquatic Resources and Potential Project Impacts for Alternative Sites PLK-A, PLK-1, and PLK-2 Based on Maps and Aerial Photographs

Aquatic Resource Characteristics	Recommended Alternative Sites		
	PLK-A (acres)	PLK-1 (acres)	PLK-2 (acres)
Total site area	2,837†	5,301	3,512
Site mine ponds and cuts	875	2	252
Site swamp and marsh	119	1044	713
Total site aquatic areas	994	1046	965
Potentially-impacted mine ponds and cuts*	551	0	195
Potentially-impacted swamp and marsh*	27	378	408
Total potentially-impacted aquatic areas	578	378	603
Aquatic resource types	Canals and ditches, disturbed bay, red maple, willow, and primrose willow swamp, disturbed mixed marsh, mine cuts, clay settling areas	Canals, ditches, disturbed mixed marsh, maple swamp, disturbed willow swamp, mine cuts and ponds, cypress swamp, clay settling areas	Canals and ditches, disturbed willow swamp, disturbed mixed marsh, maple swamp, mine cuts, clay settling areas
Existing aquatic area disturbances	Canals, ditches, invasion of exotic species, mining, spoil disposal	Canals, ditches, invasion of exotic species, mining, reclaimed farmland, soil disposal	Canals, ditches, invasion of exotic species, mining, reclaimed farmland, spoil disposal
Aquatic area water quality	Low	Low	Low
Aquatic area locations within site	Located on small, unmined areas of the site	Covers entire site	Covers entire site

* Acreages of potential aquatic area impacts for the sites were ascertained by overlay of conceptual site development plans over a specific area of each site.

† Includes only the site area east of SR 37 since no power plant facilities are proposed for the tract west of SR 37.

Note: These data are based on wetlands digitized from 1988 NWI maps and on blueline aerial photographs (March 1988).

Source: Modified from TEC, 1993g.

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throughout the disturbed well-drained portions of the site. Old fields are typically abandoned clearings and/or pastureland which have become overgrown through the absence of maintenance. These old fields can be characterized as open grasslands dominated by native and introduced grasses as well as a high diversity of weedy composites and legumes. Old fields can be precursors to the shrub and brushland community. Shrub and brushland can be characterized as disturbed, overgrown shrubby areas dominated by opportunistic weedy shrubs, herbs, and grasses (such as groundsel bush, shrub verbena, bushy beardgrass, wax myrtle, shiny sumac, broomsedge, sida, dog fennel, and blackberry). Spoil piles and banks occurring throughout the site are either barren or support the growth of weedy species commonly associated with other ruderal associations.

As in the well-drained sites, opportunistic vegetation has become established within the shallow-water reaches of excavated and scraped-over areas throughout the mine property. Shrub swamps are typically present along the littoral zones of the Payne Creek headwater system and in former wetland locations that were scraped over by mining activities. Shrub swamps, which can be the precursors to tree swamps, are dominated by pioneer wetland shrubs such as willow, primrose willow, and elderberry. Tree swamps distributed along the northeastern corner of the property are mostly remnant forested wetlands and artificially created systems developed as a result of mining activities. The hardwood swamps on the property are mostly dominated by wetland trees (such as red maple, swamp red bay, willow, sweet bay, and laurel oak).

A small area of cypress swamp occurs in the north-central portion of the property. This area is a semi-permanently flooded system dominated by pond cypress in the canopy. Cypress-dominated wetlands are somewhat rare within the immediate region. The limited amount of freshwater marsh on the site can be characterized as emergent aquatic macrophytes (such as soft rush, maidencane, red root, pickerelweed, arrowhead, and smartweed). These remnant wetland systems are highly disturbed due to mining operations either directly from clearing, scraping, and such, or secondarily via groundwater drawdowns and surface water drainage.

Other relict communities distributed along the northeastern and southwestern areas of the site include upland pine flatwoods and oak/pine woods. These upland forests are open to dense woods dominated by a canopy of slash and/or longleaf pine (pine flatwoods) or a combination of pines and oak species (oak/pine woods). Longleaf pine grows on well-drained locations, while slash pine inhabits wetter sites. Shrub layers within these upland plant associations are typically dominated by saw palmetto and other woody associates (such as gallberry, fetterbush, wax myrtle, and groundsel bush). Pine flatwood is a subclimax community typically maintained through periodic burning. With the absence of fire, oaks usually become a prominent subcanopy species forming the oak/pine woods association.

Uplands that have been mined are typically reclaimed for agricultural purposes. Young stands of citrus groves and pine plantations are present along the well-drained northern and southwestern portions of PLK-1. The

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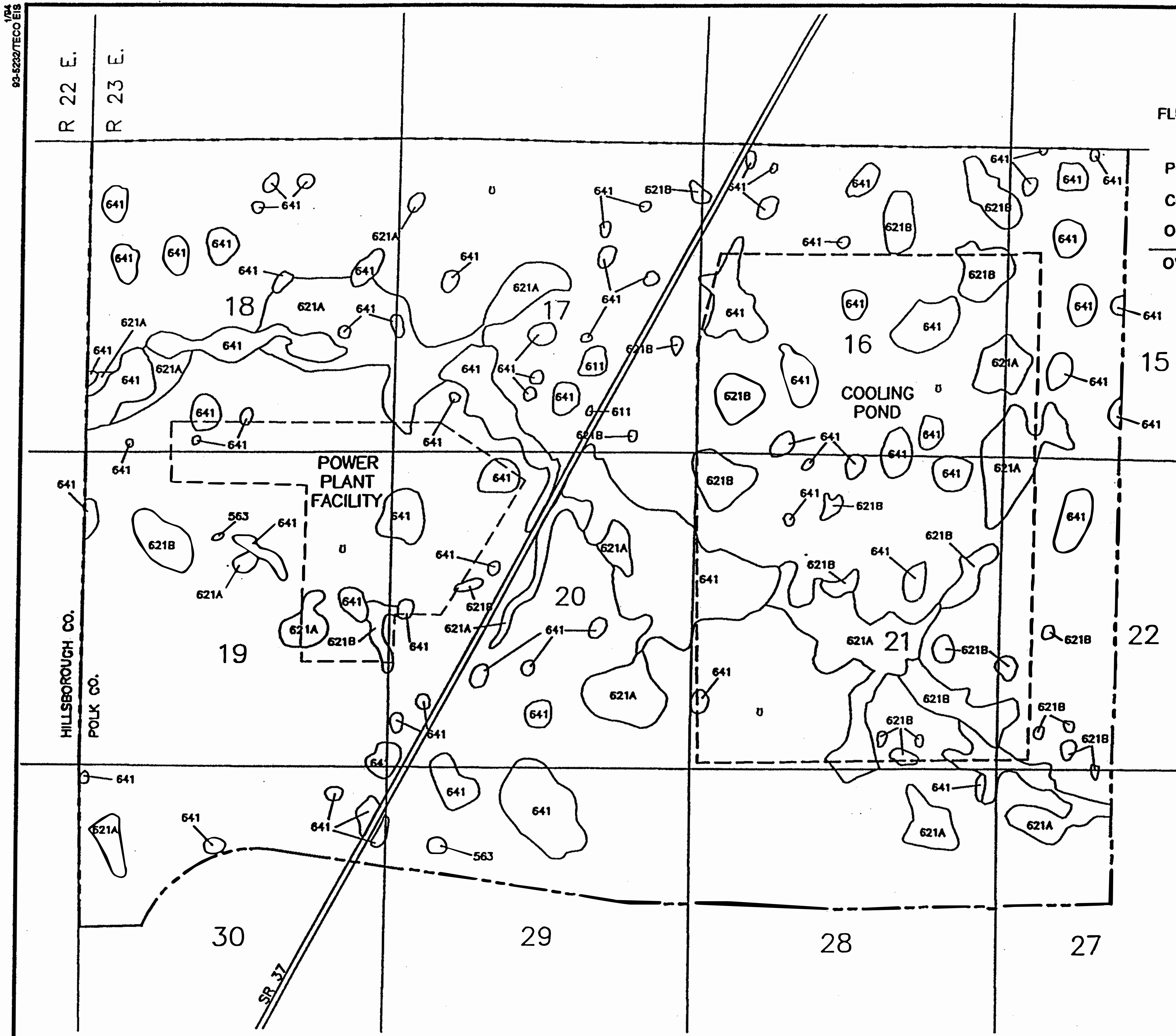

WETLAND ACREAGES

FLUCCS CATEGORY	563	611	621A	621B	641	TOTAL AREA (Including Uplands)
POWER PLANT FACILITY	0	0	15.06	0	27.67	318.12
COOLING POND	0	0	122.86	94.02	118.44	1167.32
OTHER AREAS	2.05	4.62	257.01	51.90	352.27	3815.66
OVERALL SITE	2.05	4.62	394.93	145.92	498.38	5301.10

LEGEND

- SITE AREA
- POWER PLANT FACILITY
- COOLING PONDS

FLUCCS LEGEND

563 MINE PONDS AND CUTS
621 MIXED HARDWOOD SWAMP
A TREE SWAMP
B SHRUB SWAMP
641 FRESHWATER MARSH
U UPLANDS
611 BAY SWAMPS

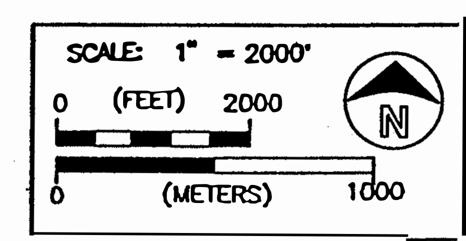

FIGURE 2.5.5-1.
Site PLK-1 Conceptual Site Layout and Wetland Areas.

SOURCES: U.S. Dept. of Interior, National Wetlands Inventory, Baird, FL, 1988; TEC 1993g; TEC, 1992a.

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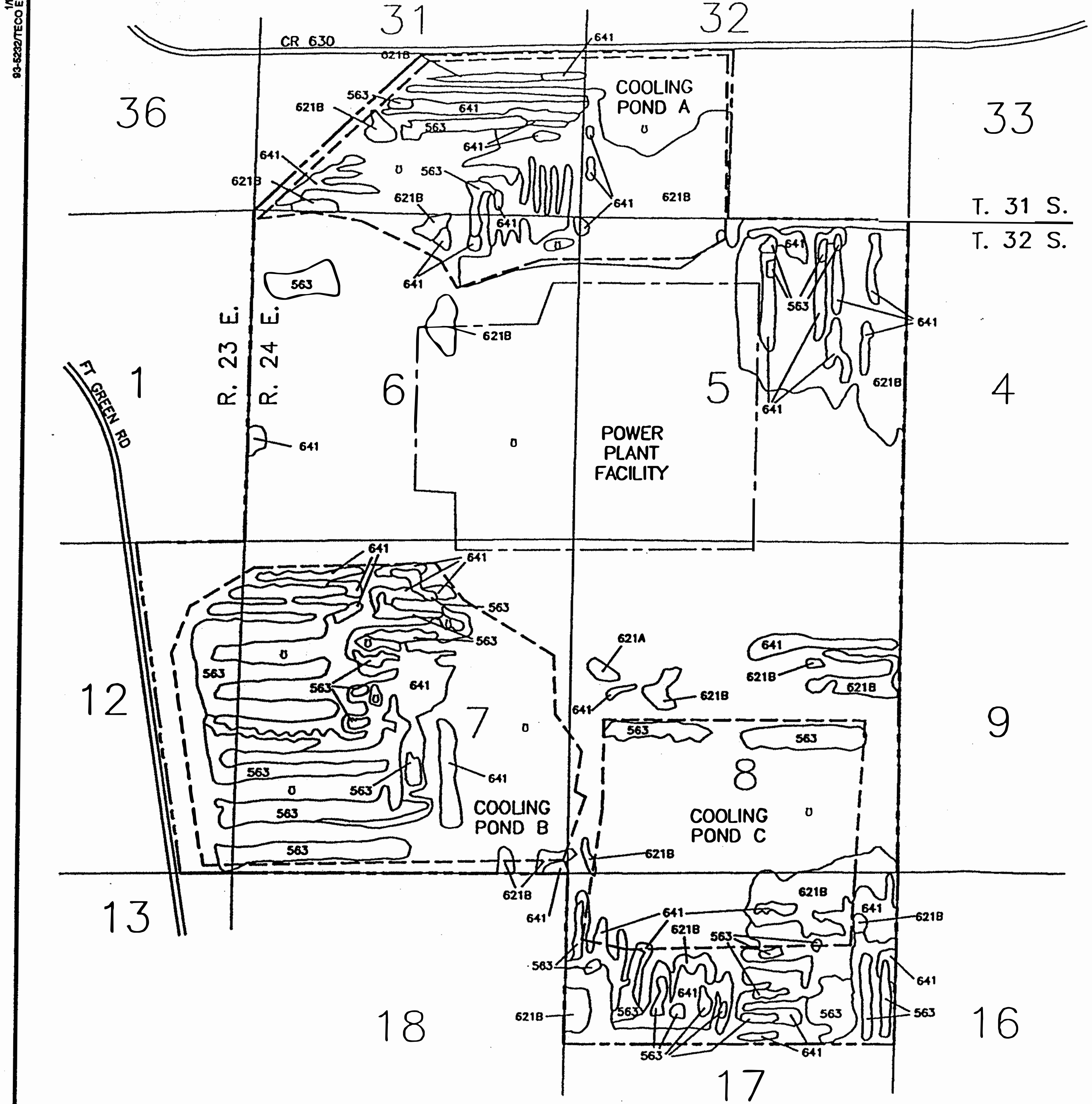

WETLAND ACREAGES

AREAS OF INTEREST	563	621A	621B	641	TOTAL AREA (Including Upland)
POWER PLANT FACILITY	0	0	14.27	0	508.40
COOLING POND A	14.78	0	189.13	60.10	463.70
COOLING POND B	154.77	0	3.16	89.61	628.73
COOLING POND C	25.87	0	33.43	18.68	356.56
OTHER AREAS	56.87	2.76	172.21	130.08	1554.41
OVERALL SITE	252.29	2.76	412.20	298.47	3511.80

LEGEND

- - - - SITE AREA
— - — POWER PLANT FACILITY
- - - - COOLING PONDS

FLUCCS LEGEND

563 MINE PONDS AND CUTS
621 MIXED HARDWOOD SWAMP
A TREE SWAMP
B SHRUB SWAMP
641 FRESHWATER MARSH
U UPLANDS

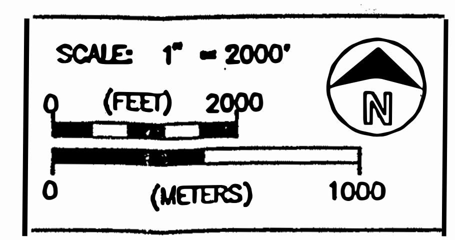

FIGURE 2.5.5-2.
Site PLK-2 Conceptual Site Layout and Wetland Areas.

SOURCES: U.S. Dept. of Interior, National Wetlands Inventory, Baird, FL, 1988; TEC 1993g; TEC, 1992a.

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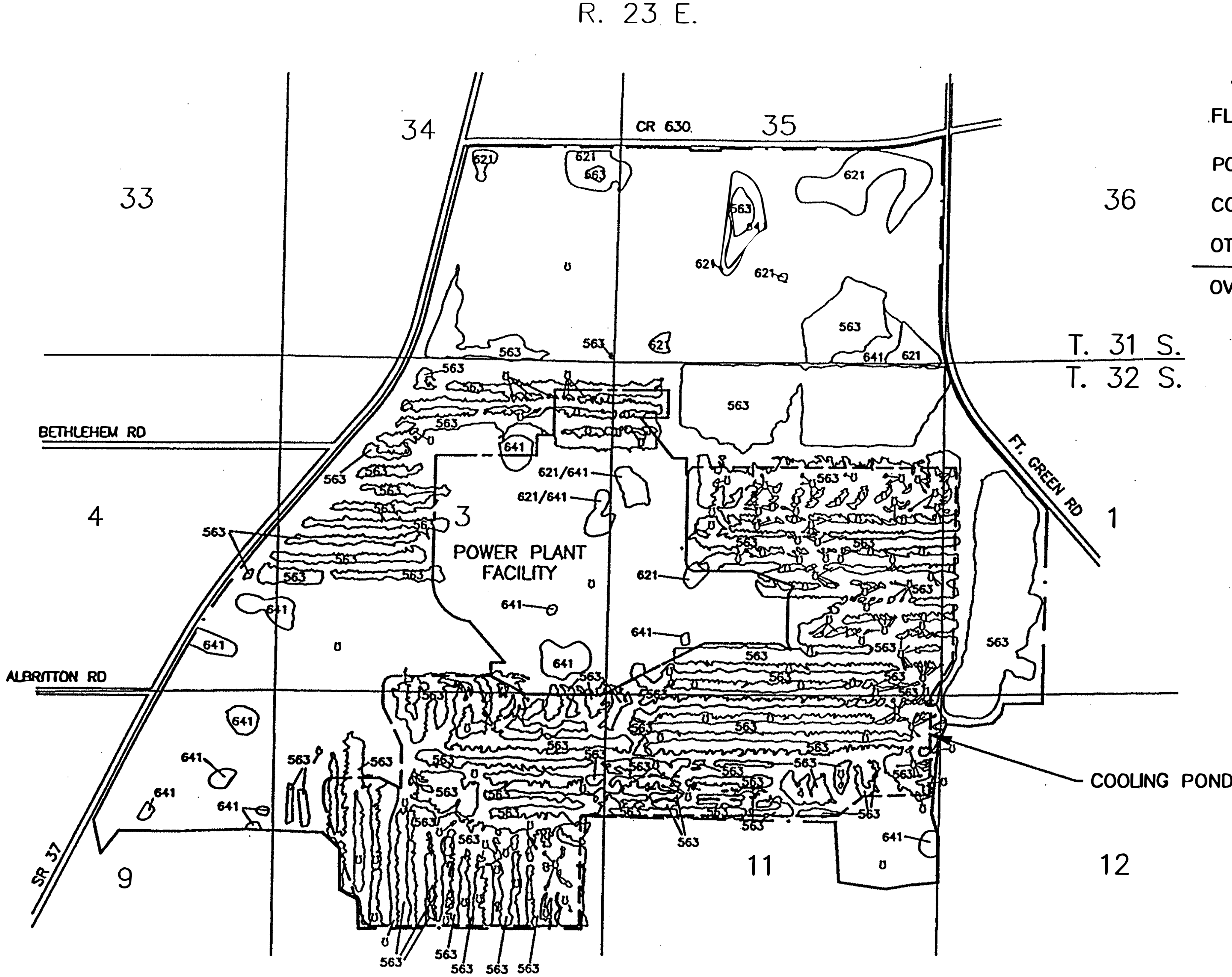

WETLAND ACREAGES

FLUCCS CATEGORY	563	621	641	TOTAL AREA (Including Upland)
POWER PLANT FACILITY	24.45	11.44	13.47	397.49
COOLING POND	527.00	0.20	2.23	855.55
OTHER AREAS	323.58	54.08	37.81	1584.38
OVERALL SITE	875.03	65.72	53.51	2837.42

LEGEND

- SITE AREA
- POWER PLANT FACILITY
- COOLING PONDS

FLUCCS LEGEND

563 MINE PONDS AND CUTS
621 MIXED HARDWOOD SWAMP
641 FRESHWATER MARSH
U UPLANDS

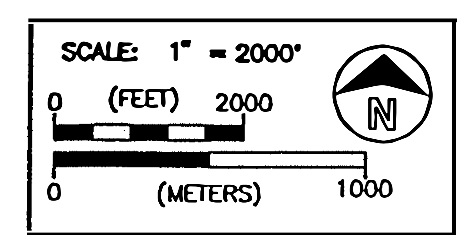

FIGURE 2.5.5-3.
Site PLK-A Conceptual Site Layout and Wetland Areas.

SOURCES: U.S. Dept. of Interior, National Wetlands Inventory, Baird, FL, 1988; TEC 1993g; TEC, 1992a.

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citrus groves and planted pines are well-maintained areas, typically planted with oranges and slash pine, respectively. Some areas of reclaimed pastureland planted with bahia grass are also present within the northern areas of the site.

Wildlife found in the vicinity of PLK-1 are species that typically inhabit disturbed, ruderal communities or aquatic species using the many mine cuts and clay settling areas. Sections 3.5 and 3.6 present descriptions of common species found on the PLK-A site and lists all species that could be expected to occur on the selected site. These species would be found in similar habitats on PLK-1.

The presence of state and federally listed species on site is based only on available literature as no site surveys were performed on PLK-1. A historic wading bird colony is located within the boundaries of PLK-1 in the southwestern corner of Section 21 (T32S, R23E). This colony, if it still exists, is not in an area proposed for site development. The closest active eagle nest is located off site but adjacent to PLK-1, approximately 2.5 miles east of the site (S1, T32S, R23E).

Tampa Electric Company evaluated the potential construction of the proposed power plant and associated facilities within the PLK-1 site. At PLK-1, the primary power plant facilities (power blocks, coal and by-product storage areas, fuel oil storage areas, and cooling towers, if used) would be situated west of SR 37. The cooling reservoirs, if used as the cooling system for the power facility, would be located east of SR 37. Approximately 1,485 acres within PLK-1 would be needed for the power facility layout as depicted on Figure 2.5.5-1. Based on this figure, the layout would impact 138 acres of mixed hardwood tree swamp, about 94 acres of mixed hardwood shrub swamp, more than 146 acres of freshwater marsh, and approximately 1,107 acres of uplands.

Unlike a site that has not been reclaimed, the construction of these facilities on the PLK-1 site would involve redisturbing lands that have already been or are currently being reclaimed. Construction of the cooling reservoir in the clay settling areas would require reconstruction of earthen berms in areas currently under reclamation. The cooling reservoir would be located entirely above-grade since the clay settling areas have been filled to more than 30 ft above premining elevations. The above-grade cooling reservoir would require significantly more groundwater well withdrawals to provide cooling water makeup than the below-grade reservoir since there would be no surficial groundwater seepage into the reservoir. Also, the operation of the reservoir would require careful control and maintenance in order to avoid resuspending the clays in the recirculating water system.

Review of Polk County and Hillsborough Property Appraiser 1993 tax maps, aerials, and land use data indicate that few sensitive land uses are located either on or within sections within 1 mile of the PLK-1 site. Land use is almost exclusively in the phosphate mining and phosphate with agriculture land-use categories.

There are 54 residential parcels in the 19,200-acre area within approximately 1 mile of the site boundary. No other potentially sensitive land uses were listed in the property appraiser data base. Assuming the average household size of Polk County is 2.52 persons (based on 1990 census; BEBR, 1992a), the population within approximately 1 mile of the site boundary would be 136 and the average density for the 30-square-mile area around the site would be 4.5 persons per square mile.

Similar to the PLK-2 and PLK-A sites, given the disturbance of much of the site from phosphate mining activities, the probability of finding undisturbed cultural resources on the PLK-1 site would be reduced. FDHR reports that no cultural resources are known to exist on site (Amiss, 1993).

PLK-2 Site

The PLK-2 site is bordered on the north by CR 630 and the east by Fort Green Road and the CSX Railroad line. The northern area of the site contains an approximately 500-acre clay settling pond recently retired from use and currently undergoing the long dewatering process for reclamation. The southern area of the site contains an approximately 575-acre clay settling pond that is currently in use and will not be inactivated until the late 1990s. The area of the PLK-2 site between the two clay settling ponds consists primarily of unmined land that has been covered by waste sand tailings to a height of more than 20 ft above premining elevations. PLK-2 is similar in character to PLK-1. Therefore, the description of the site's flora and fauna would be the same as previously provided for PLK-1. This 3,512-acre site has been, or is in the process of, being mined or disturbed by phosphate mining activities. Small remnant areas of oak-pine woods, pine flatwoods, maple/willow swamp, and marsh also occur sporadically within the property boundaries.

Wildlife communities found in the vicinity of PLK-2 as well as PLK-1 and PLK-A are species typically inhabiting disturbed, ruderal communities or aquatic species using the many mine cuts and clay settling areas. Sections 3.5 and 3.6 present descriptions of common species found on the PLK-A site and lists all species that could be expected to occur in the region. These species would likewise be found or expected utilizing similar habitats on PLK-2.

The PLK-2 site does contain man-made nesting platforms for ospreys, so this species likely nests on site. The nearest active eagle nest (S1, T32S, R23E) is just west of Fort Green Road on the site's western border. This nest is located a few hundred feet from the site's property line and the proposed cooling reservoir B and less than 1 mile from the proposed power block. No other eagle nests, active or inactive, were found within 1 mile of the PLK-2 site (TEC, 1992a).

Figure 2.5.5-2 depicts the conceptual power facility layout for the PLK-2 site. The primary power plant facilities would be placed in the central portion of the site on unmined lands. If cooling reservoirs are used, three cooling reservoirs are planned to be located within existing clay settling area at the northern, southwestern, and southeastern portions of the property. Again, these cooling reservoirs would be located significantly above premining elevations and would require significantly more groundwater well withdrawals to provide makeup water than a below-grade reservoir. Based on Figure 2.5.5-2, the layout would impact about 195 acres of mine ponds and cuts, 240 acres of mixed hardwood shrub swamps, more than 168 acres of freshwater marsh, and almost 1,354 acres of uplands, for a total of 1,957 acres.

Analysis of Polk County Property Appraiser 1993 tax maps, aerial, and land-use data indicate that few sensitive land uses are located either on or within sections within approximately 1 mile of the boundary of the PLK-2 site. Land use is almost exclusively in the phosphate mining and phosphate with agriculture land-use categories. The latter category is land that is in the process of or already has been reclaimed after phosphate mining.

Based on the Polk County Property Appraiser data, there are 12 residential parcels in the 17,280-acre area within approximately 1 mile of the site boundaries. Ten of these are located in Township 31, Range 24, Section 18, south of the site. Assuming the average household size of Polk County of 2.52 persons per household, the number of persons living in all 27 sections within 1 mile of the site boundary would be 30 persons and the average density would be 1.11 persons per square mile. The 1993 property appraiser files list no institutional or other potentially sensitive uses in this area. All of the land within the PLK-2 site is in the phosphate or phosphate with agriculture land-use category.

Review of aerial photographs of the site indicates that most of the area has been disturbed by previous mining activities. Given the significant disturbance to the site from phosphate mining, the probability of finding undisturbed cultural resources would be reduced. FDHR reports that no cultural resources are known to exist on site (Amiss, 1993).

PLK-A Site

The PLK-A site has similar features to PLK-1 and PLK-2. Major land-use and cover types occurring on the site include mined land, pasture, shrub and brushland, overgrown spoil, old fields, orange grove, mixed oak/pine woods, palmetto rangeland, pine flatwoods, oak hammock, hardwood swamp, marsh, ditches, canals, mine cuts, reclaimed lakes, and an intermittent stream/floodplain swamp.

The wildlife communities and presence of endangered and threatened species inhabiting PLK-A are discussed in Sections 3.5 and 3.6. These species would also be expected to occur in PLK-1 and PLK-2. The closest active eagles nest (State of Florida site location code P0-40-A) known at the time of the screening is 1.5 miles from the proposed power block of PLK-A. No other eagle nests, active or inactive, are within 1 mile of PLK-A based on available inventory information from FGFWFC and on-site surveys.

As shown in Figure 2.5.5-3, the location of the main power block and other major facilities on unmined lands lessens the engineering and related cost requirements for constructing the foundations for these facilities. The construction of the cooling reservoir within an area that was previously mined and currently contain of a series of water-filled mine cuts and spoil piles creates the opportunity to construct the required cooling reservoir as a primarily below-grade facility. This proposed construction technique significantly lessens the requirements for groundwater withdrawals and water use for heat dissipation cooling requirements for the proposed project and the required land area size of the cooling reservoir. The proposed, primarily below-grade, cooling reservoir also lessens the potential for berm failures and maintenance costs versus an above-grade reservoir. Based on the information in Figure 2.5.5-3, the proposed layout would take about 551 acres of mine ponds and cuts, almost 12 acres of mixed hardwood swamp, almost 16 acres of freshwater marsh, and about 674 acres of uplands.

The PLK-A site is located north of the PLK-1 site and west of the PLK-2 site. As with sites 1 and 2, land use on and around PLK-A is predominantly in phosphate mining, reclaimed from phosphate mining, or in the process of being reclaimed from disturbance due to phosphate mining. The property appraiser tax maps, aerials, and other land-use data were used to locate residential and other sensitive land uses located within the site or within any section within 1 mile of the boundaries of the site. To provide an objective comparison of the three sites, the section of the PLK-A site east of SR 37 was used as the site boundary and not the proposed wildlife habitat area west of SR 37. Review of the property appraiser data showed a total of 32 residents within the 17,920-acre area around the site. Assuming an average household size of 2.52 persons per household, approximately 81 persons reside in the area and the overall density is 2.89 persons per square mile.

Site PLK-A is also disturbed due to phosphate mining. The probability of on-site undisturbed cultural resources is therefore reduced. However, FDHR records indicate that one archaeological site exists in a surveyed portion of the site (8P01508: see Appendix 11.5 in SCA [TEC 1992a]), although this site was determined not to be significant. FDHR also indicated concern over significant archaeological and historical sites possibly present in on-site areas undisturbed by phosphate mining (see Appendix 11.5 in SCA [TEC 1992a]).

2.5.5.2 Tampa Electric Company Selection of a Preferred Site

In a comparison of the three sites, the advantages for the potential use of all the sites for the development of a power plant and associated facilities are as follows:

- All three sites have been, or currently are, being altered through mining operations
- Impacts to disturbed, remnant upland and wetland habitats associated with development could be minimized by FDEP-approved reclamation procedures

- Surface water associated with clay settling areas, which are an aquatic habitat resource, in the region would not be lost through the normal reclamation process, but would remain via the creation of large cooling reservoirs
- Aside from the surface water created by mine cuts, there is a relative small acreage of natural wetlands and/or significant upland habitat associated with power plant development
- It is not anticipated that there would be significant impacts to regional populations of federally or state-listed species of plants or animals

The plant communities and associated wildlife habitats that would be impacted by development of the PLK-2 site as a power station are 168 acres of freshwater marsh, 240 acres of mixed hardwood swamp, and 1,354 acres of uplands. Development at the PLK-1 site would impact 146 acres, 232 acres, and 1,107 acres of these areas, respectively. Of the three sites, development at the PLK-A site clearly would have the least environmental impacts to these communities and their associated wildlife habitats since only approximately 16 acres of freshwater marsh, 12 acres of mixed hardwood swamp, and 674 acres of uplands would be impacted. However, development at the PLK-A site would impact 551 acres of mine ponds and cuts, compared with 195 acres for the PLK-2 site and zero acres for the PLK-1 site. Mine ponds and cuts could be jurisdictional wetlands, but they generally are considered to be of much less biological value than the other type of wetlands that are present on these sites. Potential impacts to endangered/threatened species are expected to be similar for PLK-A and PLK-A sites. The PLK-2 site represents a slightly greater potential for impacting osprey nests and an eagle nest.

Additional factors favoring selection of PLK-A over the two alternatives are:

- PLK-1 site is adjacent to an ozone (O_3) non-attainment area
- PSD margins for PLK-1 site are not as adequate as PLK-A site
- AAQS margins are relatively slim for PLK-2 site due to its closer proximity to existing sources
- In-ground cooling reservoir at PLK-A site would provide most conducive ecological edge characteristic
- In-ground, cooling reservoir at PLK-A site would have less discharges than reservoirs using clay settling ponds at other alternate sites
- PLK-A site is considered to be the least environmentally sensitive compared to PLK-1 and PLK-2 sites
- PLK-A site would lessen engineering and related cost requirements as assessed by Tampa Electric Company

- Proposed cooling reservoir construction at PLK-A site would lessen the requirements for groundwater withdrawals and water use for heat dissipation cooling requirements for the proposed project

Based upon potential ecological impacts, the PLK-A site was considered by Tampa Electric Company to be the least environmentally sensitive when compared with potential alternative sites PLK-1 and PLK-2. Thus, Tampa Electric Company selected the PLK-A site as the preferred site for the proposed Polk Power Station. Tampa Electric Company believes the potential PLK-1 and PLK-2 sites offer no environmental advantages relative to the PLK-A site. Therefore, these two potential alternative sites were not considered further for the proposed project in this EIS.

Since the time of site selection, additional information has been collected for the PLK-A site and is provided in Section 3.0 (Affected Environment) and Section 4.0 (Environmental Consequences) in this EIS. This new/refined information includes a USACOE jurisdictional determination for the PLK-A site of wetlands that would be impacted by construction of the proposed project. Based on the site inspection and jurisdictional determination by a USACOE representative, USACOE determined that approximately 253 acres of jurisdictional wetlands (i.e., approximately 211.78 acres of mine cuts and 41.33 acres of highly stressed wetlands: see Appendix C for USACOE Public Notice dated October 7, 1992) would be impacted by the proposed project (compared to the 551 acres of mine ponds/cuts and 27 acres of swamp/marsh estimated using 1988 NWI maps, as presented in Table 2.5.5-2). Additionally, more detailed information on potential impacts to wetland and ecological resources and to other resources such as cultural resources, air quality, and water quality that would result from the development of the proposed project at the PLK-A site is presented in Chapter 4.0 of this EIS. For example, a FDHR-requested cultural resource assessment survey was conducted by Tampa Electric Company for the PLK-A site (see copy of FDHR correspondence and the assessment survey report in Appendix 11.5 of SCA [TEC 1992a]). The SHPO concurred with the results of the assessment that the PLK-A site preferred by Tampa Electric Company would not likely contain archaeological or historical resources (see Section 4.10 and DEIS, Appendix Q).

2.6 ALTERNATIVE PROCESSES AND FACILITIES

In this section, the potential alternatives to the major processes, facilities, and systems comprising the proposed Polk Power Station project are discussed. These potential alternatives are identified and evaluated to determine which alternatives are considered reasonable compared to the proposed project based on environmental, engineering, and economic factors.

2.6.1 Site Layout Alternatives

Due to the size of the proposed PLK-A site (approximately 4,348 acres), numerous site layout alternatives could have been considered. However, the use of the limited unmined area on the site to the east of SR 37 for the main power plant structures and facilities, and the use of mined-out portions for the cooling reservoir and other water management/wildlife habitat areas were determined to take the best advantage of the existing site conditions. Within the proposed Polk Power Station property site, two potential site layout alternatives were considered. The potential alternatives included Tampa Electric Company's proposed site layout and a layout that reverses the locations of the coal and slag storage areas. These proposed uses would minimize earth-moving costs, while enhancing the environmental quality of the mined-out areas through effective reclamation programs.

2.6.1.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

The proposed layout of the major facilities for the Polk Power Station project are illustrated in Figure 2.3.2-1. The main power plant facilities would be located on unmined lands to the east of SR 37. Its unmined condition gives this part of the site a more stable geotechnical environment for the proposed power block. The area contains several small, isolated marsh and willow/elderberry swamp wetlands. Most of these wetland areas have been previously disturbed by adjacent phosphate mining activities. According to Tampa Electric Company's proposed development plans, the entire main facility area, which is currently approximately 140 ft-NGVD, would be filled to an elevation of between 140 to 145 ft-NGVD to provide adequate flood protection and drainage for the facilities. The fill material would be obtained from spoil piles in adjacent mined-out areas during the cooling reservoir construction. Therefore, the existing small wetland areas on the main plant site area would be eliminated by the proposed project site layout.

Since these small wetlands are in scattered locations on the unmined plant site area, it would be extremely difficult and costly to design a facility layout that avoided these wetlands. Additionally, the overall ecological value and function of these isolated wetlands is limited. The proposed development/reclamation plan for the proposed Polk Power Station site would result in a net increase in wetland acreage on the site compared to premining conditions. Thus, the impact of the loss of these wetlands on the main plant site area would be minimal and can presumably be mitigated to the satisfaction of appropriate resource agencies.

2.6.1.2 Alternative

In the proposed project layout, the coal unloading area and storage silos are located west of the CG facilities, and the slag storage area is located east of the coal unloading area and south of the CG facilities. Tampa Electric Company evaluated the alternative of reversing the coal and slag storage area locations. However, the alternative of reversing the area locations was found to have no environmental advantages and would decrease the efficiency (i.e., increase costs) of the operations. This alternative layout would also involve the filling of the small wetland areas on the main plant site area. Based on these findings, this potential alternative layout was not environmentally advantageous and was not considered further.

2.6.2 Fuel Handling and Storage Alternatives

The proposed Polk Power Station project would involve the delivery, handling, and storage of three fuels: natural gas, No. 2 fuel oil, and coal. These fuels are proposed as the primary fuels to be utilized for operating on-site electric generating facilities.

Natural gas would be delivered to the site by pipeline from the existing or future gas transmission system in the region, with no on-site storage expected. Various alternatives to the natural gas supply were evaluated; however, no specific interconnection points to the existing or planned future gas transmission system have been determined at this time. Fuel oil would be delivered to the site by tanker truck, rail, or potentially via pipeline if the proposed General American Transportation Corporation fuel oil pipeline is constructed along Fort Green Road adjacent to the eastern boundary of the site. Coal would be delivered to the site by rail and/or by truck. A rail spur accessing the site would be constructed from the existing CSX Railroad line which runs adjacent to the eastern site boundary along Fort Green Road. Truck delivery of coal would involve the use of custom-designed aluminum, bottom-dump trailers with knife gate top covers to prevent fugitive dust impacts during transport.

All of the proposed fuel delivery systems would be designed to meet applicable regulatory standards and codes to minimize potential safety concerns and environmental impacts. No reasonable alternatives to these proposed fuel delivery systems were identified and considered. Therefore, only coal unloading and handling alternatives and coal and oil storage alternatives are discussed.

2.6.2.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

For the proposed Polk Power Station project, coal would be unloaded from the rail cars and/or trucks by bottom dumper into receiving hoppers and transported by conveyor to the coal storage silos. The coal handling and storage facilities would also include appropriate fugitive dust controls (e.g., covered conveyors, baghouses at transfer points, water sprayers).

2.6.2.2 Alternatives

Potential alternatives to the proposed coal unloading and stacking methods include rail car rotary dumpers, boom stacker, traveling stacker/reclaimer, and rotary plow reclaim. Since these potential alternatives do not provide environmental advantages compared to the proposed methods and would involve significantly higher costs, they were not given further consideration for the proposed project in this EIS.

Potential alternatives to the proposed enclosed coal storage silos would involve use of a lined or unlined storage area and/or a covered storage area. A lined coal pile storage area would require storm water runoff and leachate collection systems that are not needed for the proposed storage silos. An unlined coal storage area would have greater potential environmental impacts due to leachate seepage into the surficial aquifer. Because of the environmental disadvantages, the lined and unlined coal pile storage area alternatives were not pursued for the proposed project in this EIS.

The alternative of a covered coal pile storage area would have several environmental advantages relative to uncovered pile alternatives. The cover would divert most or all rainfall from the coal pile and, therefore, minimize potential leachate seepage impacts or the need for leachate collection and treatment. Also, the cover would potentially reduce fugitive air emissions from the coal pile relative to an uncovered pile. However, a covered pile has no environmental advantages compared to the proposed storage silos.

The proposed coal storage silos would avoid potential leachate seepage impacts. Management plans for the silos include appropriate fugitive emission control measures such as wetting and baghouses. Because the covered coal storage area alternative would involve significantly higher costs without significant environmental advantages compared to the proposed storage silos, Tampa Electric Company proposes coal storage in silos.

Oil storage in below-ground steel tanks is an alternative for the proposed aboveground fuel oil storage steel tanks. One of the advantages of this alternative is that it would not occupy large above-ground space; however, it would significantly increase the construction and maintenance costs and introduce the environmental disadvantage of possible undetected leaks. This alternative was not considered a beneficial alternative and was not further considered for the proposed project in this EIS.

2.6.3 Cooling System Alternatives

The cooling or heat rejection system involves the transfer and/or rejection to the atmosphere of waste heat from the condensation of the ST exhaust steam. Optimization of the heat rejection system would minimize plant capital and operation costs as well as potential environmental impacts of the operations. In general, three alternative cooling systems are available for power plant facilities involving ST generating technology:

- Cooling reservoir
- Cooling towers
- Once-through cooling

Once-through cooling requires the availability of large quantities of water compared to the other cooling systems and is, therefore, usually feasible only for coastal sites or inland sites adjacent to large rivers or lakes. Given the location of the proposed Polk Power Station site, the alternative of a once-through cooling system was not considered to be a reasonable or a feasible alternative.

2.6.3.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

Tampa Electric Company evaluated the alternatives of using either a cooling reservoir or mechanical draft cooling towers as the heat rejection system for the proposed Polk Power Station project. Tampa Electric Company selected the cooling reservoir alternative as the proposed system for the project based on a combination of environmental and engineering/economic considerations as well as the existing characteristics of the site. The proposed reservoir would be constructed in an area that has been mined for phosphate and currently consists of water-filled mine cuts between rows of spoil piles. Locating the reservoir in this area offers several advantages. First, the mined-out area would require reclamation even without the proposed reservoir use; therefore, the costs associated with the reservoir development, for the most part, represent reclamation costs which would be required in any case. Second, constructing the reservoir in the mined-out lands allows the reservoir to be primarily a below-grade water body. As a below-grade facility, some of the needed makeup water would be provided by surficial aquifer groundwater seepage, reducing the use of groundwater pumped from the Floridan aquifer for makeup.

Further, the cooling reservoir alternative reduces the discharge of cooling water blowdown and treated wastewaters from the site directly to other surface water bodies. Treated process wastewaters, except from the CG facilities, would be discharged to the cooling reservoir for reuse as the recirculating water which again reduces the use of pumped groundwater for cooling water makeup. The normal operating level of water in the reservoir would be approximately 136 ft-NGVD, with an outfall control structure designed to allow for continuous blowdown discharges and to control storm water discharges from the reservoir. Based on this design, the cooling reservoir would have the storage capacity to detain direct rainfall and runoff to the reservoir to reduce peak runoff flows during storm events and to maintain mass flow contributions to the Little Payne Creek system. Based on the outfall control structure design, discharges from the cooling reservoir would be approximately 3.1 mgd on a daily average basis. Further, based on the estimated water quality in the reservoir, the discharged water would not require treatment and would not result in adverse impacts to water quality and quantity conditions in the receiving water body (i.e., unnamed reclaimed lake leading to Little Payne Creek).

The development and construction of the cooling reservoir would make use of the mined-out area. However, if the mined-out area for the reservoir was not used for this proposed project use, the area would still need to be reclaimed in compliance with FDEP reclamation regulations. The estimated costs for these resource agency reclamation activities would be approximately 50 percent of the estimated costs for development and construction of the cooling reservoir. Therefore, the net estimated costs for developing the mined-out area for the proposed cooling reservoir versus required, standard reclamation of the area are approximately half the total cost. Also, the proposed cooling reservoir would require less electrical power to operate than the alternative cooling tower system which equates to an environmental advantage and additional cost savings for the proposed reservoir.

2.6.3.2 Alternative

The alternative cooling system would involve the use of mechanical draft cooling towers. In a mechanical draft cooling tower system, cooling water is pumped from the cooling tower basin through the condenser to condense the turbine exhaust steam. This heated water is returned to the cooling tower where it is distributed over the tower fill and allowed to cascade down through the tower. Large fans pull air through the tower; heat exchange occurs by evaporation and convection. Cooling tower water evaporation losses would be replaced by makeup water pumped from the Floridan aquifer. Based on the anticipated Floridan aquifer water quality, treatment of makeup water would be required to allow approximately 15 cycles of concentration. The 15 cycles were selected to minimize groundwater withdrawals. Blowdown (i.e., discharge) water from the cooling tower system would be required on a routine basis to maintain adequate water quality in the tower for efficient performance. This blowdown water would not meet Florida Class III surface water quality standards or groundwater quality standards. Therefore, the blowdown water would require extensive treatment prior to reuse and/or discharge from the site. The blowdown water would also need to be considered in the NPDES permitting process. Additional land area on the site would be required for the treatment of the cooling tower makeup and blowdown waters and for the disposal of sludge and solid wastes generated by these water treatment systems.

Although freshwater (surface and groundwater) rather than saltwater would be used in the cooling towers, the drift after 15 cycles of concentration would nevertheless contain high TDS. These solids would contribute to particulate levels in the air with its attendant degradation of ambient air quality. The drift may also have potential terrestrial ecology impacts. The use of biocides for control of algae and other biota in the cooling towers introduces the potential for accidental release of these materials during transport and handling and, depending on their chemical nature, possible release to the atmosphere with the drift.

Based on Tampa Electric Company's evaluations, the alternative cooling tower system was considered to have greater environmental impacts than the proposed cooling reservoir system. Biocides are added to cooling tower water to control growth of organisms in and on the cooling tower. This biocide represents an environmental disadvantage because of its potential toxicity. Uncontrolled spills of biocide and release of water with biocide contained in the cooling tower could result in environmental damage. Wastes from the required treatment systems for the cooling tower makeup and blowdown waters would require the development of additional landfill areas on the site or consume off-site landfill capacities if the wastes were shipped off the site for disposal. As indicated above, the use of cooling towers would also involve potential environmental impacts associated with drift from the towers.

The estimated costs for the cooling tower equipment, equipment foundations, and associated water treatment facilities are more than twice the costs of the cooling reservoir. In addition, the mined-out area for the proposed cooling reservoir would still need to be reclaimed to meet agency requirements. Therefore, the cooling tower alternative would actually require approximately 2.5 times the expenditure for the proposed cooling reservoir.

Based on these evaluations, the use of the cooling tower system alternative for the Polk Power Station versus the proposed cooling reservoir would result in increased environmental issues and potential impacts and significantly higher costs for the facility construction, operation, and maintenance. The cooling tower alternative was found to be environmentally and economically disadvantageous compared to the proposed cooling reservoir. Therefore, the cooling tower alternative was not further considered for the proposed project in this EIS.

2.6.4 Cooling Water Makeup/Process Water Source Alternatives

2.6.4.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

The proposed Polk Power Station project would involve the use of a combination of sources for makeup water for the cooling reservoir to replace water primarily lost through net evaporation and discharge for water quality management purposes. The proposed makeup water sources include:

- Direct rainfall on the reservoir
- Direct storm water runoff from surrounding and internal earthen berms
- Treated storm water runoff from areas associated with industrialized activities (e.g., slag storage, power block, and fuel oil storage areas)
- Treated process wastewaters (except CG process waters)
- Treated domestic wastewaters
- Net seepage from the surficial aquifer
- Groundwater pumped from the Floridan aquifer

The proposed uses of all these sources of cooling makeup water are focused on the objective of maximizing water reuse and recycling to minimize the use of groundwater withdrawals from the Floridan aquifer.

According to current engineering designs and analyses, groundwater from the Floridan aquifer would be withdrawn and provided directly to the cooling reservoir at an estimated annual average rate of 5.0 mgd, with a peak rate of 6.5 mgd, to maintain normal operational water levels of approximately 136 ft-NGVD upon full build-out (1,150 MW) of the proposed facilities. In addition, groundwater withdrawals from the Floridan aquifer for process, service, and potable uses are estimated to be approximately 1.6 mgd on an annual average basis and approximately 2.8 mgd on a maximum basis. Thus, for the proposed project, the total estimated groundwater withdrawals for cooling water makeup and other plant uses are approximately 6.6 mgd on an annual average basis under normal operating conditions at full build-out of the project, and 9.3 mgd at peak conditions.

Most of the groundwater for process uses would be treated prior to use to provide water of adequate quality to meet process water requirements (e.g., boiler makeup, pump seals, and nonchemical cleaning). An RO system is proposed to treat the Floridan aquifer water to meet the relatively high water quality needs for process water uses and to meet Tampa Electric Company's objectives of maximizing the reuse of treated wastewaters and, in turn, minimizing groundwater withdrawals.

2.6.4.2 Alternatives

Potential alternative sources of cooling water makeup and process water to either replace or supplement the proposed Floridan aquifer groundwater withdrawals include:

- Groundwater withdrawn from the intermediate aquifer found in the Hawthorn group
- Groundwater withdrawn from the deep, lower Floridan aquifer (i.e., highly mineralized water)
- Storm water runoff from all or a larger portion of the site
- Surface water from streams
- Public water supply/wastewater treatment systems

The intermediate aquifer consists of isolated limestone units located in the Hawthorn group. The capacities of these units vary with their size and recharge sources. The majority of wells serving individual homes in the area draw water from the intermediate aquifer. Because of the limited capacity of the intermediate aquifer units, utilization of this source of groundwater by the proposed Polk Power Station would severely drawdown aquifer levels in the area causing adverse impacts upon local wells. It is possible that a severe drawdown of this aquifer may also find expression in reduced water levels in recharge areas, adversely affecting their ecologic systems. Thus, the intermediate aquifer was not considered an environmentally advantageous alternative for required water supplies for the proposed project and was not further considered for the proposed project in this EIS.

As a potential alternative, withdrawing groundwater to supply all or some portion of the needed cooling water makeup and process water from the deep, lower Floridan aquifer was considered. Water from this deep unit of the Floridan aquifer is highly mineralized and would require extensive treatment prior to use for potable, industrial process, and cooling makeup water purposes. Without this pretreatment, the use of this highly mineralized water would create significant operation and maintenance problems by forming calcium rich sludges and mineral and brine deposition on equipment. If this water was provided directly to the cooling reservoir for makeup water, it would have adverse water quality impacts in the surficial aquifer due to groundwater seepage from the reservoir and from discharges from the reservoir. Therefore, use of groundwater from the deep, mineralized unit of the Floridan aquifer for process water or cooling water makeup would require substantially more extensive and costly pretreatment compared to the proposed use of low mineralized water from the upper Floridan aquifer system. Such extensive treatment would also create additional volumes of brine or sludge wastes, which, in turn, would require additional on-site or off-site disposal areas. Based on these facts, Tampa Electric Company did not consider the potential use of groundwater from the deep Floridan aquifer as an environmentally beneficial alternative for the proposed project and its use was not considered further in this EIS.

In order to minimize groundwater withdrawals, Tampa Electric Company also considered the potential alternative of collecting and using storm water runoff from all or a larger portion of the proposed Polk Power Station site to supplement process water and cooling water makeup needs. This potential alternative would involve diverting some volume of the storm water runoff to the Payne Creek, Little Payne Creek, and/or South Prong Alafia River drainage basins. The collected storm water runoff from these drainage basins would be directed to the cooling reservoir to potentially reduce the need for groundwater withdrawals. However, based on the reclamation requirements of FDEP and SWFWMD to maintain hydrologic conditions similar to premining conditions in terms of the rate and volume of storm water runoff, the incorporation of this potential alternative into the proposed project would not meet regulatory reclamation requirements. Therefore, the potential alternative of collecting additional storm water from the site area was not considered a feasible alternative from a regulatory compliance standpoint for the proposed project and was not further considered in this EIS.

Withdrawals or diversions of surface water from the nearby Little Payne Creek, Payne Creek, and South Prong Alafia River systems were considered as potential sources for process and cooling water makeup. However, due to the periodic low flow conditions in these streams, they would not be a reliable source of water. Further, withdrawal of water for the proposed action would cause longer and more frequent low flow events in these stream systems. This, in turn, would cause adverse environmental impacts upon the ecological systems dependent upon these streams. Thus, this alternative is not feasible because the source of water is not as reliable as the preferred alternative, and the alternative is not environmentally beneficial when compared to the preferred alternative. For these reasons, this alternative was not considered further in this EIS.

Other potential alternative sources of cooling makeup and/or process water would be from public water supply or wastewater treatment systems. However, the nearest public system is located over 10 miles from the site. The nearest potable water service area is located in Bradley Junction, servicing the general boundaries of the community of Bradley Junction. No sewer service is available in Bradley Junction. Therefore, these alternatives were not considered reasonable at this time.

2.6.5 Cooling Reservoir Discharge Alternatives

2.6.5.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

The proposed Polk Power Station project has been designed to maximize water recycling and reuse to minimize groundwater withdrawals and water discharges. Except for the CG process waters, the treated wastewaters from other plant processes and systems would be routed to the cooling reservoir for reuse in the recirculating water cooling system. Discharges from the cooling reservoir are estimated to be approximately 3.1 mgd on an annual average basis to the Little Payne Creek drainage system. During storm events, discharges from the reservoir would be greater. However, the discharges of primarily excess storm water would be managed and controlled to reduce peak flows from the reservoir and, in turn, downstream flooding conditions compared to premining conditions and to satisfy FDEP and SWFWMD requirements for mass flow contributions.

2.6.5.2 Alternatives

Potential alternatives for discharges from the cooling reservoir would include:

- Discharge to Payne Creek or South Prong Alafia River surface water systems
- Deep well injection of discharge water
- Zero discharge from the cooling reservoir

The first potential alternative would involve the discharge of water from the cooling reservoir directly to the Payne Creek or South Prong Alafia River systems. The Payne Creek and South Prong Alafia River drainage systems in the vicinity of the site have been significantly affected by phosphate mining activities similar to the Little Payne Creek system, the proposed receiving water body. Direct discharges to these creeks from the cooling reservoir and plant site area would not meet FDEP requirements to reclaim drainage basins of mined areas to premining conditions. Therefore, since the use of these other surface water drainage systems does not meet regulatory requirements and offers no environmental advantages, these potential discharge alternatives were not considered for the proposed project in this EIS.

Another potential discharge alternative would involve disposing cooling reservoir discharge water in a deep injection well. Due to predicted volumes, this well would need to be at least 24 inches in diameter and at least 3,000 to 4,000 ft deep to reach deep strata capable of receiving these quantities of discharge water. This potential discharge alternative would minimize surface water quality or quantity concerns associated with the proposed discharge plan to the Little Payne Creek system. However, the deep injection well alternative would be costly to construct and would require the following:

- Engineering feasibility studies
- Coordination with FDEP regarding a possible underground injection control (UIC) permit and related coordination
- A dedicated monitoring well located near the injection well to monitor the fate of the injected wastewater, and thus ensure that the injected water is not upwelling into desirable drinking water strata
- As an "industrial" as opposed to "municipal" injection well, a "tubing and packer system" instead of a simple casing would be needed, which in turn is limited to 12- to 16-inch diameter well as opposed to the predicted need for a 24-inch well
- At least two, and possibly as many as four, injection wells would be needed given the fact that tubing and packer system is limited to 12- to 16-inch diameter well (and the attendant greater costs of two to four wells instead of one)
- An emergency backup system to accept the injected water if deep well injection is not possible or is interrupted, or for discharges from mechanical integrity test (MIT) analyses

In regard to the emergency backup system, this capability could include pit storage areas or, alternatively, an EPA NPDES permit for emergency discharges to waters of the United States. Given these considerations, this potential alternative was not considered environmentally or economically beneficial and was not further considered in this EIS.

If the project were designed to have zero discharge from the cooling reservoir, potential environmental concerns with any surface discharges would be eliminated. The implementation of this zero-discharge alternative may be feasible by increasing the heights of the earthen berms surrounding the cooling reservoir to provide sufficient water storage capacity under all foreseen and unforeseen situations and providing water treatment facilities to ensure water quality in the reservoir does not exceed applicable groundwater and surface water standards. The specific height of berms required would be difficult to determine since the design must consider all, even unforeseen, future situations. Another means of implementing this zero-discharge alternative would be to subject the potential discharge water or water within the reservoir to extensive treatment that would produce a concentrated solid waste. This solid waste would then need to be disposed in an on- or off-site landfill facility.

Both of these methods of potentially achieving the zero-discharge alternative would involve significantly higher construction and operating costs compared to the proposed project. In addition, the technical feasibility of being able to demonstrate that zero discharges would occur under all future situations may not be possible. Based on these issues and the fact that the proposed discharge plan for the Polk Power Station project is expected to have minimal environmental impacts, the potential zero-discharge alternative was not considered reasonable.

The Tampa Electric Company preferred alternative of using a cooling reservoir provides more environmental advantages than the alternatives. It allows more water recycling and reuse than the other alternatives considered, which results in less groundwater withdrawals and water discharges. It also allows management of discharges to Little Payne Creek to reduce flow extremes and approach premining conditions in the creek.

2.6.6 Sanitary Wastewater Treatment System Alternatives

The following potential alternatives were evaluated for treatment of the 10,500 gpd of sanitary wastewater generated from the proposed Polk Power Station project:

- On-site package treatment system
- Septic systems
- Off-site publicly-owned treatment works (POTW)

2.6.6.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

The proposed on-site package treatment system is a prefabricated outdoor module that treats sanitary wastes through continuous aeration, sedimentation and biodegradation, filtration, and chlorination of the effluent prior to discharge to the cooling reservoir. The treatment process would generate sludge, which would be dewatered and hauled off the site by a licensed contractor for disposal in a landfill or applied to land in accordance with federal, state, and local regulations.

2.6.6.2 Alternatives

Septic tanks are commonly used in this part of Polk County. To be effective, the on-site soils must have a satisfactory absorption rate without interference from groundwater or impervious strata. Septic tanks require periodic pumping to remove sludge and grease that might clog the system. The use of a septic tank also does not allow direct recycling of wastewater. Although the septic system alternative is viable at the Polk Power Station site, it offers no environmental advantages compared to the proposed treatment system.

Off-site treatment involves directing the sanitary wastes by pipeline to the nearest POTW. The closest POTW that may have sufficient capacity to accept the project sanitary wastewaters is located more than 10 miles from the Polk Power Station site (i.e., Mulberry or Fort Meade). The environmental and economic costs for the required pipeline from the site to these facilities with its associated equipment would be quite high. The corridor for the pipeline would have to be cleared and maintained, pumping stations would need to be constructed at key locations along the pipeline, and power provided. In addition, the water would be removed from the proposed power station eliminating the possibility of recycling. This would require additional groundwater to be pumped to make up for this loss. The alternative of off-site treatment was therefore considered to offer no environmental advantages over the Tampa Electric Company preferred alternative and is not considered further in this EIS.

2.6.7 CC Process Wastewater Treatment/Disposal Alternatives

2.6.7.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

For the proposed Polk Power Station project, process wastewaters, except for process water from the CG facilities, and storm water runoff from industrial activity areas of the site would be appropriately treated and routed to the cooling reservoir for reuse in the recirculating water cooling system. Sources of these process wastewaters would include boiler blowdown, nonchemical cleaning water, and other low-volume, intermittent streams such as plant drains and laboratory wastes. Sources of storm water runoff industrial activity areas include the slag storage area and the immediate power block areas. The proposed treatment systems for these wastewaters and storm waters include a combination of sedimentation, oil/water separation, neutralization, and polishing filtration. The treated waters would have acceptable quality for reuse in the cooling reservoir and their discharge to the reservoir would not create any significant adverse environmental impacts.

2.6.7.2 Alternatives

Potential alternatives to the proposed process wastewater treatment system that were considered included:

- Discharge of treated wastewater directly off site
- Disposal of wastewater by deep well injection
- Zero liquid discharge treatment

The discharge of treated wastewater directly to off-site surface waters (i.e., Little Payne Creek, Payne Creek, or South Prong Alafia River) rather than the proposed discharge to the cooling reservoir would create the need for additional groundwater makeup withdrawals by approximately 0.5 mgd to maintain the normal operating water level in the reservoir. Also, since the treated wastewater may not meet all Florida Class III water quality standards, the direct discharge of the wastewater to the smaller streams (i.e., Little Payne Creek) in the site vicinity would not be feasible or pennitted. These smaller streams do not have sufficient flow volumes to allow for mixing in compliance with the state standards. The South Prong Alafia River may have sufficient flow to allow for mixing; however, discharge of wastewater to the river offers no environmental advantages compared to the proposed discharge to the cooling reservoir since the water volume in the reservoir is greater than the river flow. Also, construction of a discharge pipeline to the South Prong Alafia River would involve higher costs than the proposed discharge plan.

As discussed previously for the cooling reservoir discharge alternatives, the potential alternative of disposing the treated wastewater in a deep injection well would involve construction of a 3,000 to 4,000-ft deep well to reach suitable strata for receiving the water. Again, the injection well alternative would be significantly more costly than the proposed discharge plan and would require feasibility studies and coordination with FDEP monitoring and pennit considerations.

The third wastewater disposal alternative considered involves the construction and operation of additional treatment facilities to reduce the wastewater to a solid waste or sludge with no liquid discharge. This alternative would eliminate any concerns associated with the quality of the treated wastewater in the cooling reservoir. However, the disposal of the solid waste or sludge would require additional land area for storage on the site or in an off-site landfill facility. Further, the construction and operation of such treatment facilities would involve significantly higher costs than the proposed plan.

Thus, these potential alternatives for wastewater disposal offered no significant environmental advantages compared to the proposed treatment and discharge system, and in most cases, would involve significantly higher costs and certain technical uncertainties. Therefore, these potential alternatives were not further considered for the proposed project in this EIS.

2.6.8 CG Process Water Handling Alternatives

2.6.8.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

The chemical and physical characteristics of process water from the gasification facilities depends on the composition of the coal used in the facilities. If DOE provides cost-shared financial assistance for this CCT Demonstration Project, a variety of coals would be tested and used in the gasification facilities. Therefore, it is difficult to predict the specific quality of the process water generated in the gasification facilities at this time. Based on this consideration, the proposed gasification process water would be contained and processed in a separate system. The gasification process water would be handled and recycled within the process, to the extent possible. The proposed handling system for the gasification process water would have no liquid discharges, and after concentration and drying would create a brine product primarily consisting of ammonium chloride with some amounts of sodium chloride and ammonium format. This brine would be stored in a protected, lined area on the site. There is a potential for off-site uses of the brine.

2.6.8.2 Alternative

No other alternatives were considered reasonable for the handling of the gasification process waters. Therefore, no other potential alternatives were considered in this EIS. However, during and after the demonstration period for the IGCC unit, Tampa Electric Company may develop operational data on the quality of the gasification process water and examine other possible handling and treatment methods for this water. If these future operational testing data demonstrate that the gasification process water would meet applicable water quality standards after certain treatment and not adversely affect the reservoir operations, Tampa Electric Company may request appropriate regulatory approvals to discharge these process waters to the cooling reservoir or off site.

2.6.9 Solid Waste Storage/Disposal Alternatives

2.6.9.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

The nonhazardous solid wastes generated by the Polk Power Station project would include sanitary wastewater treatment sludge, IWT sludge, CG wastewater treatment brine solids, water treatment media, HGCU system wastes, and general solid wastes. These solid wastes would be stored and disposed in accordance with federal, state, and local regulations.

The sludge generated from the sewage treatment package plant and solids from the IWT filtration would be periodically transported off site for disposal in a landfill or by-land application. These solids would consist primarily of slag runoff and are expected to be nonhazardous, which would be verified by testing.

The concentrated CG wastewater treatment brine would be stored in a secure, on-site area consisting of storage cells with a leachate collection system and an impermeable liner in accordance with Chapter 17-701, FAC. The nonhazardous plant trash would be removed to an off-site sanitary landfill. The wastewater treatment media and filter media would be removed to an off-site permitted landfill.

The HGCU system is expected to generate sorbent fines from the regenerator, salt from the barrier filter, and solids from the cyclone unit. The salt from the barrier filter would be stored in the brine storage area. The sorbent fines would be reclaimed off site. The cyclone solids are expected to be nonhazardous because they would contain zinc sulfide, titanium dioxide, and carbon. These solids would be removed to a permitted off-site landfill.

2.6.9.2 Alternative

Off-site storage and disposal can be a potential alternative for those nonhazardous solid wastes that are designated to be stored or disposed of at the proposal power station site. However, the advantages and drawbacks of off-site disposal depends on many factors, including the disposal costs, environmental impacts, and regulatory requirements. At this time, the proposed solid waste storage and disposal plan is considered to be adequate. Off-site storage and disposal may also be a reasonable potential alternative in the future, but was not considered further for the proposed project in this EIS.

2.6.10 <u>By-Products Storage and Management Alternatives</u>

2.6.10.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

For the proposed Polk Power Station project, the slag and H_2SO_4 by-products would be temporarily stored on the site, marketed, and sold for off-site use. The proposed temporary slag storage area would be lined with a synthetic material, or other materials with similar low-permeability characteristics, and have a storm-water runoff collection system. The H_2SO_4 would be temporarily stored in tanks or specifically designed rail cars.

2.6.10.2 Alternatives

Other potential alternatives for disposal of these by-products would be the provision of disposal facilities on the site or disposal in off-site landfill facilities. These potential alternatives would involve the commitment of much larger on-site or off-site land areas for disposal of these by-products than the proposed disposal plans. Also, these alternatives would not allow for use or reuse by selling these commercially useful by-products. Based on these facts, these potential alternatives were not further considered for the proposed project in this EIS.

2.6.11 <u>Air Emission Control Alternatives</u>

A general requirement of the PSD permitting process is a determination of the BACT for each pollutant emitted over the PSD significant emission rates. The BACT determination takes into account energy, environmental, economic, and other costs as well as technical feasibility. BACT is defined in terms of a numerical emissions limit based on the application of air pollution control equipment, specific production processes, methods, systems or techniques, fuel cleanings, or combustion techniques. BACT limitations must not exceed any applicable federal or state NSPS or National Emission Standard for Hazardous Air Pollutants (NESHAPS) or any other limitation established by state regulations.

BACT analysis for the proposed Polk Power Station was performed using a "top-down" analysis. First, information on all applicable available control technology was acquired. Sources of information which were used to identify control alternatives include:

- EPA BACT/Lowest Achievable Emission Rate (LAER) Clearinghouse via the BACT/LAER Information System (BLIS) computer database
- EPA New Source Review (NSR) bulletin board
- EPA Control Technology Center (CTC) bulletin board
- Recent FDEP BACT determinations for similar facilities
- Vendor information

Following an identification of available control technologies, the technological feasibility of each alternative was evaluated. Next, all technologically feasible alternatives were ranked from high to low in order of control effectiveness (i.e. the most stringent alternative is at top). The hierarchy was then evaluated (starting at the top) to determine the feasibility and appropriateness of each alternative in terms of economic, environmental, and energy impacts, referred to as "top-down" analysis. Finally, a BACT emission limit corresponding to the most stringent, technically feasible control technology that was not eliminated based on adverse energy, environmental or economic factors was selected.

A summary of the emission controls decided on after BACT analysis, and a summary of the alternatives considered are contained in the following two sections. This information was submitted as part of the PSD application included in Vol. 4 of the SCA, as well as Section 3.4.2 in Vol. 2 of the SCA.

2.6.11.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

Particulate Matter and Heavy Metals Controls

Some heavy metals may volatilize during combustion processes and condense in the stack gases. There would also be heavy metals associated with PM emissions. Therefore, BACT for PM also applies as BACT for heavy metals. PM and heavy metals (e.g. lead and mercury) controls planned for Polk Unit 1 (the IGCC facility) consists of water scrubbing (integral to the CGCU process), use of clean fuels, and operational practices to achieve efficient combustion. In the conventional CGCU process, the syngas is scrubbed and cooled prior to entering the acid gas removal system. This results in the condensation of trace volatile heavy metals and further reduction in syngas particulate levels. The demonstration HGCU technology employs a high temperature barrier filter to remove 99.5 percent or more of the PM contained in the treated syngas stream.

The amount of control of the heavy metal emissions will vary per metal. For example, mercury, with its relatively higher vapor pressure, will not be controlled to the same efficiency as lead with the customary PM controls.

The IGCC 7F CT would operate primarily on syngas, but with distillate fuel oil as a backup fuel. Syngas and distillate fuel oil are both low in ash and sulfur content, resulting in low PM emissions.

Fugitive PM emissions resulting from the handling of coal in the IGCC facility would be controlled by using a comprehensive system of equipment enclosures, storage silos, fabric filter dust collection, application of water/chemical dust suppression, and paved roads (rather than dirt or gravel roads) within the Polk Power Station site.

The stand-alone CC units and the simple-cycle CT units would be fired primarily with natural gas with distillate fuel oil as a backup fuel. Both fuel types are low in sulfur and ash content, which would result in low PM emissions.

Carbon Monoxide and Volatile Organic Compounds Controls

CO and VOC emissions from Polk Unit 1, as well as the stand-alone CCs and CTs, would be controlled by the use of advanced combustion equipment and operational practice for efficient combustion. An increase in combustion zone residence time and improved mixing of fuel and combustion air would increase oxidation rates and cause a decrease in CO and VOC emission rates.

Sulfur Oxides and Sulfuric Acid Mist

SO_x and H_2SO_4 mist emission control is integral to the Polk Unit 1. Using conventional CGCU technology, H_2S and COS present in the syngas leaving the gasifier would be removed using an amine process. These sulfur compounds would eventually be stripped from the amine solution and converted to H_2SO_4 in the H_2SO_4 plant. Approximately 95.6 percent of the inlet sulfur would be removed and sent to the H_2SO_4 plant.

The demonstration HGCU technology would react H_2S present in the syngas stream with zinc titanate sorbent in a moving bed absorber. Regeneration of the absorber would yield a concentrated SO_2 stream which would then be converted to H_2SO_4 in the H_2SO_4 plant. Sulfur removal efficiency is expected to meet or exceed that of conventional CGCU technology.

SO_2 and H_2SO_4 mist emissions from combustion sources would be further controlled by the use of low-sulfur fuels. The 7F CT associated with Polk Unit 1 would be fired on syngas with distillate fuel oil as a backup. The sulfur content of syngas and distillate fuel oil would be 0.07 and 0.05 weight percent, respectively. The stand-alone CT and CC units would use low-sulfur natural gas and distillate fuel oil as backup. Natural gas sulfur content would be less than 10 gr per 100 scf (gr/scf). Distillate fuel oil would contain a maximum of 0.05 weight percent sulfur.

Nitrogen Oxides

The 7F CT associated with Polk Unit 1 would use nitrogen addition to control NO_x emissions during syngas firing. Nitrogen acts as a diluent to lower peak flame temperatures and reduce NO_x formation. Water injection would be employed to control NO_x formation when firing on backup distillate oil. Nitrogen injection is preferred over water injection during syngas firing, because the water consumption and treatment/disposal requirements associated with water injection would be eliminated. Other combustion sources associated with Polk Unit 1 would be controlled using low-NO_x burners and/or combustion practices that reduce NO_x formation.

The stand-alone CC and CT units would utilize dry, low-NO_x burners when fired on natural gas and water injection when fired on backup distillate fuel as NO_x control alternatives.

2.6.11.2 Alternatives

The following discussions summarize control alternatives that were considered but eliminated during BACT analyses.

Particulate Matter and Heavy Metals

Available technologies for controlling PM and heavy metal emissions from the proposed Polk Power Station combustion sources include the following:

- Centrifugal collectors
- Electrostatic precipitators (ESP)
- Fabric filters or baghouses
- Wet scrubbers

While these control alternatives would be technically feasible, the naturally low PM concentrations predicted for exhaust gases would not make these alternatives cost effective. PM removal efficiencies would be too low to justify the cost of additional controls. However, a wet scrubber to remove PM from the syngas is an integral part of the Texaco CGCU process.

Carbon Monoxide and Volatile Organic Compounds Emissions

Noble metal (commonly platinum or palladium) oxidation catalysts are used to promote oxidation of CO and VOC to CO_2 and water at temperatures lower than would be necessary for oxidation without a catalyst. However, oxidation catalysts are susceptible to deactivation due to impurities present in the exhaust stream. Arsenic, iron, sodium, phosphorus, and silica will act as catalyst poisons causing a reduction in catalyst activity and pollutant removal efficiencies.

Also, oxidation catalysts are nonselective and will oxidize other compounds in addition to CO and VOC. This nonselectivity is important in assessing the applicability of oxidation catalyst to exhaust streams containing sulfur compounds. Sulfur compounds that have been oxidized to SO_2 in the combustion process will be further oxidized to SO_3, which will combine with moisture in the gas stream to form H_2SO_4 mist.

The application of oxidation catalyst technology to a combustion device would also result in an increase in back pressure on the device due to pressure drop across the catalyst bed; thereby, increasing energy consumption.

For these reasons, oxidation catalysts were not considered to be a viable control alternative for any of the combustion sources.

Sulfur Oxides and Sulfuric Acid Mist

Sulfur removal and recovery processes are integral to the IGCC facility. As the project would achieve an overall sulfur removal efficiency (95.6 percent) that is higher than the highest efficiency listed in BLIS for large coal-fired power plants, no other control alternatives were considered for the Polk Unit 1.

The control alternatives considered for the stand-alone CC and CT units included fuel treatment and FGD systems. While FGD technology would be technically feasible, there have been no applications to CTs in the United States, since the use of low-sulfur fuels has become commonplace. Low-sulfur fuels result in low SO_2 emissions in the exhaust gases. Because SO_2 removal efficiency of FGD systems decreases with decreasing inlet SO_2 concentrations, this alternative was not considered cost effective.

Nitrogen Oxides

The selective catalytic reduction (SCR) control alternative for control of NO_x emissions was eliminated for a variety of reasons. SCR catalyst would promote the oxidation of flue gas SO_2 to SO_3, which will then combine with water vapor to form H_2SO_4. Consequently, corrosion of downstream piping and heat transfer equipment would be of concern when using SCR with sulfur-bearing fuels. Also, SO_3 will combine with unreacted NH_3 to form ammonium bisulfate and ammonium sulfate resulting in increased PM emissions. Other technical concerns include catalyst poisoning from arsenic and sulfur compounds, and any unreacted NH_3 causing corrosion and reduced efficiency of downstream heat transfer equipment. Also, spent SCR catalyst would require handling and disposal as a hazardous waste due to vanadium pentoxide content.

2.6.12 Transmission Line Corridor Alternatives

The electric transmission lines are one of the linear facilities for the proposed Polk Power Station project. The proximity of the site to existing transmission lines was a key Tampa Electric Company consideration in selecting the proposed Polk Power Station site.

2.6.12.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

Two transmission line corridors, each containing two 230-kV circuits, would be needed to connect the Polk Power Station to the regional power grid. One of these corridors would connect the on-site substation to the existing Tampa Electric Company Hardee-Pebbledale 230-kV transmission line. The right-of-way for the existing Hardee-Pebbledale line is located within the proposed Polk Power Station site along the northeast boundary. Therefore, this proposed transmission line corridor is located completely within the site boundaries so that no other alternative corridor route was considered necessary to minimize environmental effects.

The other proposed transmission line corridor for the Polk Power Station would connect the on-site substation to the existing Tampa Electric Company Mines-Pebbledale 230-kV transmission line located to the north of the site at a point west of the unincorporated community of Bradley Junction. This proposed line will be located on site and off site. The proposed corridor of the transmission line would run west from the on-site substation to SR 37. This portion of the corridor would be 400 ft wide and would be located entirely within the proposed Polk Power Station site boundaries. The proposed centerline of the corridor would turn north at SR 37 at a point approximately 1,500 ft north of Bethlehem Road. The proposed corridor would traverse north along SR 37, and then turn northwest at a point south of Bradley Junction in order to connect to the existing circuit while avoiding this community. The corridor width along SR 37 would be 0.5 mile increasing to 1 mile southwest of Bradley Junction to allow flexibility in routing the line around mined areas and phosphate clay settling ponds, and to avoid the existing community. The total length of this transmission line corridor would be approximately 5.2 miles, including approximately 0.75 mile on the proposed Polk Power Station site.

Although Tampa Electric Company proposes these transmission line corridors, the actual right-of-way alignments within the corridors have not been finalized. Once proposed alignments are finalized, Tampa Electric Company will need to further coordinate with appropriate federal and State of Florida agencies (FWS, USACOE, FDHR, and FDEP), as needed. Considerations in these coordination efforts would include potentially endangered species, wetland, and cultural resource concerns. The resources that may potentially be impacted from construction of the transmission line are presented in Section 3.5. The potential impacts of the most probable right-of-way are described in Sections 4.5.1.4 and 4.6.1.3.

During this EIS process, FWS inspected the transmission line corridor on December 23, 1993. FWS appears to no longer have habitat concerns regarding the red-cockaded woodpecker and the Florida scrub jay along the corridor (see Appendix B, Coordination Letters and Responses - FWS).

2.6.12.2 Alternative

In addition to the proposed corridor route, Tampa Electric Company considered a potential alternative corridor that would run south on SR 37 to SR 674 and west to the Polk/Hillsborough County line. The alternative corridor would then run north along the county line to the existing Mines-Pebbledale transmission line. This alternative corridor was significantly longer than the proposed corridor and would likely affect more wetland and residential areas along the county line. Because this alternative has more environmental disadvantages and is more costly, it was not considered further for the proposed project in this EIS.

2.6.13 Other Linear Facility Alternatives: Natural Gas Pipeline, Fuel Oil Pipeline, and Rail Spur

In addition to the electric transmission lines, the proposed Polk Power Station project would also include several other associated, linear facilities: railroad spur, natural gas pipeline, and a possible fuel oil pipeline. The proximity of the site to existing linear facilities was another key consideration by Tampa Electric Company in selecting the proposed Polk Power Station site.

2.6.13.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

Natural Gas Pipeline

Natural gas would be used as the primary fuel for the stand-alone CT and CC units proposed for the Polk Power Station, and would be delivered to the site via a pipeline from the existing or future natural gas transmission system in the region. FGT has existing gas transmission pipelines in the vicinity, including a pipeline crossing the western tract of the site, and plans to expand its system in the proposed site vicinity (such as a new metering station at the intersection of SR 37 and CR 630 within the Polk Power Station site and a new pipeline between its St. Petersburg and Sarasota laterals, which would be located primarily along CR 39 in Hillsborough County, approximately 5.5 miles to the west of the site). Other natural gas transmission companies are also considering developing new systems in the region.

Although natural gas would not be needed at the site until 1999, Tampa Electric Company is currently evaluating the various alternatives to supply natural gas to the Polk Power Station. Specific interconnection points to the existing or planned gas transmission system in the site area and, in turn, the proposed interconnecting pipeline route or alternative routes to the Polk Power Station site have not been determined or finalized. When specific interconnection points and alternative routes to the Polk Power Station site have been determined, Tampa Electric Company will need to consult with appropriate federal, state, and local agencies (FWS, USACOE, FDHR, and FDEP) for coordination, possible permitting, and NEPA compliance. It is expected that the specific interconnection point and route for the pipeline will not be finalized until after the timeframe of this EIS.

Fuel Oil Pipeline

The needed No. 2 fuel oil would be primarily delivered to the site by tanker truck and/or rail. General American Transportation Corporation is considering construction of a new fuel oil pipeline in the region, possibly running parallel to Fort Green Road and the CSX Railroad located adjacent to the eastern boundary of the proposed Polk Power Station site. If this potential project is constructed, fuel oil could be delivered via a pipeline to the on-site fuel oil storage tanks. The corridor for interconnection with this supply pipeline would primarily be located within the boundaries of the proposed Polk Power Station site.

If the fuel oil pipeline were constructed and Tampa Electric Company chose to interconnect with the pipeline, additional consultation with appropriate federal, state, and local agencies regarding the appropriate coordination, possible permitting, and NEPA compliance would be needed for the final alignment. This would be needed even though the alignment would be located primarily on the proposed site, since additional on-site wetlands could be affected. The off-site interconnection portion of the alignment would also need coordination. This coordination would need to be initiated by Tampa Electric Company since the possible interconnection alignment would not be finalized until after the timeframe of this EIS.

Railroad Spur

Railroad access to the Polk Power Station would be provided by construction of a rail spur from the existing CSX Railroad line that runs along the east side of Fort Green Road adjacent to the eastern boundary of the site. The proposed rail spur would be used for the delivery of coal, materials, and certain equipment. The site access point for the rail spur alignment presently preferred by Tampa Electric Company is shown in the site layout in Figure 2.3.2-1. As shown in this figure, except for a short segment of approximately 200 ft of the rail spur to cross Fort Green Road and the associated roadway drainage ditches, the spur would be located within the power station property boundaries. The proposed rail spur would enter the site adjacent to the proposed site access road to Fort Green Road and parallel the access road to the main plant facilities area.

Since the present alignment preferred by Tampa Electric Company will likely become the final alignment selected by Tampa Electric Company, EPA has coordinated the off-site spur alignment by contractor with FWS regarding endangered species through a site inspection on December 23, 1993 (see Appendix B: Coordination Letters and Responses - FWS). Telephone coordination with FDHR has also been conducted (see Appendix B: Coordination Letters and Responses - FDHR). Considering that FWS also reviewed the proposed site and that FDHR has indicated that it has no concerns regarding on-site historic resources, the on-site alignment of the rail spur should not impact FWS or FDHR concerns. Through distribution of this EIS, coordination with USACOE is being implemented. At the discretion of USACOE, additional field coordination for the crossing of the off-site drainway or on-site railroad alignment may be needed. Tampa Electric Company will also need to coordinate the rail spur with the Interstate Commerce Commission (ICC).

2.6.13.2 Alternatives

Natural Gas Pipeline

Because the location of the interconnection with a prospective natural gas pipeline has not been determined, Tampa Electric Company has not considered off-site or on-site alignment alternatives. Tampa Electric Company, through appropriate coordination with resource agencies during permitting for a prospective proposed alignment, would need to consider reasonable potential alternatives to a proposed alignment at that time.

Fuel Oil Pipeline

If the location of a fuel oil pipeline in the site vicinity is finalized, Tampa Electric Company would determine or finalize its determination as to the feasibility of interconnecting with such a pipeline for fuel oil delivery. If pipeline delivery was selected, Tampa Electric Company would need to finalize the alignment of the interconnecting pipeline. However, pipeline delivery of fuel may or may not be selected as a cost-effective alternative. Tanker truck delivery of fuel oil would be an alternative to pipeline interconnection.

Railroad Spur

The rail spur could potentially be located anywhere along the CSX line that passes east of the property adjacent to Fort Green Road. Because of the geographic shape of the property available for the power plant structures and cooling reservoir, alternative siting of the access point would require construction of two, rather than one, separate crossings: one across the right-of-way and drainway associated with Fort Green Road and another over other drainways on the Tampa Electric Company plant site. Both of these crossings would increase the cost of the rail spur and the potential for additional environmental impacts.

In addition to alignment alternatives, a feasible alternative to rail delivery of coal, fuel oil, and other materials would be truck transportation. This alternative would not eliminate the rail spur since at least some deliveries can be expected by rail, but it would reduce rail operational impacts. The truck alternative is considered in this EIS for such impacts as noise along the probable truck delivery route (see Section 4.11). However, alternatives to the natural gas pipeline through truck transport are not considered feasible and were not further considered for the proposed project in this EIS.

2.7 TAMPA ELECTRIC COMPANY'S ALTERNATIVE POWER RESOURCE PROPOSAL (WITHOUT DOE FINANCIAL ASSISTANCE)

If DOE were to decide not to provide Tampa Electric Company with financial assistance for the demonstration project, or for some reason the proposed IGCC demonstration project were no longer needed, Tampa Electric Company would remove the IGCC unit from its resource plan. As described in Sections 1.2.2, 1.2.3, 1.2.4, and 2.4, Tampa Electric Company's ongoing, long-range integrated resource planning efforts consider a wide range of factors in determining the optimal plan to reliably and economically meet its future customer demands. The supply-side factors considered in this process include generation-technology options, generating unit sizes, fuel-mix within its generating system, and unit timing. If DOE financial assistance was not available, the IGCC unit would not be constructed by Tampa Electric Company and an alternate power resource proposal would be considered as the optimal plan. Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance) is shown in Table 2.7-1. Without DOE financial assistance, this alternative proposal would be proposed by Tampa Electric Company for the site instead of the present plan presented in Table 1.2.2-2 and described as the Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance) in this document. This alternative proposal would include construction of the two nominal 220-MW CC units first, then a nominal 75-MW CT and a nominal 500-MW PC unit with FGD. In the final phase, three nominal 75-MW CT units would be added.

Table 2.7-1. Tampa Electric Company Polk Power Station Alternative Power Resource Proposal (Without DOE Financial Assistance)

Year In Service	Nominal Generating Capacity Addition	Ultimate Unit Configuration
1995	75 MW CT	
1996	75 MW CT	220 MW CC
1997	70 MW HRSG/ST	
1998	75 MW CT	
1999	75 MW CT	220 MW CC
2000	70 MW HRSG/ST	
2001	75 MW CT	
2002	500 MW PC with FGD	
2003	--	
2004	--	
2005	--	
2006	--	
2007	--	
2008	75 MW CT	
2009	75 MW CT	
2010	75 MW CT	

Source: TEC, 1993f.

2.8 NO-ACTION ALTERNATIVE

The No-Action Alternative represents the situation in which the proposed Polk Power Station project would not be constructed and operated. Such a situation would potentially occur if EPA or FDEP and Siting Board denied Tampa Electric Company's required permits and certifications for the proposed facilities after Tampa Electric Company had exhausted all feasible redesigns to make the project acceptable to the agencies. The No-Action Alternative would also occur if Tampa Electric Company would decide to withdraw its certification and permit applications.

If the proposed project were not constructed, all potential environmental impacts of the project would be avoided. To varying degrees, these potential impacts involve air quality, groundwater and surface water resources, wetland and ecological resources, and socioeconomic and transportation conditions. These potential impacts involve both potentially adverse impacts such as ground water withdrawal and waste production and beneficial impacts such as wetland creation and management (beyond normal mined land reclamation requirements, see Section 5.2.3), job creation, and increased taxes paid to local government.

Under the No-Action Alternative, Tampa Electric Company would be unable to reliably meet the future electricity needs of its customers beginning in 1996 when the Polk Unit 1 is currently scheduled to be in-service. Further, without the proposed future units, Tampa Electric Company may be forced to implement a program of selective or rolling blackouts during periods of peak demand. Operating at LOLP levels that are detrimental to system reliability and with forced blackouts would present unacceptable conditions for an electric utility with the mandated obligation to provide reliable and cost effective electric power to its customers. The No-Action Alternative would also be inconsistent with the FPSC certification of the need for the proposed Polk Unit 1. Finally, under the no-action alternative, DOE would not achieve its objective for this proposed IGCC demonstration project to demonstrate the efficient and environmentally acceptable use of the coal for electric power generation.

If the power station was not built, the proposed site development/reclamation plans would not be implemented, the 1,511-acre portion of the site to the west of SR 37 and other wetland mitigation areas on the eastern site, designated for reclamation to a significant wildlife habitat/corridor system consisting of integrated series of forested and nonforested wetlands and uplands in southwest Polk County, would not be completed by the Tampa Electric Company using proposed planting densities and success criteria which exceed typical mined land reclamation requirements. However, since the majority of the proposed site was mined or will be mined and has not been reclaimed, the reclamation of these mined lands would still be required according to FDEP phosphate mined land reclamation regulations.

2.9 SUMMARY OF PROJECT ALTERNATIVES

As presented in the previous discussions, reasonable alternatives/subalternatives to the proposed project that could avoid or minimize potentially adverse effects on the quality of the human environment have been identified and considered. The alternatives/subalternatives considered in this EIS are summarized in Table 2.9-1, with the Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance) indicated as "TEC's proposed project" and Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance) indicated as "TEC's alternative power resource proposal."

Table 2.9-1. Summary of Alternatives/Subalternatives Considered in this EIS (Page 1 of 3)

1. Alternatives to Constructing New Generating Facilities

- Construct all 2,100 MW of needed capacity
- Conservation (TEC's proposed project)
- Interruptible load (TEC's proposed project)
- Residential load control (TEC's proposed project)
- Cogeneration power purchases (TEC's proposed project)
- Other purchased power (TEC's proposed project)

2. Alternative Generation Technologies

- TEC's proposed resource plan (TEC's proposed project)
- Three CC without CG facilities
- Three IGCC units
- PC with FGD unit (TEC's alternative power resource proposal)

3. Alternative Sites

- PLK-A site (TEC's proposed site)
- PLK-1 site
- PLK-2 site

4. Site Layout Alternatives

- Reversing locations of coal unloading and storage and slag by-product storage areas
- Proposed site layout (TEC's proposed project)

5. Fuel Handling and Storage Alternatives

- Coal delivery by rail or truck, bottom-dump rail car or truck, coal storage in silos, above-ground fuel oil storage tanks (TEC's proposed project)
- Lined storage pile with fugitive emission, leachate, and runoff controls and mobile equipment reclaimation
- Rotary dumper unloading and stacker-reclaimer
- Unlined storage area and covered coal storage area
- Below-ground oil storage tank.

6. Cooling System Alternatives

- Cooling reservoir (TEC's proposed project)
- Cooling towers: mechanical draft
- Once-through cooling

7. Cooling Water Makeup Source Alternatives

- Groundwater from upper Floridan aquifer, treated wastewater, storm water runoff (TEC's proposed project)
- Groundwater from intermediate aquifer
- Groundwater from deep lower Floridan aquifer (highly mineralized)
- Storm water from all or large portion of the site
- Surface water from streams
- Public water supply/wastewater treatment system

Table 2.9-1. Summary of Alternatives/Subalternatives Considered in this EIS (Page 2 of 3)

8. Cooling Reservoir Discharge Alternatives

- Discharge to Little Payne Creek (TEC's proposed project)
- Discharge to Payne Creek or South Prong Alafia River
- Deep well injection
- Zero discharge

9. Sanitary Wastewater Alternatives

- On-site package plant (TEC's proposed project)
- Septic tank system
- Off-site publicly-owned treatment works

10. CC Process Wastewater Treatment/Disposal Alternatives

- Discharge of treated wastewater to reservoir (TEC's proposed project)
- Discharge of treated wastewater directly off site
- Disposal by deep well injection
- Zero liquid discharge

11. CG Process Water Handling Alternatives

- Treat and reuse of water with zero off-site discharge (TEC's proposed project)
- Treat discharge to cooling reservoir
- Treat and discharge off-site

12. Air Emission Control Alternatives

• PM and trace heavy metals alternatives	a) Use natural gas, syngas, and distillate fuel oil (TEC's proposed project)
	b) Post-combustion controls: electrostatic precipitators, centrifugal collector, baghouse, or wet scrubber
• SO_2 alternatives	a) CGCU and HGCU systems and low-sulfur fuels (TEC's proposed project)
	b) Lower sulfur fuel oil
	c) Post-combustion controls: FGD
• NO_x alternatives	a) Nitrogen and water injection, and dry low-NO_x burners (TEC's proposed project)
	b) Steam injection
	c) Selective catalytic reduction
	d) Selective noncatalytic reduction
• CO and VOCs alternatives	a) Efficient combustion practices (TEC's proposed project)
	b) Oxidation catalyst
• Fugitive alternatives	a) Coal storage in silos, equipment enclosures, filters, application of dust suppression materials, and use of paved roads (TEC's proposed project)
	b) Covered coal storage areas

Table 2.9-1. Summary of Alternatives/Subalternatives Considered in this EIS (Page 3 of 3)

13. Solid Waste Storage/Disposal Alternatives

- Combination of on-site and off-site storage and disposal (TEC's proposed project)
- All on-site storage and disposal
- All off-site disposal

14. By-product Storage and Management Alternatives

- Sale for off-site commercial use with temporary storage on site (TEC's proposed project)
- Permanent disposal on site
- Permanent disposal off site

15. Transmission Line Corridor Alternatives

- North on SR 37 and west of Bradley Junction to Mines-Pebbledale transmission line (TEC's proposed project)
- South on SR 37 to SR 674 and west to Polk/Hillsborough county line, then north to Mines-Pebbledale transmission line

16. Other Linear Facility Alternatives

- Natural gas pipeline, alternatives to be determined
- Fuel oil pipeline, alternatives to be determined
- TEC proposed rail spur location (TEC's proposed project)
- Adjacent rail spur location

17. EPA and DOE "EIS Action Alternatives"

- EPA approves NPDES permit and DOE provides financial assistance (TEC's proposed project)
- EPA approves NPDES permit and DOE denies financial assistance (TEC's alternative power resource proposal)
- EPA approves NPDES permit with conditions and DOE provides financial assistance (TEC's proposed project)
- EPA approves NPDES permit with conditions and DOE denies financial assistance (TEC's alternative power resource proposal)
- EPA denies NPDES permit and DOE provides financial assistance
- EPA denies NPDES permit and DOE denies financial assistance

18. No-Action Alternative

- EPA denies NPDES permit
- FDEP denies site certification
- TEC withdraws permit/certification applications

Note: "TEC" refers to Tampa Electric Company.

CHAPTER 3.0

Affected Environment

3.0 AFFECTED ENVIRONMENT

The following sections describe the existing environmental conditions at the proposed Polk Power Station site and surrounding area. This EIS considers the existing environment rather than premining conditions as the affected environment although premining conditions are considered in some cases. Much of the information in this chapter is based on the SCA for the Polk Power Station (TEC, 1992a). The Polk Power Station site consists of approximately 4,348 acres in southwest Polk County. The site is bordered by the Hillsborough County line along the western boundary; Fort Green Road (CR 663) on the east; CR 630 and Bethlehem and Albritton Roads along the north; and SR 674 and phosphate clay settling areas on the south. A recent aerial photograph of the site and adjacent areas is shown on Figure 2.3.1-2. SR 37 bisects the property running in a southwest to northeast direction. The property to the east of SR 37 consists primarily of recently mined areas with water-filled mine cuts between over-burden spoil piles, recently reclaimed areas, and old mined and unreclaimed areas. The area to the west of SR 37 is currently being mined for phosphate matrix. These operations are scheduled to continue into 1994. Except for the approximately 775-acre tract south of CR 630 (Sections 34 and 35), the site has been part of the Agrico Fort Green Mine (TEC, 1992a).

Southwest Polk County is relatively flat, with elevations generally ranging between 120 and 150 ft-msl. The prevalent land use in the area is phosphate strip mining. The elevation of the Polk Power Station site is approximately 140 ft-msl. Approximately 94 percent (4,070 acres) of the approximately 4,348-acre site has been or will be mined or disturbed by phosphate mining activities prior to Tampa Electric Company's proposed use of the site. If the proposed project is implemented, some of the mined-out areas would be developed into a cooling reservoir that would discharge into the Little Payne Creek headwaters.

3.1 AIR RESOURCES

3.1.1 Climatology and Meteorology

The central Florida climate is classified as subtropical with maritime influences from the Atlantic Ocean and the Gulf of Mexico. Summers are long, warm, and relatively humid, while winters are generally mild because of the southern latitude and the warming influence of the Gulf Stream.

National Weather Service (NWS) climatic observation stations in the vicinity of the proposed Polk Power Station include Bartow, located 25 kilometers (km) northeast of the Polk Power Station, and Tampa International Airport (TIA), located 62 km northwest of the Polk Power Station. Given these stations' proximity to the site, the reported weather conditions are generally representative of conditions at the Polk Power Station site.

Monthly mean and extreme temperatures based on NWS data collected at Bartow for the period-of-record 1941 through 1980 (NWS, 1990) are summarized in Table 3.1.1-1. January exhibits the lowest mean minimum temperature (49.2°F) and the lowest normal mean monthly temperature (61.2°F). The highest normal mean maximum temperature (92.6°F) and the maximum normal mean monthly temperature (82.4°F) occur in August.

Based on the same 40-year precipitation record (NWS, 1990), normal annual rainfall is approximately 53 inches. Table 3.1.1-1 summarizes precipitation data, which shows the rainy season to begin in May or June and end in early September. Summer rainfall is generally derived from local showers or thunderstorms. The highest normal monthly rainfall is 8.5 inches in July. November and December are the driest months, with an average of approximately 2 inches of precipitation each month.

Table 3.1.1-2 provides a summary of normal monthly mean and extreme temperatures based on NWS data collected at TIA for the period of record 1951 to 1980. January exhibits the lowest mean minimum temperature (49.5°F) and the lowest normal mean monthly temperature (59.8°F). The highest normal mean monthly temperature (82.2°F) and the highest mean maximum temperature (90.3°F) occur in August. Table 3.1.1-2 also provides a summary of monthly mean and extreme precipitation and relative humidity. The highest normal monthly precipitation (7.64 inches) occurs in August, and the lowest normal monthly precipitation (approximately 1.8 inches) occurs in November and April.

Figure 3.1.1-1 presents a 5-year annual wind rose (1982 to 1986) based on wind direction and wind speed observed at TIA. The values presented in the figure represent the percent of the time that the wind blows from a particular direction at a given speed. The predominant wind direction during the 5-year period was from the east, which occurred approximately 14 percent of the time. Wind directions from the east-northeast, northeast, and east-southeast each occurred more than 8 percent of the time. March has the highest mean

Table 3.1.1-1. Meteorological Data from Bartow, Florida (1941 to 1980)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
<u>Total Monthly Precipitation (inches)</u>													
Average	2.27	2.97	3.53	2.51	4.57	7.30	8.48	7.39	6.62	2.83	2.13	2.17	53.42
Maximum	7.79	8.42	11.53	8.40	13.05	15.03	17.58	14.39	15.59	9.10	7.40	11.38	83.44
Minimum	0.03	0.24	0.05	0.00	0.02	0.73	2.91	2.60	1.04	0.20	0.00	0.15	37.19
<u>Maximum Daily Precipitation (inches)</u>													
Average	1.00	1.44	1.31	1.24	1.61	2.34	2.07	1.86	2.10	1.23	1.10	1.05	
Extreme	3.36	4.07	4.72	3.56	4.30	9.82	4.00	4.64	6.75	5.06	4.57	3.49	
<u>Monthly Average of Daily Maximum Temperature (°F)</u>													
Maximum	83.1	82.3	87.3	90.3	94.4	95.4	94.9	95.3	93.5	88.6	85.0	79.9	89.1
Average	73.3	75.3	79.9	84.8	89.4	91.7	92.3	92.6	90.4	85.4	79.3	74.4	84.1
<u>Monthly Average of Daily Minimum Temperature (°F)</u>													
Minimum	37.0	43.5	49.4	53.5	60.7	66.8	69.3	68.3	66.5	59.2	48.8	44.5	55.5
Average	49.2	50.7	55.2	59.8	65.3	70.4	71.8	72.1	71.1	64.3	56.7	51.1	61.4

Sources: NWS, 1990; TEC, 1992a.

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Table 3.1.1-2. Meteorological Data from Tampa, Florida (1951 to 1980)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Monthly Precipitation (inches)													
Normal	2.17	3.04	3.46	1.82	3.38	5.29	7.35	7.64	6.23	2.34	1.87	2.14	46.73
Maximum	8.02	7.95	12.64	6.59	17.64	13.75	20.59	18.59	13.98	7.36	6.12	6.66	
Minimum	0.00	0.21	0.06	0.00	0.17	1.86	1.65	2.35	1.28	0.16	0.00	0.21	
Maximum Daily Precipitation (inches)													
Extreme	3.29	3.68	5.20	3.70	11.64	5.53	12.11	5.37	4.67	2.54	4.22	3.28	12.11
Monthly Temperature (°F)													
Normal	59.8	60.8	66.2	71.6	77.1	80.9	82.2	82.2	80.9	74.5	66.7	61.3	72.0
Average Maximum	70.0	71.0	76.2	81.9	87.1	89.5	90.0	90.3	88.9	83.7	76.9	71.6	81.4
Average Minimum	49.5	50.4	56.1	61.1	67.2	72.3	74.2	74.2	72.8	65.1	56.4	50.9	62.5
Relative Humidity (percent)													
Hour 01	85	83	83	82	82	84	85	87	86	85	86	85	84
Hour 07	86	86	86	87	86	87	88	91	91	88	88	88	88
Hour 13	59	56	55	51	53	60	63	65	62	57	57	59	58
Hour 18	73	69	67	61	62	69	73	76	75	71	74	74	70

Sources: NWS, 1990; TEC 1992a.

93-5232/TECO EIS 1/94

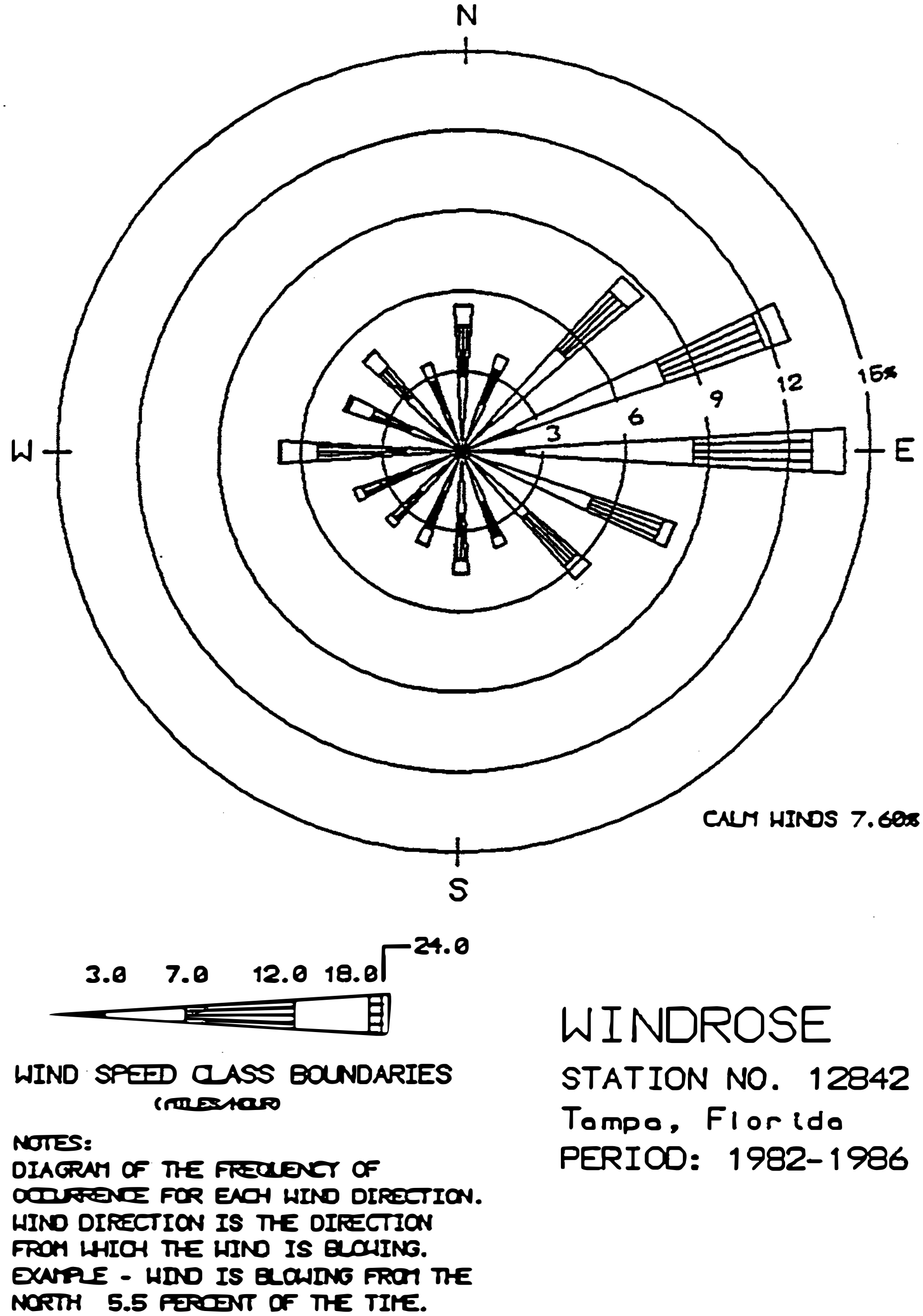

FIGURE 3.1.1-1.
5-Year Annual Wind Rose for Tampa International Airport, 1982 - 1986.

SOURCE: ECT, 1992; TEC, 1992a.

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monthly wind speed of 9.7 miles per hour (mph). The lowest mean monthly wind speed of 7.2 mph occurs in August. An easterly prevailing wind direction is evident during most of the year. The annual average wind speed is 8.6 mph. This pattern is consistent with the short-term wind observations obtained at the Polk Power Station site, as shown in Figure 3.1.1-2. Calm wind conditions occurred 29 percent of the time (April 1, 1991 through March 31, 1992) at the Polk Power Station site and 7.6 percent at TIA.

Table 3.1.1-3 presents the annual and seasonal pattern of atmospheric stability in the Tampa area, as determined by NWS. During the summer, unstable conditions are present approximately 38 percent of the time because of strong insolation. During the winter, the occurrence of unstable conditions is reduced to 16 percent of the time. Neutral stability is more common in the winter, occurring approximately 43 percent of the time. Stable conditions are uniformly distributed throughout the year, occurring 41 to 47 percent of the time.

Thunderstorms are the most common severe weather in the area, occurring on an average of 87 days each year at the NWS Tampa observation station. Thunderstorms occur most frequently from late spring to early autumn, but may occur at any time during the year (TEC, 1992a).

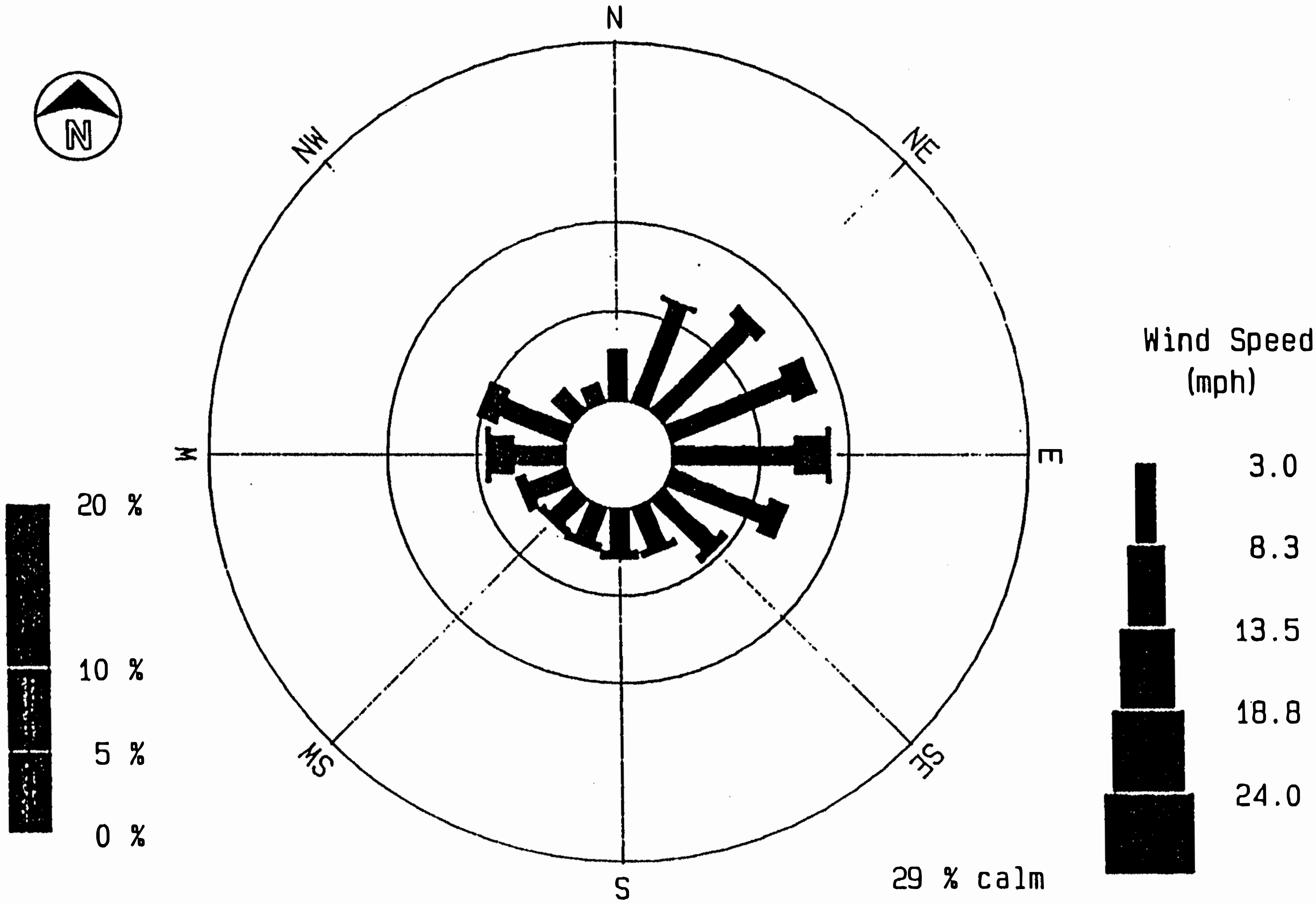
Hurricanes and tornadoes may occur in the area, but the probability of a hurricane or tornado passing over the Polk Power Station site is small. The possibility of any tropical storm crossing the Tampa Bay area is less than 10 percent in any given year. The possibility of a hurricane-strength tropical storm (winds greater than 117 km per hour) crossing the area is approximately 6 percent in any given year. The possibility of a hurricane with winds greater than 200 km per hour crossing the area in any given year is approximately 1 percent. Tornadoes also are reported rarely in the area, with June being the month of highest occurrence.

Wind, temperature, and precipitation measurements were collected by Tampa Electric Company on the Polk Power Station site from April 1, 1991, to March 31, 1992. The annual wind rose for the site is presented in Figure 3.1.1-2. The wind data is also summarized in Table 3.1.1-4 and Table 3.1.1-5. Tables 3.1.1-6 and 3.1.1-7 summarize temperature and precipitation data collected on site.

3.1.2 Ambient Air Quality

Polk County meets all National AAQS and State of Florida AAQS (jointly referred to as AAQS), as presented in Table 3.1.2-1. As a result, FDEP has classified the area as attainment for all criteria pollutants, in accordance with Section 17-2.420, FAC. Ambient air monitoring data are available with which to characterize the existing conditions in the vicinity of the site. FDEP monitored ambient air quality during 1989, 1990, and 1991 at several locations in the vicinity.

WIND ROSE ANALYSIS FOR 04/01/91 TO 03/31/92



Tampa Electric Station AQ-1 Averaging Time: 3600 sec

FIGURE 3.1.1-2.
Annual Wind Rose Analysis for Polk Power Station Site, April 1991 - March 1992.

SOURCE: ECT, 1992; TEC, 1992a.

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Table 3.1.1-3. Annual and Seasonal Average Distribution of Atmospheric Stability Classes for Tampa, Florida (1982 through 1986)

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

Sources: NWS, 1986; TEC, 1992a.

Table 3.1.1-4. Average Frequency Distribution of Wind Direction and Wind Speed for the Polk Power Station Site (April 1991 through March 1992)

Direction	Frequency Distribution Speed (mph) 3.0 - 8.3	8.3 - 13.5	13.5 - 18.8	18.8 - 24.0	>24.0
N	2.8	0.0	0.0	0.0	0.0
NNE	5.9	0.2	0.0	0.0	0.0
NE	7.0	0.6	0.0	0.0	0.0
ENE	7.2	1.4	0.1	0.0	0.0
E	6.9	1.8	0.2	0.0	0.0
ESE	5.8	1.1	0.0	0.0	0.0
SE	4.0	0.4	0.0	0.0	0.0
SSE	2.5	0.3	0.0	0.0	0.0
S	2.4	0.4	0.0	0.0	0.0
SSW	2.0	0.4	0.0	0.0	0.0
SW	1.9	0.4	0.1	0.0	0.0
WSW	2.3	0.6	0.0	0.0	0.0
W	2.9	1.3	0.2	0.0	0.0
WNW	3.9	1.1	0.0	0.0	0.0
NW	1.8	0.0	0.0	0.0	0.0
NNW	1.2	0.0	0.0	0.0	0.0
Total	60.5	10.0	0.6	0.0	0.0

Note: Calms = 30.9 percent.

Sources: ECT, 1992; TEC, 1992a.

Table 3.1.1-5. Summary of Monthly Mean, Maximum, and Minimum 1-Hour Wind Speeds; Monthly Mean Wind Direction; and Monthly Mean Sigma Theta for the Polk Power Station Site (April 1991 through March 1992)

	Speed				
Month	Mean (mph)	Maximum 1-hour (mph)	Date and Time	Direction Mean (° true)	Sigma Theta Mean (°)
April	5.6	17.0	04/23/91 14:00	150	17.3*
May	5.6	16.3	05/22/91 08:00	126	18.1
June	4.2	12.3	06/04/91 13:00	160	23.7
July	3.8	15.3	07/24/91 14:00	182	13.8†
August	3.6	11.5	08/23/91 16:00	168	23.6
September	4.2	11.1	09/18/91 14:00	97	20.3
October	4.8	13.5	10/25/91 11:00	98	17.2
November	4.9	15.9	11/29/91 12:00	115	16.2
December	4.5	17.2	12/20/91 13:00	127	16.4
January	5.0	15.7	01/23/92 13:00	166	16.5
February	5.4	16.3	02/26/92 15:00	171	16.3‡
March	5.3	17.0	03/19/92 14:00	191	18.0

* Data capture was 58.8 percent.
† Data capture was 62.6 percent.
‡ Data capture was 62.5 percent.

Sources: ECT, 1992; TEC, 1992a.

Table 3.1.1-6. Summary of Monthly Mean, Maximum, and Minimum 1-Hour Temperatures (°C) for the Polk Power Station Site (April 1991 through March 1992)

Month	Mean	Maximum 1-hour	Date and Time	Minimum 1-Hour	Date and Time
April	22.8	32.4	04/29/91 15:00	10.1	04/02/91 04:00
May	25.2	32.8	05/16/91 13:00	19.3	05/31/91 04:00
June	25.7	34.3	06/28/91 15:00	17.4	06/11/91 05:00
July	25.9	33.6	07/07/91 15:00	21.5	07/12/91 02:00
August	26.5	33.4	08/17/91 14:00	21.1	08/30/91 17:00
September	26.2	34.2	09/06/91 16:00	15.7	09/27/91 05:00
October	22.9	31.4	10/05/91 13:00	8.9	10/17/91 06:00
November	17.8	28.5	11/30/91 15:00	3.1	11/26/91 00:00
December	17.5	29.2	12/02/91 15:00	3.4	12/05/91 06:00
January	14.5	27.4	01/29/92 14:00	0.1	01/17/92 06:00
February	17.0	29.0	02/17/92 14:00	3.8	02/02/92 03:00
March	18.0	28.9	03/09/92 16:00	5.5	03/12/92 01:00

Sources: ECT, 1992; TEC, 1992a.

Table 3.1.1-7. Summary of Monthly Precipitation, Hourly Averages (inches) at AQ-1 for the Polk Power Station Site (April 1991 through March 1992) (Page 1 of 4)

Date	Amount	Monthly Total
04/01/91	0.01	
04/06/91	1.84	
04/07/91	0.29	
04/08/91	0.01	
04/17/91	0.18	
04/18/91	0.57	
04/19/91	0.01	
04/20/91	0.62	
04/23/91	0.05	
04/25/91	0.66	
04/91 total		4.24
05/07/91	0.13	
05/09/91	0.16	
05/13/91	0.12	
05/14/91	0.05	
05/16/91	0.12	
05/17/91	0.01	
05/18/91	0.03	
05/19/91	0.13	
05/20/91	0.31	
05/21/91	0.02	
05/22/91	0.80	
05/23/91	0.18	
05/24/91	0.85	
05/26/91	2.04	
05/27/91	0.06	
05/28/91	0.01	
05/30/91	0.35	
05/91 total		5.35
06/05/91	2.03	
06/06/91	0.01	
06/17/91	0.55	
06/18/91	0.03	
06/19/91	0.02	
06/20/91	0.75	
06/21/91	0.01	
06/22/91	0.57	
06/23/91	0.14	

Table 3.1.1-7. Summary of Monthly Precipitation, Hourly Averages (inches) at AQ-1 for the Polk Power Station Site (April 1991 through March 1992)
(Page 2 of 4)

Date	Amount	Monthly Total
06/24/91	0.02	
06/25/91	0.60	
06/26/91	0.01	
06/29/91	0.52	
06/30/91	0.61	
06/91 total		5.87
07/01/91	0.87	
07/02/91	0.34	
07/03/91	2.01	
07/04/91	0.01	
07/05/91	0.16	
07/06/91	0.17	
07/07/91	1.52	
07/09/91	0.47	
07/24/91	0.11	
07/25/91	0.03	
07/26/91	0.84	
07/28/91	0.24	
07/29/91	0.01	
07/30/91	0.28	
07/31/91	0.67	
07/91 total		7.73
08/01/91	0.12	
08/02/91	0.02	
08/06/91	0.01	
08/07/91	0.18	
08/09/91	0.94	
08/15/91	0.01	
08/16/91	0.01	
08/17/91	0.01	
08/18/91	0.11	
08/19/91	0.08	
08/20/91	0.19	
08/21/91	0.37	
08/23/91	0.05	
08/24/91	1.89	
08/27/91	0.08	

Table 3.1.1-7. Summary of Monthly Precipitation, Hourly Averages (inches) at AQ-1 for the Polk Power Station Site (April 1991 through March 1992)
(Page 3 of 4)

Date	Amount	Monthly Total
08/28/91	0.03	
08/30/91	1.20	
08/31/91	0.01	
08/91 total		5.31
09/03/91	0.07	
09/06/91	0.43	
09/07/91	0.48	
09/08/91	0.76	
09/24/91	0.07	
09/25/91	0.35	
09/26/91	0.34	
09/29/91	0.04	
09/30/91	0.01	
09/91 total		2.55
10/01/91	0.08	
10/02/91	0.22	
10/04/91	0.01	
10/05/91	0.09	
10/06/91	0.17	
10/07/91	0.01	
10/10/91	0.01	
10/23/91	0.02	
10/25/91	0.08	
10/30/91	0.01	
10/91 total		0.70
11/03/91	0.02	
11/09/91	0.04	
11/20/91	0.05	
11/91 total		0.11
12/02/91	0.24	
12/03/91	0.19	
12/04/91	0.29	
12/24/91	0.01	
12/27/91	0.03	
12/91 total		0.76
01/01/92	0.06	
01/09/92	0.01	

Table 3.1.1-7. Summary of Monthly Precipitation, Hourly Averages (inches) at AQ-1 for the Polk Power Station Site (April 1991 through March 1992)
(Page 4 of 4)

Date	Amount	Monthly Total
01/92 total		0.07*
02/26/92	0.02	
02/27/92	0.14	
02/92 total		0.16†
03/01/92	0.07	
03/02/92	0.06	
03/03/92	0.04	
03/04/92	0.15	
03/05/92	0.01	
03/08/92	0.05	
03/10/92	0.09	
03/11/92	0.01	
03/12/92	0.12	
03/13/92	0.06	
03/16/92	0.01	
03/17/92	0.05	
03/21/92	0.04	
03/22/92	0.46	
03/23/92	0.28	
03/30/92	0.27	
03/31/92	0.02	
03/92 total		1.79
Annual total		34.48

* Data capture was 61.3 percent.
† Data capture was 61.6 percent.

Sources: ECT, 1992; TEC, 1992a.

Table 3.1.2-1. National and State of Florida AAQS

Pollutant	Averaging Time	NAAQS Primary µg/m³	NAAQS Primary ppb	NAAQS Secondary µg/m³	NAAQS Secondary ppb	Florida AAQS µg/m³	Florida AAQS ppb
Particulate matter $PM_{(10)}$	Annual arithmetic mean	50	NA	50	NA	50	NA
	24-hour maximum*	150	NA	150	NA	150	NA
Sulfur dioxide (SO_2)	Annual arithmetic mean	80	30	NA	NA	60	20
	24-hour maximum*	365	140	NA	NA	260	100
	3-hour maximum*	NA	NA	1,300	500	1,300	500
Nitrous oxides (NO_x)	Annual arithmetic mean	100	53	100	53	100	53
Carbon monoxide (CO)	8-hour maximum*	10,000	9,000	NA	NA	10,000	9.000
	1-hour maximum*	40,000	35,000	NA	NA	40,000	35,000
Ozone (O_3)	1-hour maximum†	235	120	235	120	235	120
Lead	Calendar quarter arithmetic mean	1.5	NA	1.5	NA	1.5	NA

Note: µg/m³ = micrograms per cubic meter.
ppb = parts per billion.
NA = not applicable.

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

† The O_3 standard is attained when the expected number of days per calendar year with a maximum hourly average concentration above the standard is equal to or less than one.

Sources: 40 CFR 50.
Chapter 17-2.300, F.A.C.
TEC, 1992a.

These locations were:

- Auburndale, approximately 43 km north, northeast of the site
- Nichols, approximately 20 km north of the site
- Bartow Municipal Airport, approximately 25 km northeast of the site

The monitoring results for total suspended particulates (TSP) are summarized in Table 3.1.2-2. In all cases, the measured concentrations are well below TSP standards.

SO_2 concentrations have been measured by FDEP at Nichols and in Mulberry, approximately 20 km north of the Polk Power Station. Table 3.1.2-3 summarizes existing SO_2 concentrations collected by FDEP from 1989, 1990, and 1991.

Ambient data for NO_x, CO, O_3, and lead have been collected by FDEP only in the Tampa and Sarasota metropolitan areas and would not be representative of southwest Polk County. However, given the rural location of the site, existing concentrations of these pollutants, which are usually associated more closely with urban environments, should be well below the applicable standards.

On-site ambient air quality was monitored by Tampa Electric Company from April 1, 1991, through March 31, 1992. The monitoring network consisted of two stations, AQ-1 and AQ-2. AQ-1 was located east of SR 37 in Section 9, Township 32 S, Range 23 E. AQ-2 was located northeast of AQ-1 on the east side of SR 37 in Section 3, Township 32 S, Range 23 E. Figure 3.1.2-1 shows the location of the on-site ambient air monitoring stations. Ambient levels of SO_2 and O_3 were monitored continuously at AQ-1. PM_{10} was monitored at two locations, with colocated samplers at one location. Table 3.1.2-4 summarizes the on-site ambient monitoring of SO_2 by Tampa Electric Company. The maximum 24-hour SO_2 concentration (17 parts per billion [ppb]) observed during on-site monitoring occurred in November of 1991 at monitoring station AQ-1. The maximum 3-hour (78 micrograms per cubic meter [$\mu g/m^3$]) and 24-hour (17 $\mu g/m^3$) on-site measured ambient SO_2 levels are well below the applicable AAQS.

A summary of the on-site ambient monitoring O_3 data is presented in Table 3.1.2-5. The National and Florida AAQS 1-hour maximum O_3 concentration standard is 120 ppb or 235 $\mu g/m^3$. The 1-hour maximum O_3 concentration observed at monitoring station AQ-1 was 99 ppb during September 1991. Monthly mean concentrations ranged from 18 to 35 ppb during the on-site survey. The on-site measured ambient O_3 levels are below the applicable AAQS.

A summary of the on-site ambient monitoring PM_{10} data is presented in Table 3.1.2-6. Maximum observed level (48.3 $\mu g/m^3$) is well below the applicable AAQS.

Table 3.1.2-2. Summary of FDEP TSP Monitoring Near the Polk Power Station Site

Location	Site Identification Number	Year	24-Hour Measurement Highest ($\mu g/m^3$)	24-Hour Measurement Second-highest ($\mu g/m^3$)	Annual Geometric Mean ($\mu g/m^3$)
Auburndale	0120-001-F01	1989	98	90	38
		1990	169	68	44
		1991*	60	60	42
Bartow	0180-003-F01	1989†	49	46	28
		1990	78	66	29
		1991‡	68	64	34
Nichols	3680-010-F02	1989	91	71	38
		1990	96	76	42
		1991‡	65	63	36

Note: The 24-hour ambient TSP standard was 150 $\mu g/m^3$, not to be exceeded more than once per year; the annual ambient TSP standard was 60 $\mu g/m^3$, annual geometric mean. Ambient TSP standards have been replaced with standards for PM_{10}.

* January through April.
† October through December.
‡ January through July.

Source: TEC, 1992a.

Table 3.1.2-3. Summary of FDEP SO_2 Monitoring Near the Polk Power Station Site

Location	Site Identification Number	Year	Highest 3-Hour Average ($\mu g/m^3$)	Highest 24-Hour Average ($\mu g/m^3$)	Annual Average ($\mu g/m^3$)
Nichols	3680-010-F02	1989	356	63	10
		1990	341	66	9
		1991	179	67	10
Mulberry	2860-006-F02	1991*	203	42	12

* February through December.

Note: The 3-hour ambient standard is 1,300 $\mu g/m^3$, not to be exceeded more than once per year. The 24-hour ambient standard is 260 $\mu g/m^3$, not to be exceeded more than once per year. The annual ambient standard is 60 $\mu g/m^3$, arithmetic mean.

Source: TEC, 1992a.

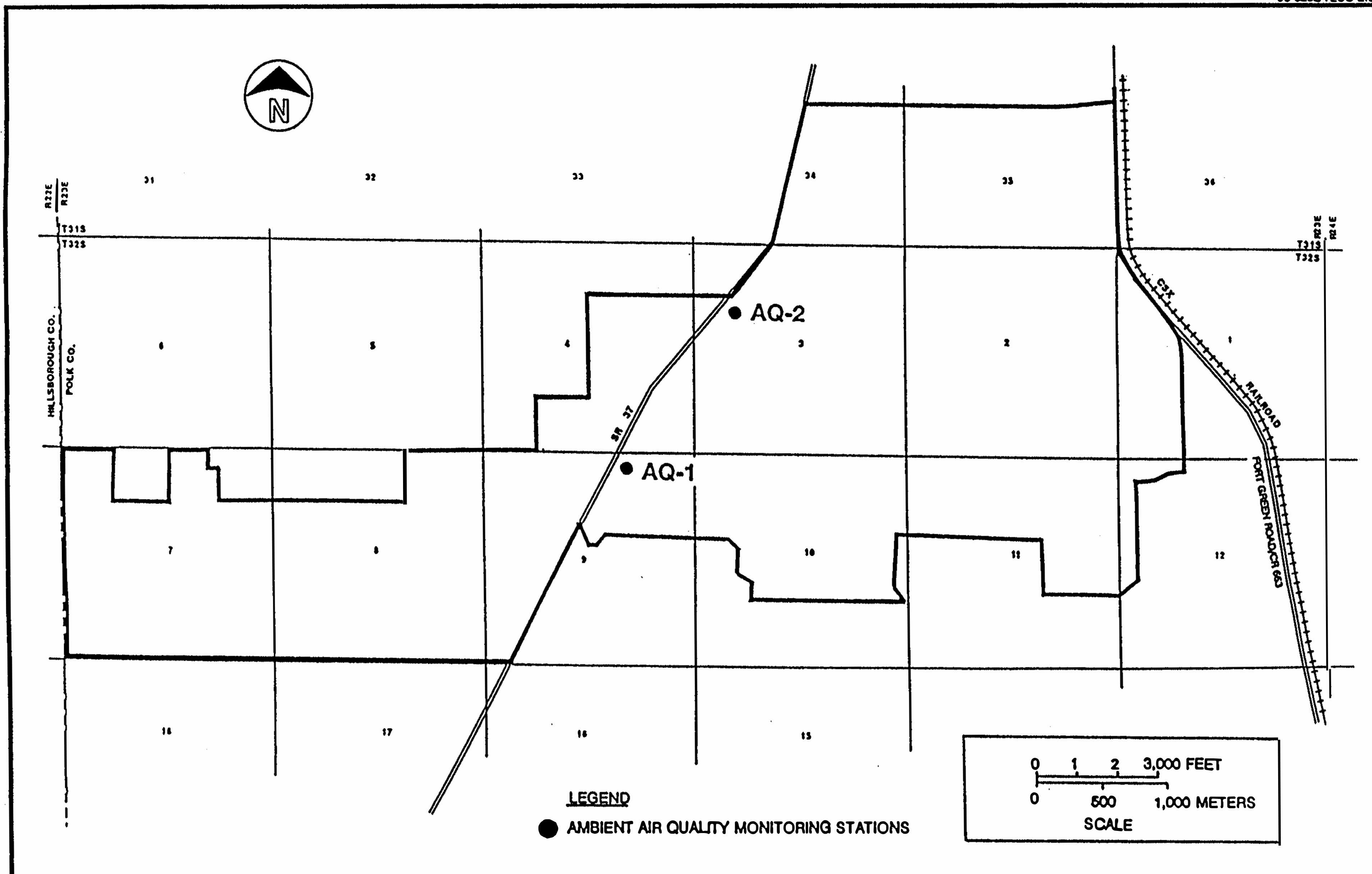

FIGURE 3.1.2-1. Ambient Air Monitoring Stations. SOURCE: TEC, 1992a.	**U.S. Environmental Prote tion Agency, Re ion IV** ***Environmental Impact Statement***	**Polk Power Station Polk Count , Florida**

Table 3.1.2-4. Summary of Monthly Mean, Maximum 3-Hour, and 24-Hour SO_2 Concentrations (ppb) at AQ-1 for the Polk Power Station Site (April 1991 through March 1992)

Month	Mean	Maximum 3-Hour*	Ending Date and Time	Maximum 24-Hour*	Ending Date and Time
April	2	21	04/21/91 17:00	9	04/22/91 11:00
May	3	43	05/06/91 17:00	16	05/07/91 14:00
June	4	53	06/04/91 18:00	11	06/04/91 21:00
July	3	40	07/09/91 11:00	12	07/09/91 10:00
August	2	31	08/09/91 13:00	10	08/09/91 17:00
September	2	26	09/26/91 15:00	9	09/27/91 12:00
October	3	23	10/11/91 17:00	7	10/17/91 05:00
November	5	78	11/23/91 17:00	17	11/24/91 04:00
December	3	29	12/22/91 20:00	10	12/19/91 19:00
January	4	48	01/06/92 15:00	15	01/07/92 07:00
February	4	26	02/28/92 19:00	11	02/27/92 17:00
March	4	76	03/07/92 23:00	16	03/08/92 20:00

* Based on a rolling average.

Sources: ECT, 1992; TEC, 1992a.

Table 3.1.2-5. Summary of Monthly Mean and 1-Hour Maximum O_3 Concentrations (ppb) at AQ-1 for the Polk Power Station Site (April 1991 through March 1992)

Month	Mean	Maximum 1-Hour	Date and Time
April	24	69	04/02/91 19:00
May	25	72	05/30/91 14:00
June	35	82	06/13/91 16:00
July	24	77	07/23/91 16:00
August	23	81	08/24/91 17:00
September	34	99	09/20/91 14:00
October	31	96	10/13/91 13:00
November	24	67	11/08/91 13:00
December	18	53	12/18/91 15:00
January	21	53	01/18/92 14:00
February	25	64	02/29/92 15:00
March	33	75	03/28/92 16:00

Sources: ECT, 1992; TEC, 1992a.

Table 3.1.2-6. Summary of PM_{10} Concentrations ($\mu g/m^3$) at AQ-1 and AQ-2 for the Polk Power Station Site (April 1991 through March 1992)
(Page 1 of 2)

Date	PM_{10} Concentration by Site		
	AQ-1	AQ-2C	AQ-2D
03/31/91	23.3	28.3	26.9
04/06/91	17.6	*	*
04/12/91	18.9	18.1	18.7
04/18/91	14.3	*	*
04/24/91	19.7	*	*
04/30/91	18.2	*	*
05/06/91	20.5	17.3	19.8
05/12/91	22.5	26.4	22.4
05/18/91	15.4	17.6	16.5
05/24/91	13.8	14.6	14.1
05/30/91	29.3	30.0	33.5
06/05/91	20.9	22.7	21.2
06/11/91	16.4	16.3	15.8
06/17/91	13.3	18.2	12.9
06/23/91	20.6	20.4	21.1
06/29/91	48.3	17.1	29.6
07/05/92	23.4	43.5	†
07/11/91	†	29.6	12.0
07/17/91	45.4	16.7	23.6
07/23/91	29.9	18.8	29.9
07/29/91	42.4	46.9	†
08/04/91	14.6	15.1	13.8
08/10/91	12.3	11.0	†
08/16/91	25.1	27.0	26.5
08/22/91	16.2	9.4	9.4
08/28/91	9.9	8.4	†
09/03/91	14.0	14.5	14.9
09/09/91	10.9	10.5	10.1
09/15/91	16.6	16.8	16.7
09/21/91	16.2	16.4	14.0
09/27/91	25.1	25.0	30.8
10/03/91	26.9	22.5	†
10/09/91	26.3	†	†
10/15/91	23.5	20.0	19.5
10/21/91	10.8	14.4	13.3
10/27/91	11.6	12.1	10.5
11/02/91	14.6	12.6	12.1
11/08/91	45.1	42.7	43.9

Table 3.1.2-6. Summary of PM_{10} Concentrations ($\mu g/m^3$) at AQ-1 and AQ-2 for the Polk Power Station Site (April 1991 through March 1992)
(Page 2 of 2)

Date	PM_{10} Concentration by Site		
	AQ-1	AQ-2C	AQ-2D
11/14/91	19.5	22.4	24.0
11/20/91	7.5	7.2	6.8
11/26/91	24.4	20.7	22.7
12/02/91	7.9	8.5	8.7
12/08/91	8.1	8.5	7.4
12/14/91	7.1	8.7	9.0
12/20/91	16.8	17.6	18.3
12/26/91	13.7	14.1	14.0
01/01/92	12.3	11.7	11.6
01/07/92	19.2	19.1	19.3
01/13/92	9.9	10.6	11.4
01/19/92	7.6	8.8	8.3
01/25/92	14.8	16.5	15.8
01/31/92	10.2	11.6	12.1
02/06/92	7.7	7.6	8.2
02/12/92	25.5	27.6	28.1
02/18/92	11.8	11.4	9.0
02/24/92	7.1	8.6	10.0
03/01/92	19.3	19.1	17.6
03/07/92	8.1	7.3	7.7
03/13/92	12.2	12.4	13.6
03/19/92	30.2	18.7	19.6
03/25/92	15.0	14.8	14.9
03/31/92	14.4	12.5	13.4
Highest	48.3	46.9‡	43.9
Date	06/29/91	07/29/91	11/08/91
Second highest	45.4	43.5‡	33.5
Date	07/17/91	07/05/91	05/30/91
Average	18.4	17.7	17.2

* Electrical problems.
† Invalid data.
‡ The data for AQ-2D were not valid on July 5 and 29, 1991.

Sources: ECT, 1992; TEC, 1992a.

3.1.3 Existing Emission Sources

Existing and planned sources of air pollutant emissions in the vicinity of the site were inventoried to determine which sources emit quantities significant enough to be considered in AAQS dispersion modeling. These sources are listed in Table 3.1.3-1. The listed sources include SO_2 sources within 75 km and PM and NO_x sources within 50 km of the proposed facility.

Existing sources consist primarily of phosphate-related chemical plants, and power generating facilities. The largest sources of SO_2, NO_x, and PM are typically power generating facilities. SO_2 emission sources range from 175 tpy (Pasco County Cogeneration Facility) to 371,760 tpy (Tampa Electric Company Big Bend Power Plant). NO_x emission sources range from 118 tpy (Agrico Chemical Co. Pierce) to 50,132 tpy (Tampa Electric Company Big Bend Power Plant). PM emission sources range from 162 tpy (Imperial Phosphates Ltd.) to 40,179 (Florida Power & Light).

3.1.4 Planned Emission Sources

Air pollutant emissions from planned sources in the vicinity of the Polk Power Station site are shown in Table 3.1.3-1 These planned emission sources include two cogeneration facilities and a Florida Power Corporation (FPC) facility. All facilities are within 50 km of the Polk Power Station site. Estimated emission concentrations for SO_2, NO_x, and PM are reported in Table 3.1.3-1.

Emissions from the planned sources generally fall within the ranges for existing sources with two exceptions. The Ridge Cogeneration facility will have the lowest NO_x emissions (55 tpy) and the Auburndale Cogeneration facility will have the lowest PM emissions (161 tpy) for sources included in the AAQS dispersion modeling.

Table 3.1.3-1. Emission Sources Included in AAQS Dispersion Modeling

Facility	County	Distance from Site (km)	SO_2 (tpy)	NO_x (tpy)	PM (tpy)
Hardee Power Station Ft. Green Springs	Hardee	10.3	16,080.0	8,400.0	1,251.0
C F Industries (Central Phosphate)	Hillsborough	50.7	9,035.0		
TECO Hooker's Point	Hillsborough	49.2	13,522.0	1,256.0	1,231.0
Cargill Fertilizer Inc. (Gardinier)	Hillsborough	41.0	5,480.0		932.0
TECO Big Bend	Hillsborough	39.9	371,760.0	50,132.0	7,897.0
TECO Gannon	Hillsborough	45.8	126,940.0	28,126.0	5,857.0
Gulf Coast Lead Company	Hillsborough	45.5	1,709.0		
Consolidated Minerals, Inc. Plant City	Hillsborough	30.2	942.0		756.0
IMC Ft. Lonesome	Hillsborough	11.4	1,717.0	611.0	678.0
Mobil Mining & Minerals Big Four Mine	Hillsborough	6.8	569.0	155.0	
Royster Phosphate (AMAX) Piney Point	Manatee	53.4	2,084.0		
Florida Power & Light	Manatee	36.2	55,143.0	17,349.0	40,179.0
Florida Power Intercession City	Osceola	74.4	24,763.0		
Florida Power PL Bartow	Pinellas	60.6	61,853.0		
Florida Power Higgins	Pinellas	71.7	12,071.0		
Florida Power Bayboro	Pinellas	62.3	6,876.0		
Pinellas Resource Recovery Facility	Pinellas	68.0	3,418.0		
Lakeland City Power Larsen Power Station	Polk	36.7	3,926.0		
Lakeland City Power McIntosh	Polk	40.0	30,176.0	5,237.0	15,138.0
Gardinier	Polk	14.8	1,173.0		
Seminole Fertilizer (W R Grace)	Polk	21.6	9,129.0	539.0	2,760.0
Mobil Mining & Minerals SR 676	Polk	18.3	832.0		990.0
Royster Company	Polk	19.0	1,265.0		1,393.0
US Agri-Chemicals Hwy 60	Polk	22.8	1,575.0		443.0
US Agri-Chemicals Hwy 630	Polk	15.1	6,881.0		1,071.0
C F Industries Bonnie Mine Rd	Polk	17.1	5,413.0		1,319.0
Farmland Industries Green Bay Plant	Polk	15.6	4,213.0	410.0	1,486.0
Agrico Chemical Co Pierce	Polk	12.3	417.0	118.0	840.0
Agrico Chemical Co South Pierce	Polk	7.9	4,740.0		1,096.0
Conserv Inc.	Polk	17.4	1,586.0		1,598.0
IMC Fertilizer New Wales	Polk	13.1	6,296.0	494.0	1,430.0
Mobil-Electrophos Division	Polk	13.2	1,440.0		544.0
Imperial Phosphates Ltd.	Polk	4.5	275.0		162.0
Auburndale Cogeneration*	Polk	41.3	882.0	736.0	161.0
Hillsborough Co Resource Recovery	Hillsborough	41.7	702.0		
Pasco Co Cogeneration Facility	Pasco	73.6	175.0		
Ridge Cogeneration*	Polk	36.9	479.0	55.0	
Tampa City McKay Bay Refuse-to-Energy	Hillsborough	48.0	1,489.0	2,630.0	
TECO Sebring Airport	Highlands	70.7	3,864.0		
FPC-POLK*	Polk	13.6	1,718.6	5,575.0	297.6
Citrus World	Polk	44.9		1,381.0	
Estech	Polk	12.7			311.0
LaFarge Corp	Hillsborough	49.3			1,221.0
Estech-Duette Phosphate Mine	Manatee	23.2			750.0
IMC Noralyn Mine	Polk	19.1			1,689.0
IMC Kingsford	Polk	9.1			422.0
IMC/Uranium Recovery C F Industries	Polk	17.4			1,071.0

* Planned sources, not yet constructed.

Sources: ECT, 1993; TEC, 1992a.

3.2 SURFACE WATER RESOURCES

Major surface water resources in Polk County include the Withlacoochee River, South Prong Alafia River, North Prong Alafia River, and Peace River. The Withlacoochee River drains the northern part of the county, the North Prong and South Prong of the Alafia River drain the western part, and the Peace River drains the central part to the Highlands County line. Lake Kissimmee and the Kissimmee River, located on the eastern county line of Polk and Osceola, drain a large area in the southeastern part of the county. Water resources in the county are managed by the Southwest Florida, South Florida, and St. Johns River Water Management Districts.

Naturally occurring surface water bodies in the vicinity of the Polk Power Station include the South Prong Alafia River, Payne Creek, and Little Payne Creek. Other surface water bodies, created as a result of the mining activities, include a reclaimed lake, a large mine-cut lake, and numerous water-filled mining cuts.

3.2.1 Site Water Budget

Meteorological data representative of the hydrological characteristics of the Polk Power Station site, with the exception of pan evaporation data, were obtained from the NWS station at Bartow, Florida, for the years 1941 through 1990. Annual precipitation for the period of record varies from 37.19 to 83.44 inches with an average of 53.42 inches. July has the highest monthly average with 8.48 inches, while November has the lowest with 2.13 inches. Table 3.1.1-1 presents a summary of the meteorological data for Bartow, Florida.

Pan evaporation data were obtained from the Lake Alfred Experiment Station at Lake Alfred, Florida, for the years 1965 through 1990. Annual pan evaporation for the period of record varies from 66.8 to 86.3 inches with a mean of 73.4 inches. The highest monthly mean occurs in May with 8.7 inches, while December has the lowest monthly mean with 3.3 inches. The pan evaporation rates may be adjusted to indicate lake evaporation rates by multiplying by a pan coefficient of 0.70. The average annual lake evaporation is, therefore, 51.4 inches. Dohrenwend (1976; TEC, 1992a) estimated the evapotranspiration rates for the State of Florida and determined that the general evapotranspiration rate for the project area is approximately 36 inches per year (TEC, 1992a).

The estimated annual runoff from the proposed site for the premining condition was derived from discharge data collected at nearby U.S. Geological Survey stream gauging stations (USGS, 1991; TEC, 1992a). The USGS station on the South Prong Alafia River near Lithia, Florida, drains a 107-square-mile (mi^2) area and records an average discharge of 101 cubic feet per second (cfs). This is equivalent to 12.82 inches of annual surface and sub-surface runoff for the watershed. The South Prong Alafia River drainage basin lying within the project site boundaries covers 816 acres. Therefore, the estimated average annual discharge from the project site to the South Prong Alafia River is approximately 1.20 cfs. The USGS station on Payne Creek near Bowling Green, Florida, drains 121 mi^2 and records an average discharge of 96.6 cfs, which is equivalent to 10.84 inches of annual surface and sub-surface runoff for the watershed. The Payne Creek and Little Payne Creek drainage basins lying within the proposed site boundaries cover 716 and 2,816 acres, respectively. Therefore, the estimated average annual discharges from the project site to Payne Creek and Little Payne Creek are 0.89 and 3.51 cfs, respectively (TEC, 1992a). The site hydrology is more extensively discussed in Section 3.2.2.

The peak discharge resulting from the 25-year, 24-hour storm event was computed by Tampa Electric Company (TEC, 1992a) for the premining condition using the HEC-1 Flood Hydrograph Package. The total precipitation for this event is 9 inches. The peak discharges were computed to be 541 cfs to the South Prong Alafia River, 1,063 cfs to Little Payne Creek, and 506 cfs to Payne Creek. Section 3.2.2 provides additional discussions of the hydrologic modeling.

Groundwater recharge rates for Polk County were examined by the SWFWMD for the intermediate and upper Floridan aquifers (SWFWMD, 1988; TEC, 1992a). Stewart (1980; TEC, 1992a) used the vertical hydraulic conductivity and thickness of the overlying confining layer to calculate the recharge to the upper Floridan aquifer in the project area as being less than 2 inches per year. Ryder (1985; TEC, 1992a), using a two-layered, steady-state, digital model, reported the recharge as being 2 to 5 inches per year. SWFWMD staff, using head differences and leakance values, calculated a recharge rate of 2 to 10 inches per year for the area of the proposed site. Using the same technique, SWFWMD staff also estimated the recharge to the intermediate aquifer system in the southern west-central Florida groundwater basin as being 0 to 2 inches per year.

Hutchinson (1978; TEC, 1992a) developed a hydrologic budget for the upper Peace and eastern Alafia River basins. Annual average values for inputs and outputs to the zone of shallow groundwater were calculated as follows: precipitation, 48.0 inches (1966-1975); input from streams, 0.3 inch; input by return flow of groundwater pumpage, 5.6 inches; evapotranspiration, 41.2 inches; runoff from Alafia River, 4.1 inches; runoff from Peace River, 5.9 inches; pumpage from the shallow groundwater zone, 0.1 inch; and leakage from the shallow groundwater zone to the lower unit of the Floridan aquifer, 2.6 inches. Although these values cannot be rigidly applied to the proposed site, they agree favorably with the values obtained from other sources.

3.2.2 Surface Water Body Hydrology

Existing water quantity and quality data, available from various sources such as USGS, EPA Storage and Retrieval of Parametric Data (STORET), and FDEP as well as field data collected by Tampa Electric Company, were utilized by Tampa Electric Company (TEC, 1992a) to describe the hydrologic conditions in the region of the Polk Power Station site.

The portion of the Polk Power Station site to the east of SR 37 consists primarily of mined-out lands with water-filled mine cuts between spoil piles surrounding an unmined parcel of land and old mined and unreclaimed lands. The area to the west of SR 37 is currently being mined for phosphate matrix, the operations of which are scheduled to continue into 1994. In general, lands surrounding the site and in the region have also been impacted by previous and ongoing phosphate mining operations. Most of the project site is located within the Fort Green Mine operated by Agrico (TEC, 1992a).

The area within the site boundaries is drained by three streams: the South Prong Alafia River, Payne Creek, and Little Payne Creek. The South Prong Alafia River is a tributary of the Alafia River that flows into Hillsborough Bay; Payne Creek and Little Payne Creek are tributaries of the Peace River that flows into Charlotte Harbor.

Previous to mining operations in the site area (premining condition), the project site included 816 acres in the South Prong Alafia River watershed located in the north and northwest portions of the property to the west of SR 37 and the extreme northwest corner of the property to the east of SR 37. The Payne Creek watershed included 716 acres located in the southeast portion of the tract lying to the west of SR 37. The Little Payne Creek watershed included 2,816 acres, all located to the east of SR 37. The premining watershed boundaries within the project site are shown in Figure 3.2.2-1. The total drainage areas, including off-site areas, at selected locations along the streams for the premining condition are presented in Table 3.2.2-1.

The USGS has maintained two stream gauging stations located near the proposed project site with long-term water-stage records. The gauge on the South Prong Alafia River near Lithia, Florida (Station No. 02301300 at latitude 27° 47' 47" north and longitude 82° 07' 04" west [Section 9, Township 31 South, Range 22 East]), is located approximately 8 miles northwest of the Polk Power Station site and approximately 10 miles downstream from the project boundary (see Figure 3.2.2-2). The total drainage area at this station is 107 mi^2 and the average discharge is 101 cfs for the period of record from December 1962 through September 1990. Another gauge on Payne Creek near Bowling Green, Florida (Station No. 02295420 at latitude 27° 37' 13" north and longitude 81° 49' 33" west [Section 9, Township 33 South, Range 25 East]), is approximately 12 miles southeast of the site and approximately 16 miles downstream from the project boundary. The drainage area at this station is 121 mi^2 and the average discharge is 96.6 cfs for the period of record from October 1963 to September 1968 and from October 1979 through September 1990.

The average flow and drainage areas of five USGS gauging stations in west-central Florida are shown in Table 3.2.2-2. The discharge per square mile was calculated for each station. The values for the gauges along the Alafia River system range from 0.94 to 1.16 cfs per square mile (CSM). The contribution per square mile from the Peace River basin is somewhat less, having values in the range of 0.77 to 0.80 CSM. These values are typical for the terrain and soils of Florida. To estimate the average flow contributed by the

Table 3.2.2-1. Premining Drainage Areas for Selected Locations (acres)

Location	On-site	Off-site	Total
<u>Alafia River Drainage Basin</u>			
South Prong Alafia River at Hillsborough/ Polk County Line	816	20,219	21,035
South Prong Alafia River near Lithia	816	67,231	68,047
Alafia River at Lithia	816	213,151	213,967
Alafia River near Riverview	816	257,951	258,767
<u>Little Payne Creek Drainage Basin</u>			
At Fort Green Road	2,816	3,751	6,567
4.5 miles downstream from Fort Green Road	2,816	15,751	18,567
At Route 665 near Bowling Green	2,816	21,877	24,693
<u>Payne Creek Basin Drainage Basin</u>			
At SR 37	716	2,957	3,673
4.2 miles downstream from SR 37	716	12,953	13,669
At Fort Green Road	716	25,635	26,351
<u>Payne Creek and Little Payne Creek Drainage Basin</u>			
At U.S. Highway 17 near Bowling Green (including Little Payne Creek Basin)	3,532	74,342	77,874

Sources: USGS, 1990.
ECT, 1992.
TEC, 1992a.

LEGEND

- PROJECT BOUNDARY
- 140 — ELEVATION CONTOUR
- CULVERTS BENEATH HIGHWAYS
- (1) DRAINAGE BASIN NO.
- WATERSHED DIVIDE
- WATERSHED BASINS
  - A = ALAFIA RIVER BASIN
  - L = LITTLE PAYNE CREEK BASIN
  - P = PAYNE CREEK BASIN

DRAINAGE PATTERNS BY PARCEL

PARCEL	ALAFIA BASIN	LITTLE PAYNE BASIN	PAYNE BASIN	SUB TOTAL
AGRICO	785 AC	2046 AC	716 AC	3573 AC
AmCy/IMCF	21 AC	227 AC	0 AC	248 AC
AmCy NON-MAN	0 AC	523 AC	0 AC	523 AC
AmCy (AGR MAN)	0 AC	4 AC	0 AC	4 AC
TOTAL	816 AC	2816 AC	716 AC	4348 AC

WATERSHED BASIN SUMMARY

LITTLE PAYNE CREEK (1-8,10,11,12 & 16) = 2816 ACRES
PAYNE CREEK (14) = 716 ACRES
ALAFIA RIVER (9,13 & 15) = 816 ACRES
TOTAL AREA OF SITE BASINS = 4348 ACRES

BASIN	ACRES
1	62
2	100
5	262
6	43
7	26
8	58
9	21

BASIN	ACRES
10	41
11	951
12	1095
13	381
14	716
15	414
16	178

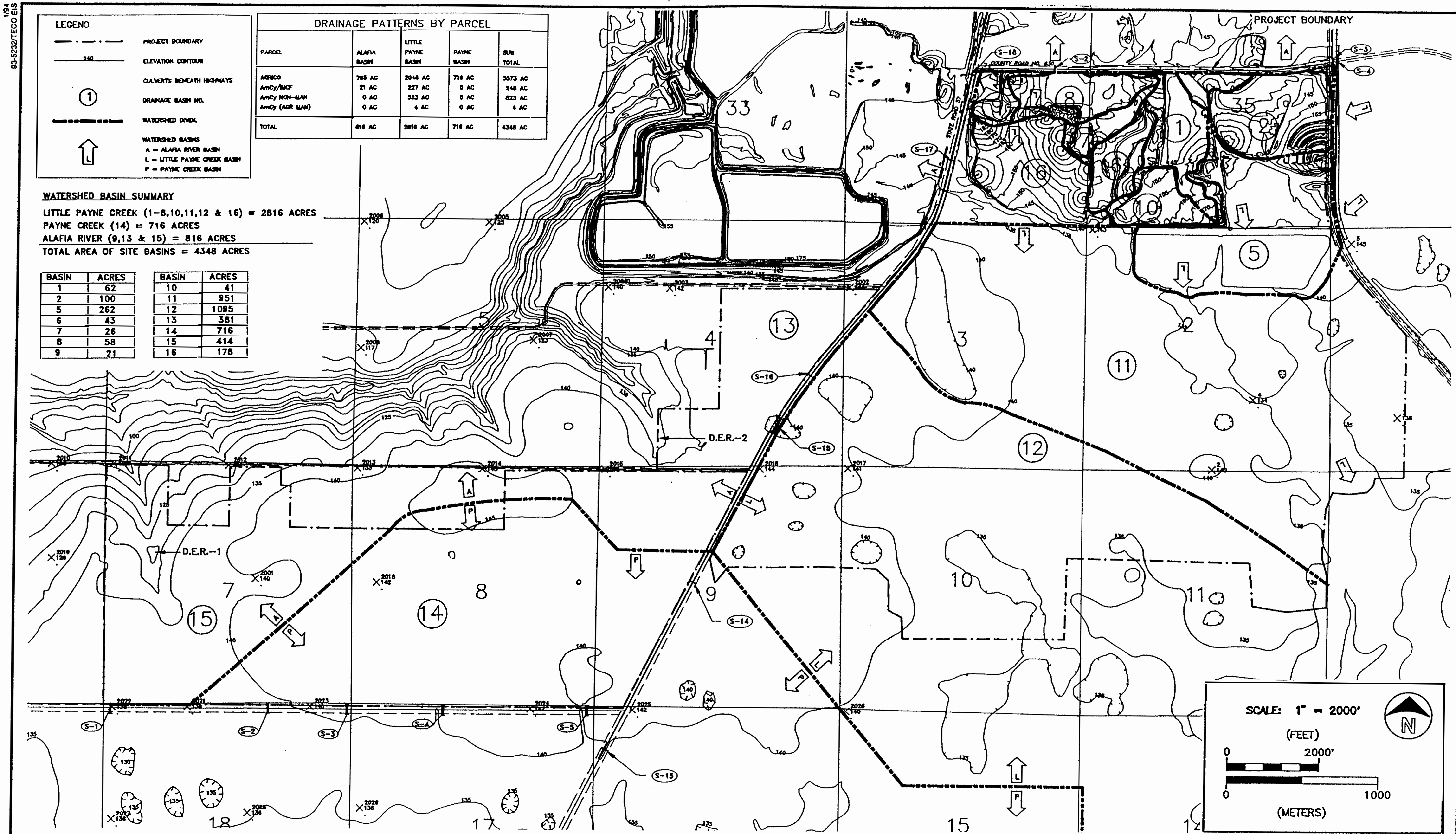

FIGURE 3.2.2-1.
Premining Topography and Drainage Map.

SOURCES: ECT, 1992; TEC, 1992a.

U.S. Environmental Protection Agency, Region IV

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Polk Power Station
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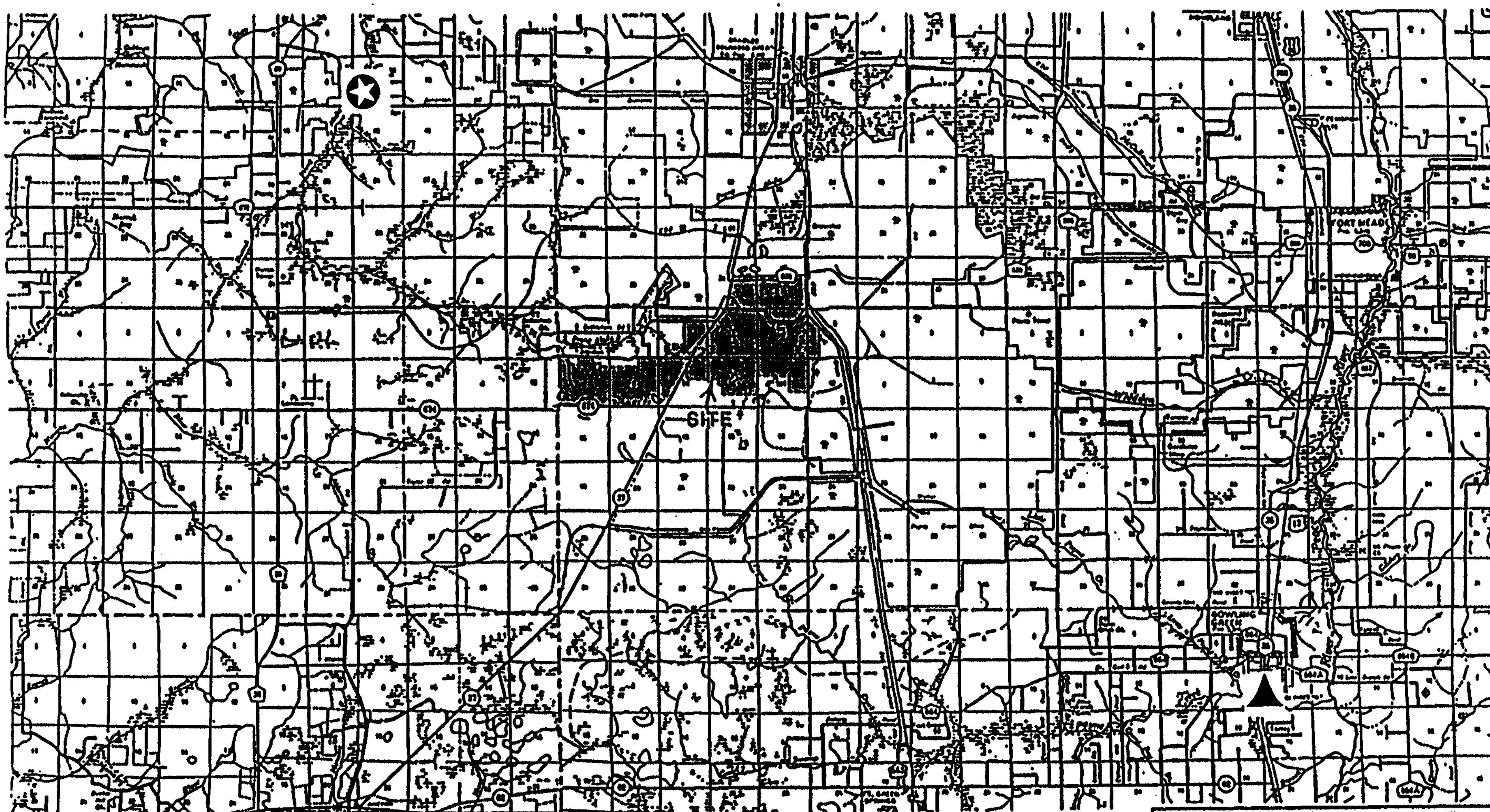

O USGS STATION 0230130

▲ USGS STATION 02295420

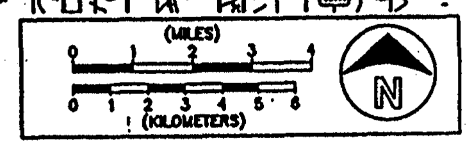

FIGURE 3.2.2-2.
Locations of USGS Surface Water Stations.

SOURCES: USGS, 1990; TEC, 1992a.

U.S. Environmental Prote tion Agency, Re ion IV

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Table 3.2.2-2. Annual Average Discharge at Selected Gauging Stations

Station	Drainage Area (mi^2)	Average Discharge (cfs)	CSM
South Prong Alafia River near Lithia	107	101.0	0.944
North Prong Alafia River at Keysville	135	156.0	1.156
Alafia River at Lithia	335	346.0	1.033
Payne Creek near Bowling Green	121	96.6	0.798
Peace River at Zolfo Springs	826	632.0	0.765

Sources: USGS, 1990; TEC, 1992a.

areas located within the project site boundaries, the values for discharge per square mile (0.94 CSM) for the South Prong Alafia River and Payne Creek were applied to the on-site drainage basin areas. The Payne Creek gauging station near Bowling Green (0.80 CSM) is located downstream of the confluence of the Little Payne Creek and Payne Creek and was, therefore, applicable to both the Payne Creek and Little Payne Creek subwatersheds. Consequently, the premining average discharges from the Polk Power Station site to the South Prong Alafia River, Payne Creek, and Little Payne Creek were calculated to be 1.20, 0.89, and 3.51 cfs, respectively (TEC, 1992a).

USGS, using the log-Pearson type III frequency distribution, has calculated the 7-day, 10-year (7Q10) low-flow rates for the South Prong Alafia River and Payne Creek gauging stations using gauge data through 1981 (USGS, 1985; TEC, 1992a). The 7Q10 low-flows for the South Prong Alafia River and Payne Creek are 3.0 and 1.6 cfs, respectively; additional flow frequency statistics are presented in Table 3.2.2-3.

To obtain site-specific information on the surface water resources surrounding the Polk Power Station site, Tampa Electric Company (TEC, 1992a) established and implemented a comprehensive surface water monitoring program consisting of seven monitoring stations. The locations of the seven stations are shown in Figure 3.2.2-3, and a description of the program is provided in Section 2.3.4.2 of the SCA (TEC, 1992a). The monitoring period extended from February to August 1991 encompassing both dry and wet season conditions. Monthly stage, discharge, and water quality measurements were taken at all stations. Stations SW-2, SW-5, and SW-6 incorporated continuous stage measurements as well. The recorded water level data for these stations with continuous stage recorders are shown in Figures 3.2.2-4 through 3.2.2-6.

The stage at SW-2 fluctuated between a low level of 80.70 ft-NGVD on February 22, 1991, and a high level of 84.53 ft-NGVD on July 12, 1991. The stage at SW-5 fluctuated between a low level of 116.12 ft-NGVD on February 22, 1991, and a high level of 118.34 ft-NGVD on August 4, 1991. The stage at SW-6, located in a reclaimed lake, fluctuated much less erratically and had a low level of 131.65 ft-NGVD on February 22, 1991, and a high level of 134.56 ft-NGVD on August 4, 1991. All three records exhibit a rise in stage in late June and early July as a result of the seasonal increase in precipitation.

The average monthly stage discharge measurements at SW-1, SW-3, SW-4, and SW-7 were 103.00, 94.61, 128.80, and 133.58 ft-NGVD, respectively, during the monitoring period.

Instantaneous stream velocity measurements were recorded at Stations SW-2, SW-3, and SW-5 with a current meter across the stream. Flow was not measurable at SW-4 due to apparent stagnation. Flow data for stations SW-6 and SW-7, located in reclaimed lake and mine cuts, was not collected. Flow at SW-1 was too low to be measured with a flow meter; therefore, it was determined by measuring a timed volume of water as it exited a culvert under Albritton Road. Instantaneous discharge was calculated for Stations SW-2, SW-3, and

Table 3.2.2-3. Low-Flow Frequency Analysis

Period of Consecutive Days	Lowest Average Flow (cfs) for Indicated Recurrence Interval (years)			
	2	5	10	20
South Prong Alafia River near Lithia				
1	10	4.0	2.3	1.4
3	11	4.4	2.6	1.6
7	12	5.0	3.0	1.9
14	14	6.0	3.6	2.3
30	19	9.0	5.8	4.0
60	27	14	9.9	7.2
90	34	18	13	9.3
120	44	24	17	12
183	54	32	25	20
Payne Creek near Bowling Green				
1	3.2	1.6	1.2	1.0
3	3.7	1.8	1.4	1.1
7	4.8	2.2	1.6	1.3
14	5.8	2.5	1.7	1.3
30	7.9	3.3	2.1	1.5
60	13	5.0	2.9	1.9
90	18	8.3	5.5	3.8
120	23	12	9.1	7.2
183	36	18	12	8.2

Sources: USGS, 1985; TEC, 1992a.

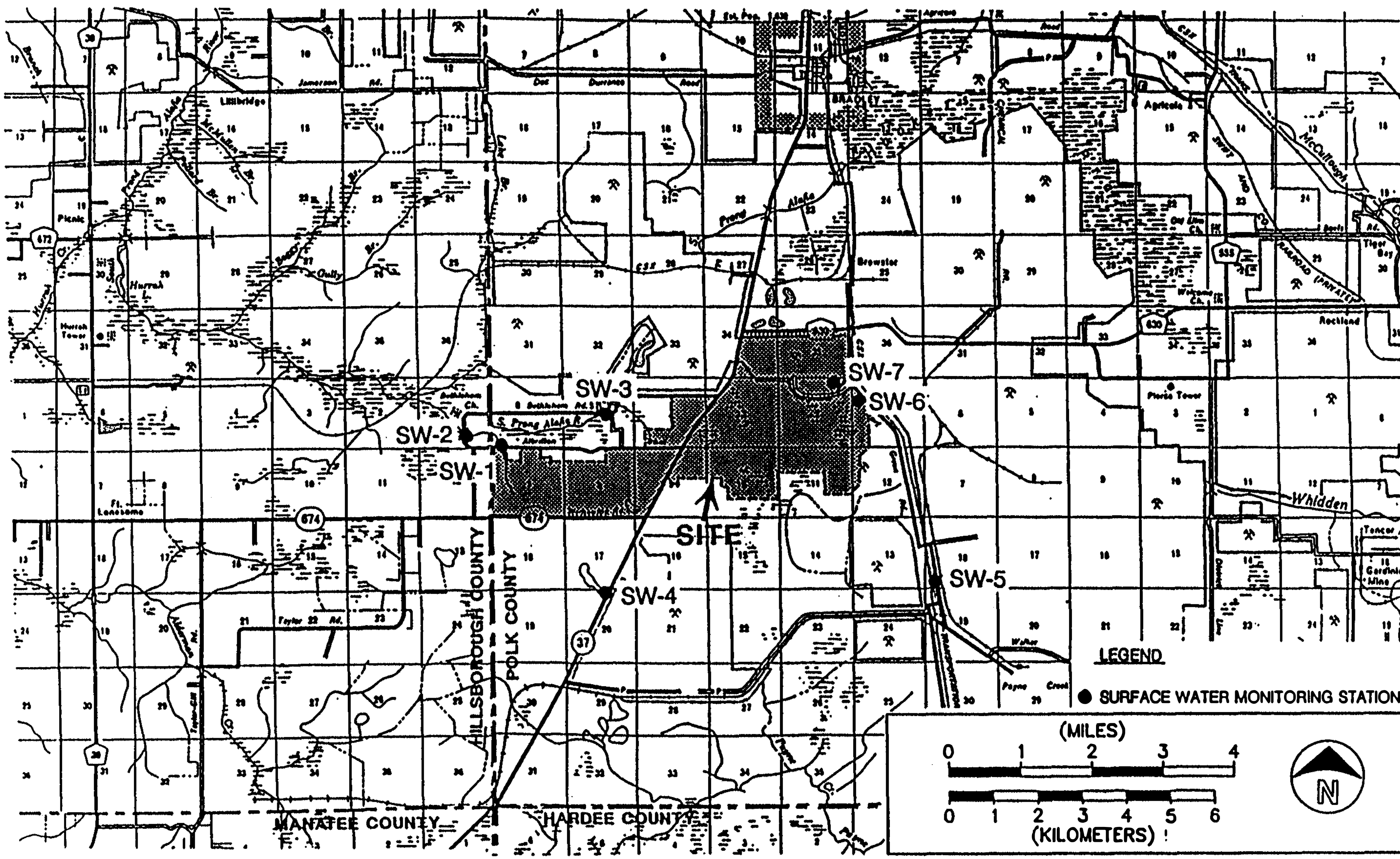

FIGURE 3.2.2-3.
Surface Water Monitoring Stations.

SOURCES: ECT, 1991; TEC, 1992a.

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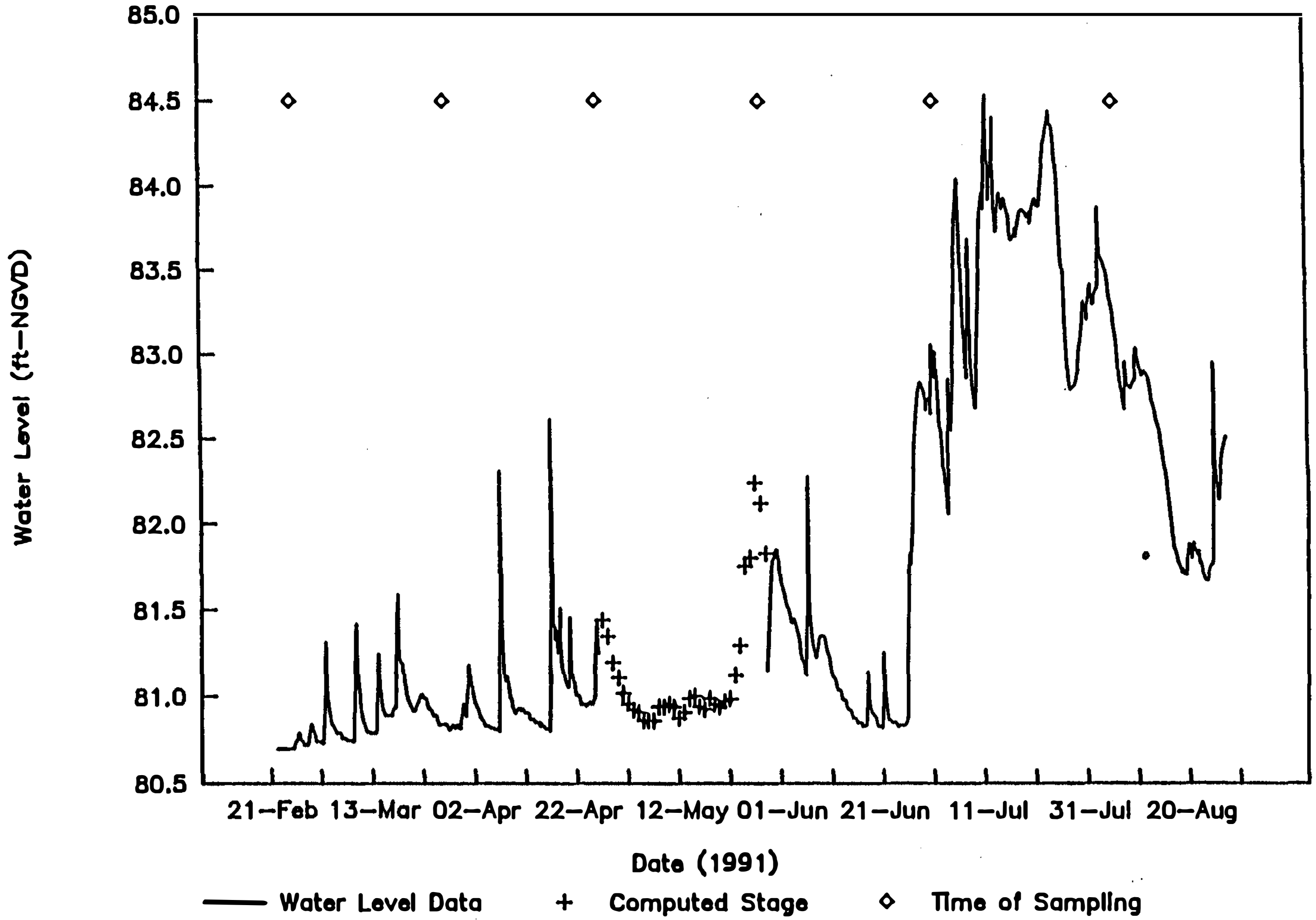

FIGURE 3.2.2-4.
Water Level Data at Station SW-2.

SOURCES: ECT, 1992; TEC, 1992a.

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Polk County, Florida

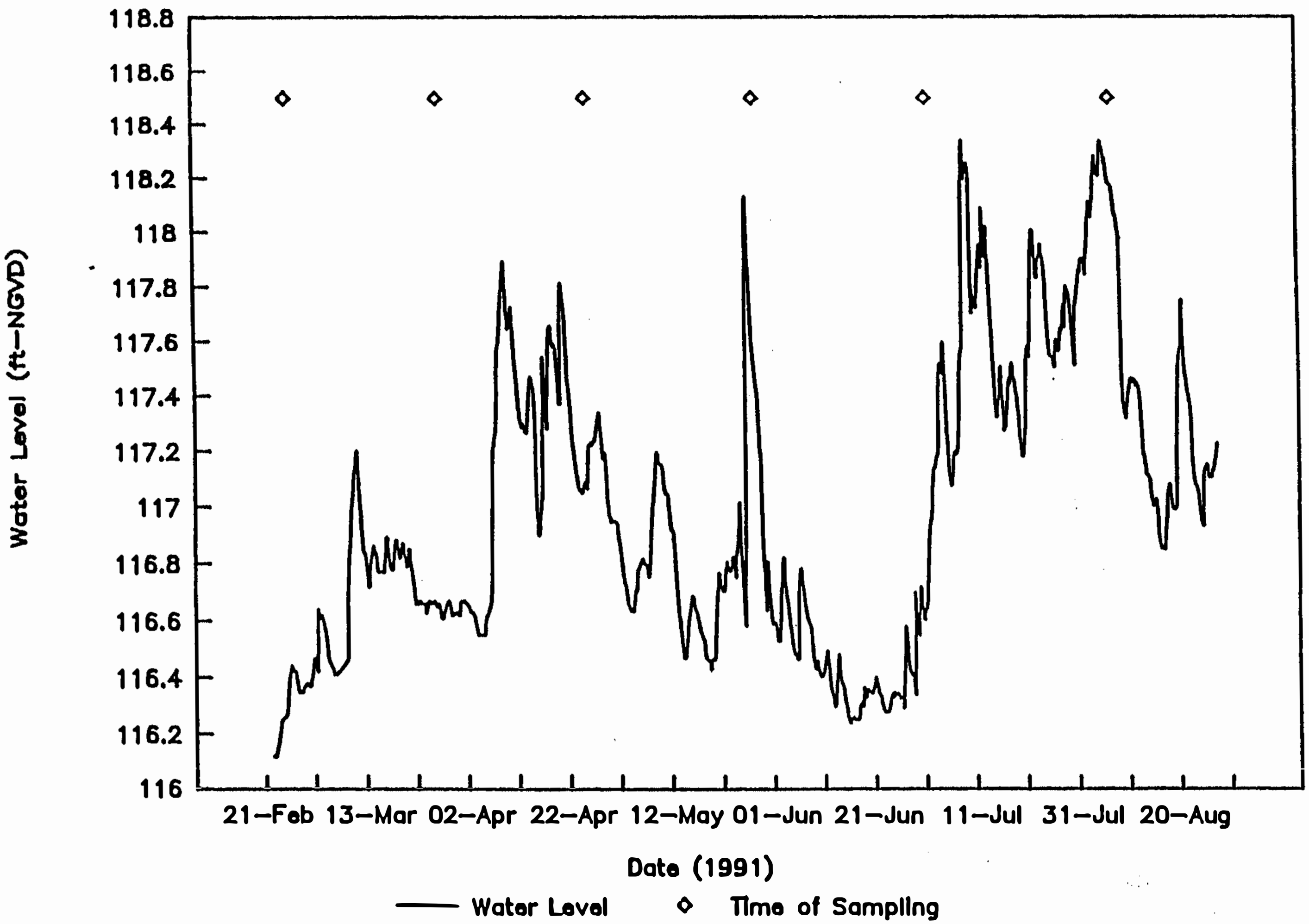

FIGURE 3.2.2-5.
Water Level Data at Station SW-5.

SOURCES: ECT, 1992; TEC, 1992a.

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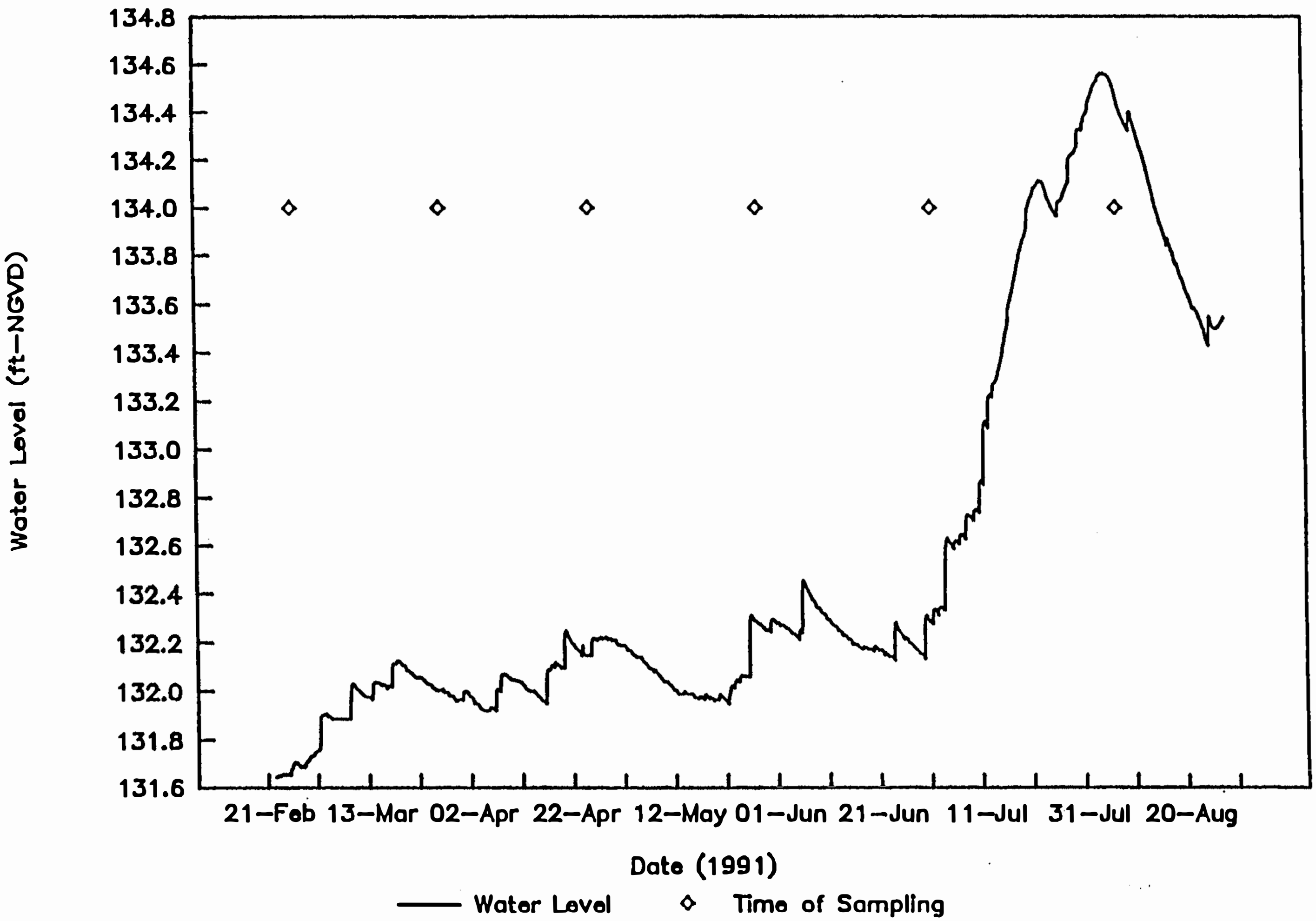

FIGURE 3.2.2-6.
Water Level Data at Station SW-6.

SOURCES: ECT, 1992; TEC, 1992a.

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SW-5 using standard USGS integration techniques. Stage-discharge relationships for SW-2, SW-3, and SW-5 were developed using these data. Examples of the stage-discharge curves are shown in Figure 3.2.2-7.

Flood frequency information for Florida streams is provided by USGS (1982; TEC, 1992a). Flood estimates are reported at selected gauging stations in the Peace River and Alafia River basins for 2- to 100-year recurrence intervals as shown in Table 3.2.2-4. These values were computed using a log-Pearson Type III distribution with long-term historical discharge data. The 100-year peak flow was estimated to be 4,330 cfs for the South Prong Alafia River gauging station near Lithia and 4,810 cfs for the Peace River at the Bartow gauging station.

Ardaman & Associates, Inc. conducted a hydrologic analysis of a 19,936-acre area (Ardaman, 1991; TEC, 1992a) for the Agrico Fort Green Mine Reclamation Plan, which includes the majority of the proposed Polk Power Station project site area. The HEC-1 Flood Hydrograph Package was used to simulate the runoff hydrographs of the premining watershed resulting from to a design storm. For the 24-hour, 25-year design storm, the premining peak flow for the South Prong Alafia River basin (889 acres) was reported to be 514 cfs, that for Payne Creek basin (13,142 acres) was 2,503 cfs, and that for Little Payne Creek basin (3,711 acres) was 1,146 cfs. The peak discharge per square mile with the design storm was calculated to be 370 CSM for the South Prong Alafia River, 122 CSM for Payne Creek, and 198 CSM for Little Payne Creek, according to Ardaman's analysis.

Only a small portion of the area lying to the west of SR 37 is located within the 100-year floodplain; and most of it has been or will be mined prior to Tampa Electric Company's use of the site. Most of the floodplain areas to the east of SR 37 were associated with the headwaters of Little Payne Creek where mining activities have also occurred. These mined areas were not the passageway of any other upstream storm water runoff since they were located at the headwaters of the drainage basin. Therefore, the on-site mining activities did not increase the downstream flooding potential. The hydrological analysis conducted by Ardaman & Associates, Inc. also substantiated that the post-reclamation peak runoff would not exceed the premining runoff due to the detention capacity of the reclaimed areas according to Agrico's approved reclamation plan for the site area (TEC, 1992a).

Currently, the proposed site does not contribute to flood hazard potential because the existing conditions resulting from the mining operations (reclaimed lake, mine pits, etc.) provide for significant water retention.

3.2.3 Surface Water Body Quality

According to Chapter 17-302, FAC, the surface waters on and around the Polk Power Station site are considered Class III waters, designated for recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife. The nearest Outstanding Florida Water is the Little Manatee River.

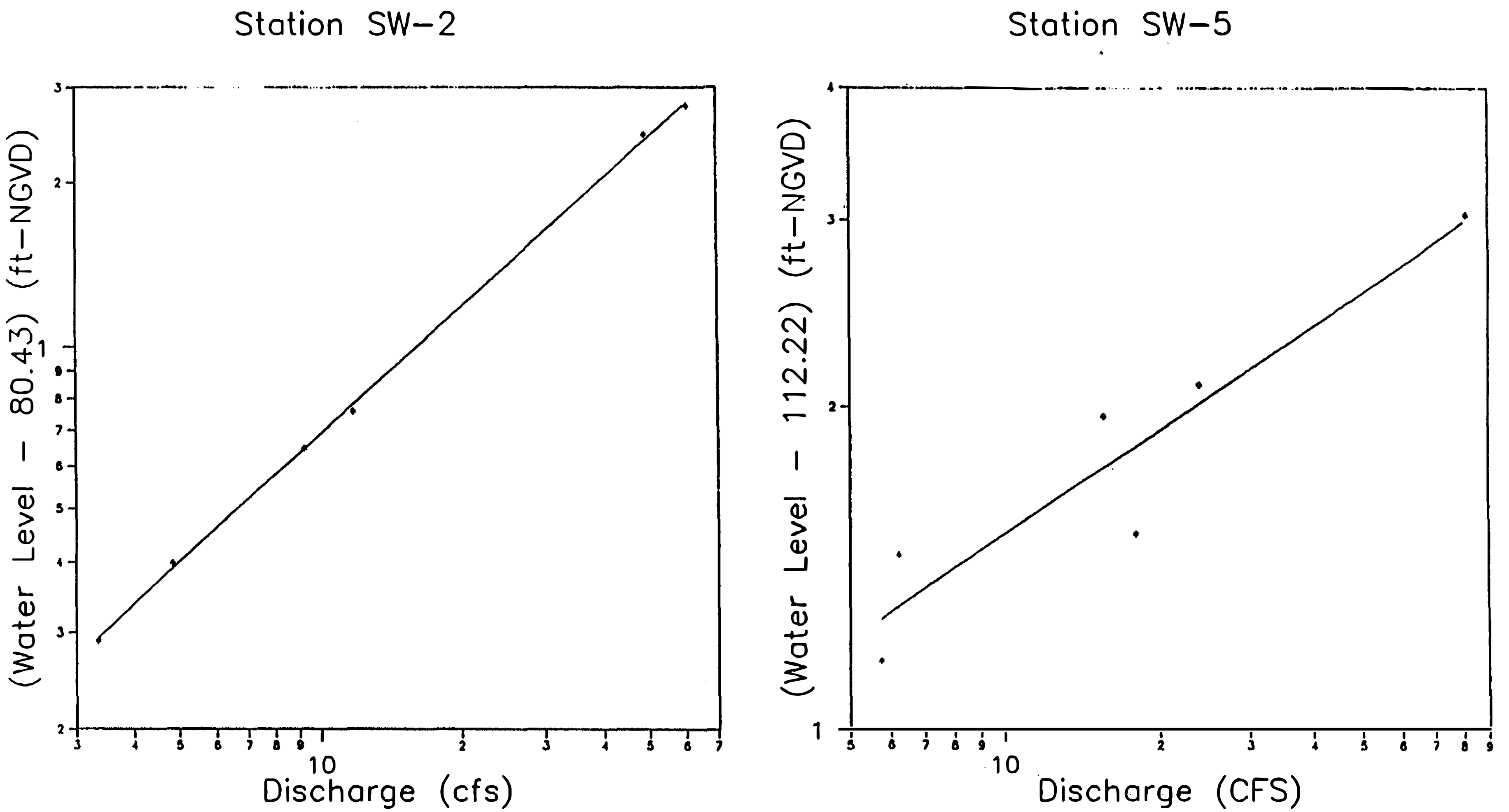

FIGURE 3.2.2-7.
Stage/Discharge Curves for Monitoring Stations SW-2 and SW-5.

SOURCES: ECT, 1992; TEC, 1992a.

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Table 3.2.2-4. Peak Flow (cfs) Frequency Analysis

Station	Years of Record	Drainage Area (mi^2)	Return Period (year) 2	5	10	25	50	100
South Prong Alafia River near Lithia	15	107	825	1,510	2,070	2,890	3,580	4,330
Alafia River at Lithia	46	335	3,060	6,580	10,000	15,900	21,700	28,800
Peace River at Bartow	39	390	978	1,740	2,350	3,240	3,990	4,810
Peace River at Zolfo Springs	46	826	4,830	8,370	11,300	15,600	19,400	23,600

Sources: USGS, 1982; TEC, 1992a.

The nearest portion of this river designated as such is approximately 11.5 miles west of the Polk Power Station site.

Water quality of the South Prong Alafia River is considered *fair* by FDEP (FDER, 1990a; TEC, 1992a). Although better than the North Prong Alafia River, the South Prong is affected to some degree by the phosphate mining industry as well as agricultural development. Elevated nutrients, TSS, and depressed dissolved oxygen (DO) values remain a problem in the South Prong Alafia River. FDEP (FDER, 1990a; TEC, 1992a) considers the water quality in Payne Creek and Little Payne Creek to be *good*, although DO concentrations occasionally fall below 5.0 mg/L and elevated nutrient levels have been observed in these streams as well.

Data used to prepare the following description of surface water quality in the vicinity of the Polk Power Station site were obtained from a variety of sources, the most extensive being Tampa Electric Company's site-specific comprehensive monitoring program; EPA's STORET data; FDER's Point-Source Evaluation Section (FDER/PSES) intensive survey of the Alafia River Basin; and USGS's routine water quality data, much of which are reported in EPA's STORET system.

In the following paragraphs, the quality of these waters is described in detail based on the aforementioned sources. Site-specific water quality data collected by Tampa Electric Company during 1991 include both the historically dry and wet seasons in this area of Florida. These data are compared with the longer-term historical data from EPA, FDER/PSES, and USGS by water body groups. For discussion purposes, the Tampa Electric Company surface water monitoring stations have been grouped according to distinct surface water systems as follows: (1) SW-1 through SW-3 (South Prong Alafia River and its unnamed tributary on the site); (2) SW-4 (Payne Creek and its unnamed tributary) and SW-5 (Little Payne Creek); and (3) SW-6 (reclaimed lake) and SW-7 (old mine cut), which are also located in the premining headwater area of Little Payne Creek. The locations of the Tampa Electric Company water quality monitoring stations are shown in Figure 3.2.2-3.

Mean values for all analytes collected by Tampa Electric Company (TEC, 1992a) at monitoring stations (SW-1 through SW-7) are presented in Table 3.2.3-1. Statistical summaries including the mean, maximum, minimum, standard deviation, and number of samples for the monitoring data are presented by station in Tables 3.2.3-2 through 3.2.3-8. These tables do not include those analytes that have not been detected during the course of the monitoring program. All monthly water quality data for the seven stations collected by Tampa Electric Company are presented in Appendix 11.8 of the SCA (TEC, 1992a).

Table 3.2.3-1. Average Water Quality Characteristics in the Stations SW-1 through SW-7 Grouped by Basin or Water Body Type (Page 1 of 5)

Analyte	Units		South Prong Alafia River		Payne Creek/ Little Payne Creek		Lake and Mine Cut	
		SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7
In Situ Measurements								
Temperature	C	26.2	25.5	26.4	25.6	27.0	27.5	27.6
Specific Conductance	µmhos/cm	143	351	383	201	377	307	333
Hydrogen Ion Activity (pH)		5.2	6.7	6.5	6.5	6.3	8.5	8.4
Dissolved Oxygen (DO)	mg/L	4.9	5.4	4.3	0.9	4.9	9.3	11.2
DO Saturation	%	59	65	52	12	60	115	140
Oxidation-Reduction Potential	V	0.103	0.033	0.110	0.068	0.082	0.044	0.014
Classical								
Alkalinity, Total as CaCO3	mg/L	10	75	84	66	92	82	67
Alkalinity, Bicarbonate	mg/L	10	75	84	66	92	60	55
Alkalinity, Carbonate	mg/L	0	0	0	0	0	22	11
Acidity, Total	mg/L	10	5	8	18	11	1	4
Hardness, Total as CaCO3	mg/L	44	138	153	81	117	104	108
Color	Pt-Co	144	77	89	263	43	48	111
Solids, Total	mg/L	122	252	287	167	242	227	270
Solids, Total Dissolved	mg/L	111	228	245	145	227	198	230
Solids, Total Suspended	mg/L	6	11	32	18	6	23	33
Turbidity	NTU	2.4	4.5	4.3	1.9	3.7	9.2	22
Chloride	mg/L	15	15	15	12	13	16	14
Fluoride, Soluble	mg/L	0.44	1.57	1.85	0.71	1.83	1.97	1.58
Sulfate	mg/L	21.2	61.2	68.7	2.9	63.0	38.2	58.0
Cyanide	mg/L	0	0	0.0	0.0	0.0	0.0	0.0
Sodium	mg/L	7	14	15	7	29	20	25
Calcium	mg/L	11	32	35	15	26	23	22
Magnesium	mg/L	3.1	15.0	16.2	10.6	12.3	12.2	13.5
Arsenic	µg/L	0	0	0	0	0	0	0
Selenium	µg/L	0	0	0	0	0	0	0
Total Anions	meq/L	0.85	2.06	2.29	0.67	2.49	1.65	2.02
Total Cations	meq/L	1.11	3.46	3.73	2.00	3.45	2.89	3.14
Ammonia (un-ionized)	mg/L	0	0	0	0	0	0.01	0.09*
Nitrogen, Nitrate	mg/L	0	0.9	0.6	0	0	0	0.88
Nitrogen, Nitrite	mg/L	0	0.01	0.28	0	0.23	0	0.24
Nitrogen, Total Organic	mg/L	0.68	0.93	0.97	1.34	1.01	1.64	2.73
Nitrogen, Kjeldahl	mg/L	0.72	0.97	1.14	1.38	1.37	1.75	2.97
Phosphorus, Total	mg/L	0.82	1.17	1.28	0.71	0.49	0.47	4.52
Total Rec. Oil & Grease	mg/L	0	0	0	0	0	0	0
Surfactants	mg/L	0.04	0.03	0.04	0.03	0.03	0.03	0.02
5-day BOD	mg/L	3	3	4	4	7	9	14
Chemical Oxygen Demand	mg/L	51	41	49	82	40	58	72
Hydrogen Sulfide	mg/L	0.2	0.2	0.2	0.3	0.1	0.1	0.1
Other Metals								
Antimony	mg/L	0	0	0	0	0	0	0
Barium	mg/L	0	0	0	0	0	0	0
Beryllium	µg/L	0	0	0	0	0	0	0
Cadmium	µg/L	0	0	0	0	0	0	0
Chromium	mg/L	0	0	0	0	0	0	0
Chromium, Hexavalent	mg/L	0	0	0	0	0	0	0
Copper	mg/L	0	0	0	0	0	0	0

Table 3.2.3-1. Average Water Quality Characteristics in the Stations SW-1 through SW-7 Grouped by Basin or Water Body Type (Page 2 of 5)

Analyte	Units	SW-1	South Prong Alafia River SW-2	SW-3	Payne Creek/ Little Payne Creek SW-4	SW-5	Lake and Mine Cut SW-6	SW-7
Iron	mg/L	0.3	0	0.3	1.2*	0	0	0
Lead	µg/L	4	4	4	4	4	4	4
Manganese	mg/L	0	0	0	0.03	0	0	0
Mercury	µg/L	0	0	0	0	0	0	0
Nickel	mg/L	0	0	0	0	0	0	0
Silver	µg/L	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Thallium	mg/L	0	0	0	0	0	0	0
Vanadium	mg/L	0	0	0	0	0	0	0
Zinc	mg/L	0.02	0.02	0.01	0	0.01	0	0
Radioactive Substances								
Radium 226	pCi/L	0	0.5	0.7	0.0	0.5	1.4	0.7
Radium 228	pCi/L	0	1.4	1.3	1.3	1.0	0.0	1.0
Gross Alpha	pCi/L	2.2	2.4	3.7	1.7	2.6	2.1	1.8
Organics (Phenols, Phthalates, PCBs)								
Phenol	µg/L	0	0	0	0	0	0	0
2-Chlorophenol	µg/L	0	0	0	0	0	0	0
2-Nitrophenol	µg/L	0	0	0	0	0	0	0
4-Nitrophenol	µg/L	0	0	0	0	0	0	0
2-Methylphenol	µg/L	-	0	0	0	0	-	-
4-Methylphenol	µg/L	-	0	0	0	0	-	-
2,4-Dimethylphenol	µg/L	0	0	0	0	0	0	0
2,4-Dichlorophenol	ug/L	0	0	0	0	0	0	0
4-Chloro-3-methylphenol	µg/L	0	0	0	0	0	0	0
2,4,5-Trichlorophenol	µg/L	-	0	0	0	0	-	-
2,4,6-Trichlorophenol	µg/L	0	0	0	0	0	0	0
2,4-Dinitrophenol	µg/L	0	0	0	0	0	0	0
2-Methyl-4,6-dinitrophenol	ug/L	0	0	0	0	0	0	0
Pentachlorophenol	µg/L	0	0	0	0	0	0	0
Di-n-butyl Phthalate	µg/L	0	0	0	0	0	0	0
bis(2-Ethyl hexyl) Phthalate	µg/L	0	0	0	0	0	0	0
Di-n-octyl Phthalate	µg/L	0	0	0	0	0	0	0
Butyl Benzyl Phthalate	µg/L	0	0	0	0	0	0	0
Diethyl Phthalate	µg/L	0	0	0	0	0	0	0
Dimethyl Phthalate	µg/L	0	0	0	0	0	0	0
PCB-1016	µg/L	0	0	0	0	0	0	0
PCB-1221	µg/L	0	0	0	0	0	0	0
PCB-1232	µg/L	0	0	0	0	0	0	0
PCB-1242	µg/L	0	0	0	0	0	0	0
PCB-1248	µg/L	0	0	0	0	0	0	0
PCB-1254	µg/L	0	0	0	0	0	0	0
PCB-1260	µg/L	0	0	0	0	0	0	0
Pesticides								
Aldrin	µg/L	0	0	0	0	0	0	0
Dieldrin	µg/L	0	0	0	0	0	0	0
Chlordane	µg/L	0	0	0	0	0	0	0
4,4-DDT	µg/L	0	0	0	0	0	0	0
4,4-DDD	µg/L	-	0	0	0	0	-	-

Table 3.2.3-1. Average Water Quality Characteristics in the Stations SW-1 through SW-7 Grouped by Basin or Water Body Type (Page 3 of 5)

		South Prong Alafia River			Payne Creek/ Little Payne Creek		Lake and Mine Cut	
Analyte	Units	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7
4,4-DDE	µg/L	-	0	0	0	0	-	-
Demeton	µg/L	0	0	0	0	0	0	0
Endosulfan	µg/L	0	0	0	0	0	0	0
Endosulfan I	µg/L	-	0	0	0	0	-	-
Endosulfan II	µg/L	-	0	0	0	0	-	-
Endosulfan Sulfate	µg/L	-	0	0	0	0	-	-
Endrin	µg/L	0	0	0	0	0	0	0
Endrin Aldehyde	µg/L	-	0	0	0	0	-	-
Guthion	µg/L	0	0	0	0	0	0	0
Heptachlor	µg/L	0	0	0	0	0	0	0
Heptachlor Epoxide	µg/L	-	0	0	0	0	-	-
a-BHC	µg/L	-	0	0	0	0	-	-
b-BHC	µg/L	-	0	0	0	0	-	-
g-BHC	µg/L	-	0	0	0	-	-	-
d-BHC	µg/L	-	0	0	0	0	-	-
Lindane	µg/L	0	0	0	0	0	0	0
Malathion	µg/L	0	0	0	0	0	0	0
Methoxychlor	µg/L	0	0	0	0	0	0	0
Mirex	µg/L	0	0	0	0	0	0	0
Parathion	µg/L	0	0	0	0	0	0	0
Toxaphene	µg/L	0	0	0	0	0	0	0
Other Priority Pollutants								
Acrolein	µg/L	-	0	0	0	0	-	-
Acrylonitrile	µg/L	-	0	0	0	0	-	-
Benzene	µg/L	-	0	0	0	0	-	-
Bromodichloromethane	µg/L	-	0	0	0	0	-	-
Bromoform	µg/L	-	0	0	0	0	-	-
Bromomethane	µg/L	-	0	0	0	0	-	-
Carbon Tetrachloride	µg/L	-	0	0	0	0	-	-
Chlorobenzene	µg/L	-	0	0	0	0	-	-
Chloroethane	µg/L	-	0	0	0	0	-	-
2-Chloroethylvinyl Ether	µg/L	-	0	0	0	0	-	-
Chloroform	µg/L	-	0	0	0	0	-	-
Chloromethane	µg/L	-	0	0	0	0	-	-
Dibromochloromethane	µg/L	-	0	0	0	0	-	-
1,1-Dichloroethane	µg/L	-	0	0	0	0	-	-
1,2-Dichloroethane	µg/L	-	0	0	0	0	-	-
1,1-Dichloroethylene	µg/L	-	0	0	0	0	-	-
trans-1,2-Dichloroethylene	µg/L	-	0	0	0	0	-	-
1,2-Dichloropropane	µg/L	-	0	0	0	0	-	-
cis-1,3-Dichloropropene	µg/L	-	0	0	0	0	-	-
trans-1,3-Dichloropropene	µg/L	-	0	0	0	0	-	-
Ethyl Benzene	µg/L	-	0	0	0	0	-	-
Methylene Chloride	µg/L	-	0	0	0	0	-	-
1,1,2,2-Tetrachloroethane	µg/L	-	0	0	0	0	-	-
Tetrachloroethylene	µg/L	-	0	0	0	0	-	-
Toluene	µg/L	-	0	0	0	0	-	-
1,1,1-Trichloroethane	µg/L	-	0	0	0	0	-	-
1,1,2-Trichloroethane	µg/L	-	0	0	0	0	-	-

Table 3.2.3-1. Average Water Quality Characteristics in the Stations SW-1 through SW-7 Grouped by Basin or Water Body Type (Page 4 of 5)

		South Prong Alafia River			Payne Creek/ Little Payne Creek		Lake and Mine Cut	
Analyte	Units	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7
Trichloroethylene	µg/L	-	0	0	0	0	-	-
Trichlorofluoromethane	µg/L	-	0	0	0	0	-	-
Vinyl Chloride	µg/L	-	0	0	0	0	-	-
Acenaphthene	µg/L	-	0	0	0	0	-	-
Acenaphthylene	µg/L	-	0	0	0	0	-	-
Anthracene	µg/L	-	0	0	0	0	-	-
Benzoic Acid	µg/L	-	0	0	0	0	-	-
Benzo(a)anthracene	µg/L	-	0	0	0	0	-	-
Benzo(a)pyrene	µg/L	-	0	0	0	0	-	-
Benzo(b)fluoranthene	µg/L	-	0	0	0	0	-	-
Benzo(k)fluoranthene	µg/L	-	0	0	0	0	-	-
Benzo(g,h,i)perylene	µg/L	-	0	0	0	0	-	-
Benzyl Alcohol	µg/L	-	0	0	0	0	-	-
bis(2-Chloroethoxy) Methane	µg/L	-	0	0	0	0	-	-
bis(2-Chloroethyl) Ether	µg/L	-	0	0	0	0	-	-
bis(2-Chloroisopropyl) Ether	µg/L	-	0	0	0	0	-	-
4-Bromophenyl Phenyl Ether	µg/L	-	0	0	0	0	-	-
2-Chloronaphthalene	µg/L	-	0	0	0	0	-	-
4-Chlorophenyl Phenyl Ether	µg/L	-	0	0	0	0	-	-
4-Chloroaniline	µg/L	-	0	0	0	0	-	-
Chrysene	µg/L	-	0	0	0	0	-	-
Dibenzo(a,h)anthracene	µg/L	-	0	0	0	0	-	-
1,2-Dichlorobenzene	µg/L	-	0	0	0	0	-	-
1,3-Dichlorobenzene	µg/L	-	0	0	0	0	-	-
1,4-Dichlorobenzene	µg/L	-	0	0	0	0	-	-
3,3-Dichlorobenzidine	µg/L	-	0	0	0	0	-	-
Dibenzofuran	µg/L	-	0	0	0	0	-	-
2,4-Dinitrotoluene	µg/L	-	0	0	0	0	-	-
2,6-Dinitrotoluene	µg/L	-	0	0	0	0	-	-
Fluoranthene	µg/L	-	0	0	0	0	-	-
Fluorene	µg/L	-	0	0	0	0	-	-
Hexachlorobenzene	µg/L	-	0	0	0	0	-	-
Hexachlorobutadiene	µg/L	-	0	0	0	0	-	-
Hexachloroethane	µg/L	-	0	0	0	0	-	-
Indeno(1,2,3-c,d)pyrene	µg/L	-	0	0	0	0	-	-
Isophorone	µg/L	-	0	0	0	0	-	-
2-Methylnaphthalene	µg/L	-	0	0	0	0	-	-
Naphthalene	µg/L	-	0	0	0	0	-	-
2-Nitroaniline	µg/L	-	0	0	0	0	-	-
3-Nitroaniline	µg/L	-	0	0	0	0	-	-
4-Nitroaniline	µg/L	-	0	0	0	0	-	-
Nitrobenzene	µg/L	-	0	0	0	0	-	-
N-Nitrosodimethylamine	µg/L	-	0	-	0	0	-	-
N-Nitrosodi-n-propylamine	µg/L	-	0	0	0	0	-	-
N-Nitrosodiphenylamine	µg/L	-	0	0	0	0	-	-
Phenanthrene	µg/L	-	0	0	0	0	-	-
Pyrene	µg/L	-	0	0	0	0	-	-
1,2,4-Trichlorobenzene	µg/L	-	0	0	0	0	-	-
Hexachlorocyclopentadiene	µg/L	-	0	0	0	0	-	-
cis-1,2-Dichloroethene	µg/L	-	0	-	0	0	-	-

Table 3.2.3-1. Average Water Quality Characteristics in the Stations SW-1 through SW-7 Grouped by Basin or Water Body Type (Page 5 of 5)

			South Prong Alafia River		Payne Creek/ Little Payne Creek		Lake and Mine Cut	
Analyte	Units	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7
2-Hexanone	µg/L	-	0	-	0	0	-	-
Methyl tert-butyl Ether	µg/L	-	0	-	0	0	-	-
4-Methyl-2-pentanone (MIBK)	µg/L	-	0	-	0	0	-	-
Vinyl Acetate	µg/L	-	0	-	0	0	-	-
Xylenes	µg/L	-	0	-	0	0	-	-
2-Butanone (MEK)	µg/L	-	0	-	0	0	-	-
Carbon Disulfide	µg/L	-	0	-	0	0	-	-
Benzidine	µg/L	-	0	-	0	0	-	-
1,2-Diphenylhydrazine	µg/L	-	0	-	0	0	-	-
Dibromomethane	µg/L	-	0	-	0	0	-	-

Notes:
Dup. = duplicate (D) sample
* = exceeds appropriate water quality standards
- = not analyzed
EST = Eastern Standard Time
cfs = cubic feet per second
C = degrees celsius
µmhos/cm = micromhos per centimeter
Zero (0) = all measurements were below method detection limits

Sources: ECT, 1991; TEC, 1992a.

Table 3.2.3-2. Statistical Summary--Surface Water Quality: SW-1

Analyte	Units	Class III Standard		Mean	Maxi-mum	Mini-mum	Standard Deviation	No.
In Situ Measurements								
Temperature	C			26.2	28.6	20.1	3.1	5
Specific Conductance	µmhos/cm			143	169	113	18	5
Hydrogen Ion Activity (pH)	su	from	6-8.5	5.2	6.7	4.5	--	5
Dissolved Oxygen (DO)	mg/L	≥	5.0	4.9	6.4	3.3	1.2	5
DO Saturation	%			59	80	41	14	5
Oxidation-Reduction Potential	V			0.103	0.139	0.082	0.023	4
Classical								
Alkalinity, Total as CaCO3	mg/L	≥	20	10	17	3	4	5
Alkalinity, Bicarbonate	mg/L			10	17	3	4	5
Alkalinity, Carbonate	mg/L			0	--	--	--	6
Acidity, Total	mg/L			10	18	5	4	6
Hardness, Total as CaCO3	mg/L			44	52	38	5	6
Color	Pt-Co			144	350	60	100	6
Solids, Total	mg/L			122	180	92	28	6
Solids, Total Dissolved	mg/L			111	160	83	25	6
Solids, Total Suspended	mg/L			6.1	10	2.5	4	6
Turbidity	NTU	≤	29	2.4	5.9	1.4	1.6	6
Chloride	mg/L			15	21	12	3	6
Fluoride, Soluble	mg/L	≤	10	0.44	0.61	0.38	0.08	6
Sulfate	mg/L			21.2	29.0	15.0	5.0	6
Sodium	mg/L			7	8	6	1	6
Calcium	mg/L			11	15	10	2	6
Magnesium	mg/L			3.1	3.4	2.7	0.3	6
Total Anions	meq/L			0.85	1.25	0.51	0.22	6
Total Cations	meq/L			1.11	1.40	0.98	0.15	6
Ammonia (un-ionized)	mg/L	≤	0.02	0	--	--	--	6
Nitrogen, Nitrate	mg/L			0	--	--	--	6
Nitrogen, Nitrite	mg/L			0	--	--	--	6
Nitrogen, Total Organic	mg/L			0.68	1.00	0.43	0.20	6
Nitrogen, Kjeldahl	mg/L			0.72	1.10	0.50	0.21	6
Phosphorus, Total	mg/L			0.82	0.94	0.67	0.09	6
Surfactants	mg/L	≤	0.5	0.04	0.08	0.01	0.02	6
5-day BOD	mg/L			2.58	7	1	2	6
Chemical Oxygen Demand	mg/L			51	110	25	32	5
Hydrogen Sulfide	mg/L			0.18	0.3	0.1	0.1	2
Other Metals								
Iron	mg/L	≤	1.0	0.35	0.6	0.2	0.2	6
Lead	µg/L	≤	0.9-1.4*	3.58	9	3	2	6
Manganese	mg/L			0	--	--	--	6
Silver	µg/L	≤	0.07	0.04	0.06	0.04	0.01	6
Zinc	mg/L	≤	0.05-0.06*	0.02	0.03	0.01	0.01	6
Radioactive Substances								
Radium 226	pCi/L	≤	5	0	--	--	--	6
Radium 228	pCi/L	≤	5	0	--	--	--	6
Gross Alpha	pCi/L	≤	15	2.2	6.3	1.0	2.2	6

Note: Analytes not detected during the monitoring program are not included in the table.
½ the method detection limit is used in place of not detected measurements to compute mean for analytes.
Zero (0) indicates all measurements were below method detection limit.

* Standard range is calculated using the hardness from each sampling period at the station from data collected by Tampa Electric Company.

Sources: ECT, 1992; TEC, 1992a.

Table 3.2.3-3. Statistical Summary--Surface Water Quality: SW-2

Analyte	Units	Class III Standard		Mean	Maxi-mum	Mini-mum	Standard Deviation	No.
In Situ Measurements								
Temperature	C			25.5	29.4	19.4	3.4	6
Specific Conductance	µmhos/cm			351	398	323	28	6
Hydrogen Ion Activity (pH)	su	from	6-8.5	6.7	7.4	6.2	--	6
Dissolved Oxygen (DO)	mg/L	≥	5.0	5.4	7.5	2.6	1.7	6
DO Saturation	%			65	81	33	18	6
Oxidation-Reduction Potential	V			0.033	0.085	-0.010	0.043	4
Classical								
Alkalinity, Total as CaCO3	mg/L	≥	20	75	81	69	5	5
Alkalinity, Bicarbonate	mg/L			75	81	69	5	5
Alkalinity, Carbonate	mg/L			0	--	--	--	6
Acidity, Total	mg/L			5	6	2	1	6
Hardness, Total as CaCO3	mg/L			138	150	120	12	6
Color	Pt-Co			77	120	30	30	6
Solids, Total	mg/L			252	280	220	21	6
Solids, Total Dissolved	mg/L			228	250	210	13	6
Solids, Total Suspended	mg/L			10.8	30	3	9	6
Turbidity	NTU	≤	29	4.5	9.6	2.0	2.7	6
Chloride	mg/L			15	17	14	1	6
Fluoride, Soluble	mg/L	≤	10	1.57	2.00	1.00	0.39	6
Sulfate	mg/L			61.2	79.0	50.0	8.7	6
Sodium	mg/L			14	16	12	1	6
Calcium	mg/L			32	36	29	3	6
Magnesium	mg/L			15.0	22.0	11.0	3.4	6
Total Anions	meq/L			2.06	3.30	1.60	0.58	6
Total Cations	meq/L			3.46	4.20	3.00	0.38	6
Ammonia (un-ionized)	mg/L	≤	0.02	0	--	--	--	6
Nitrogen, Nitrate	mg/L			0.93	2.2	0.50	0.7	6
Nitrogen, Nitrite	mg/L			0.01	0.01	0.01	0.00	6
Nitrogen, Total Organic	mg/L			0.93	1.37	0.60	0.29	6
Nitrogen, Kjeldahl	mg/L			0.97	1.40	0.60	0.32	6
Phosphorus, Total	mg/L			1.17	1.70	0.77	0.31	6
Surfactants	mg/L	≤	0.5	0.03	0.08	0.01	0.02	6
5-day BOD	mg/L			2.58	6	0.50	2	6
Chemical Oxygen Demand	mg/L			41	53	25	9	5
Hydrogen Sulfide	mg/L			0.18	0.30	0.05	0.13	2
Other Metals								
Iron	mg/L	≤	1.0	0	--	--	--	6
Lead	µg/L	≤	4.0-5.3*	4	12	3	4	6
Manganese	mg/L			0	--	--	--	6
Silver	µg/L	≤	0.07	0.04	0.06	0.04	0.01	6
Zinc	mg/L	≤	0.12-0.15*	0.02	0.03	0.01	0.01	6
Radioactive Substances								
Radium 226	pCi/L	≤	5	0.52	1.1	0.3	0.4	6
Radium 228	pCi/L	≤	5	1.4	5.7	0.5	2.1	6
Gross Alpha	pCi/L	≤	15	2.38	6.5	1.0	2.2	6

Note: Analytes not detected during the monitoring program are not included in the table.
½ the method detection limit is used in place of not detected measurements to compute mean for analytes.
Zero (0) indicates all measurements were below method detection limit.

* Standard range is calculated using the hardness from each sampling period at the station from data collected by Tampa Electric Company.

Sources: ECT, 1992; TEC, 1992a.

Table 3.2.3-4. Statistical Summary--Surface Water Quality: SW-3

Analyte	Units	Class III Standard		Mean	Maxi- mum	Mini- mum	Standard Deviation	No.
In Situ Measurements								
Temperature	C			26.4	30.4	19.6	3.4	6
Specific Conductance	µmhos/cm			383	428	329	40	6
Hydrogen Ion Activity (pH)	su	from	6-8.5	6.5	7.6	6.0	--	6
Dissolved Oxygen (DO)	mg/L	≥	5.0	4.3	5.5	2.8	1.1	6
DO Saturation	%			52	67	35	12	6
Oxidation-Reduction Potential	V			0.110	0.220	0.030	0.071	4
Classical								
Alkalinity, Total as CaCO3	mg/L	≥	20	84	100	70	10	5
Alkalinity, Bicarbonate	mg/L			84	100	70	10	5
Alkalinity, Carbonate	mg/L			0	--	--	--	6
Acidity, Total	mg/L			8	12	5	3	6
Hardness, Total as CaCO3	mg/L			153	170	130	14	6
Color	Pt-Co			89	150	40	39	6
Solids, Total	mg/L			287	390	260	47	6
Solids, Total Dissolved	mg/L			245	270	230	13	6
Solids, Total Suspended	mg/L			32	120	3	40	6
Turbidity	NTU	≤	29	4.3	7.0	1.9	1.5	6
Chloride	mg/L			15	17	12	2	6
Fluoride, Soluble	mg/L	≤	10	1.85	2.20	1.40	0.30	6
Sulfate	mg/L			68.7	79.0	54.0	8.7	6
Sodium	mg/L			15	17	13	1	6
Calcium	mg/L			35	39	29	4	6
Magnesium	mg/L			16.2	22.0	11.0	3.4	6
Total Anions	meq/L			2.29	3.80	1.80	0.68	6
Total Cations	meq/L			3.73	4.30	3.00	0.44	6
Ammonia (un-ionized)	mg/L	≤	0.02	0	--	--	--	6
Nitrogen, Nitrate	mg/L			0.63	1.3	1	0.3	6
Nitrogen, Nitrite	mg/L			0.28	1.60	0.005	0.59	6
Nitrogen, Total Organic	mg/L			0.97	1.40	0.41	0.34	6
Nitrogen, Kjeldahl	mg/L			1.14	1.50	0.41	0.36	6
Phosphorus, Total	mg/L			1.28	1.60	0.97	0.24	6
Surfactants	mg/L	≤	0.5	0.04	0.09	0.01	0.03	6
5-day BOD	mg/L			4.17	10	1	3	6
Chemical Oxygen Demand	mg/L			49	68	41	10	5
Hydrogen Sulfide	mg/L			0.18	0.3	0.05	0.1	2
Other Metals								
Iron	mg/L	≤	1.0	0.26	0.4	0.15	0.1	6
Lead	µg/L	≤	4.4-6.3*	3.83	11	2	3	6
Manganese	mg/L			0	--	--	--	6
Silver	µg/L	≤	0.07	0.04	0.07	0.025	0.01	6
Zinc	mg/L	≤	0.13-0.17*	0.01	0.02	0.010	0.00	6
Radioactive Substances								
Radium 226	pCi/L	≤	5	0.7	1.4	0.3	0.48	6
Radium 228	pCi/L	≤	5	1.3	5.3	0.5	1.96	6
Gross Alpha	pCi/L	≤	15	3.6	9.4	1.0	3.24	6

Note: Analytes not detected during the monitoring program are not included in the table.
½ the method detection limit is used in place of not detected measurements to compute mean for analytes.
Zero (0) indicates all measurements were below method detection limit.

* Standard range is calculated using the hardness from each sampling period at the station from data collected by Tampa Electric Company.

Sources: ECT, 1992; TEC, 1992a.

Table 3.2.3-5. Statistical Summary--Surface Water Quality: SW-4

Analyte	Units	Class III Standard		Mean	Maxi-mum	Mini-mum	Standard Deviation	No.
In Situ Measurements								
Temperature	C			25.6	30.1	19.4	3.2	6
Specific Conductance	µmhos/cm			201	278	126	55	6
Hydrogen Ion Activity (pH)	su	from	6-8.5	6.5	7.8	6.0	--	6
Dissolved Oxygen (DO)	mg/L	≥	5.0	0.9	2.4	0.0	0.8	6
DO Saturation	%			12	29	0	9	6
Oxidation-Reduction Potential	V			0.068	0.138	0.031	0.041	4
Classical								
Alkalinity, Total as CaCO3	mg/L	≥	20	66	93	26	26	5
Alkalinity, Bicarbonate	mg/L			66	93	26	26	5
Alkalinity, Carbonate	mg/L			0	--	--	--	6
Acidity, Total	mg/L			18	26	10	5	6
Hardness, Total as CaCO3	mg/L			81	110	40	23	6
Color	Pt-Co			263	400	130	103	6
Solids, Total	mg/L			167	230	120	39	6
Solids, Total Dissolved	mg/L			145	210	110	35	6
Solids, Total Suspended	mg/L			18	60	3	20	6
Turbidity	NTU	≤	29	2	4.5	1	1.3	6
Chloride	mg/L			12	23	5	6	6
Fluoride, Soluble	mg/L	≤	10	0.71	1.00	0.48	0.16	6
Sulfate	mg/L			2.92	5.0	3	0.9	6
Sodium	mg/L			7	13	3	4	6
Calcium	mg/L			15	20	7	5	6
Magnesium	mg/L			10.6	14.0	5.2	3.3	6
Total Anions	meq/L			0.67	2.40	0.22	0.78	6
Total Cations	meq/L			2.00	3.00	0.69	0.90	6
Ammonia (un-ionized)	mg/L	≤	0.02	0	--	--	--	6
Nitrogen, Nitrate	mg/L			0	--	--	--	6
Nitrogen, Nitrite	mg/L			0	--	--	--	6
Nitrogen, Total Organic	mg/L			1.34	1.68	1.10	0.21	6
Nitrogen, Kjeldahl	mg/L			1.38	1.70	1.10	0.19	6
Phosphorus, Total	mg/L			0.71	1.20	0.17	0.34	6
Surfactants	mg/L	≤	0.5	0.03	0.05	0.01	0.01	6
5-day BOD	mg/L			3.92	8	1	2	6
Chemical Oxygen Demand	mg/L			82	96	56.00	14	5
Hydrogen Sulfide	mg/L			0.28	0.5	0	0.2	2
Other Metals								
Iron	mg/L	≤	1.0	1.2†	1.7†	0.6	0.4	6
Lead	µg/L	≤	1.0-4.0*	4.4	14	3	4	6
Manganese	mg/L			0.03	0.07	0	0.02	6
Silver	µg/L	≤	0.07	0.04	0.08	0	0.02	6
Zinc	mg/L	≤	0.05-0.11*	0.00	--	--	--	6
Radioactive Substances								
Radium 226	pCi/L	≤	5	0	--	--	--	6
Radium 228	pCi/L	≤	5	1.33	5.5	0.5	2.04	6
Gross Alpha	pCi/L	≤	15	1.73	2.9	1.0	0.84	6

Note: Analytes not detected during the monitoring program are not included in the table.
½ the method detection limit is used in place of not detected measurements to compute mean for analytes.
Zero (0) indicates all measurements were below method detection limit.

* Standard range is calculated using the hardness from each sampling period at the station from data collected by Tampa Electric Company.

† Exceeds Class III water quality standard.

Sources: ECT, 1992; TEC, 1992a.

Table 3.2.3-6. Statistical Summary--Surface Water Quality: SW-5

Analyte	Units	Class III Standard		Mean	Maxi-mum	Mini-mum	Standard Deviation	No.
In Situ Measurements								
Temperature	C			27.0	30.3	21.0	3.4	6
Specific Conductance	μmhos/cm			377	432	308	45	6
Hydrogen Ion Activity (pH)	su	from	6-8.5	6.3	7.7	6.0	--	6
Dissolved Oxygen (DO)	mg/L	≥	5.0	4.9	7.2	2.2	1.8	6
DO Saturation	%			60	90	29	21	6
Oxidation-Reduction Potential	V			0.082	0.122	0.053	0.026	4
Classical								
Alkalinity, Total as CaCO3	mg/L	≥	20	92	97	87	3	5
Alkalinity, Bicarbonate	mg/L			92	97	87	3	5
Alkalinity, Carbonate	mg/L			0	--	--	--	6
Acidity, Total	mg/L			11	15	5	3	6
Hardness, Total as CaCO3	mg/L			117	140	100	17	6
Color	Pt-Co			43	75	30	15	6
Solids, Total	mg/L			242	280	220	20	6
Solids, Total Dissolved	mg/L			227	270	190	27	6
Solids, Total Suspended	mg/L			6	20	0	7	6
Turbidity	NTU	≤	29	3.7	5.7	2.5	1.1	6
Chloride	mg/L			13	14	12	1	6
Fluoride, Soluble	mg/L	≤	10	1.83	2.60	1.50	0.38	6
Sulfate	mg/L			63.0	81.0	42.0	12.8	6
Sodium	mg/L			29	33	23	3	6
Calcium	mg/L			26	33	21	5	6
Magnesium	mg/L			12.3	15.0	10.0	1.7	6
Total Anions	meq/L			2.49	6.70	1.20	1.90	6
Total Cations	meq/L			3.45	4.20	2.00	0.74	6
Ammonia (un-ionized)	mg/L	≤	0.02	0	--	--	--	6
Nitrogen, Nitrate	mg/L			0	--	--	--	6
Nitrogen, Nitrite	mg/L			0.23	1.20	0.02	0.44	6
Nitrogen, Total Organic	mg/L			1.01	1.28	0.68	0.21	6
Nitrogen, Kjeldahl	mg/L			1.37	1.80	0.79	0.30	6
Phosphorus, Total	mg/L			0.49	0.61	0.37	0.07	6
Surfactants	mg/L	≤	0.5	0.03	0.05	0.01	0.01	6
5-day BOD	mg/L			7	11	4	2	6
Chemical Oxygen Demand	mg/L			40	53	31	7	5
Hydrogen Sulfide	mg/L			0.13	0.2	0.05	0.1	2
Other Metals								
Iron	mg/L	≤	1.0	0	--	--	--	6
Lead	μg/L	≤	3.2-4.9*	4.42	14	2.5	4	6
Manganese	mg/L			0	--	--	--	6
Silver	μg/L	≤	0.07	0.04	0.07	0.035	0.01	6
Zinc	mg/L	≤	0.11-0.14*	0.01	0.02	0.010	0.004	6
Radioactive Substances								
Radium 226	pCi/L	≤	5	0.53	1.0	0.3	0.36	6
Radium 228	pCi/L	≤	5	0.98	3.4	0.5	1.18	6
Gross Alpha	pCi/L	≤	15	2.63	5.2	1.0	1.59	6

Note: Analytes not detected during the monitoring program are not included in the table.
½ the method detection limit is used in place of not detected measurements to compute mean for analytes.
Zero (0) indicates all measurements were below method detection limit.

* Standard range is calculated using the hardness from each sampling period at the station from data collected by Tampa Electric Company.

Sources: ECT, 1992; TEC, 1992a.

Table 3.2.3-7. Statistical Summary--Surface Water Quality: SW-6

Analyte	Units	Class III Standard		Mean	Maxi-mum	Mini-mum	Standard Deviation	No.
In Situ Measurements								
Temperature	C			27.5	32.6	21.2	3.8	5
Specific Conductance	µmhos/cm			307	328	269	21	5
Hydrogen Ion Activity (pH)	su	from	6-8.5	8.5	9.4	7.9	--	5
Dissolved Oxygen (DO)	mg/L	≥	5.0	9.3	12.7	4.7	2.7	5
DO Saturation	%			115	159	64	34	5
Oxidation-Reduction Potential	V			0.044	0.063	0.017	0.017	4
Classical								
Alkalinity, Total as CaCO3	mg/L	≥	20	82	91	75	6	5
Alkalinity, Bicarbonate	mg/L			60	91	31	24	5
Alkalinity, Carbonate	mg/L			22	50	1	17	6
Acidity, Total	mg/L			1	5	1	2	6
Hardness, Total as CaCO3	mg/L			104	110	94	6	6
Color	Pt-Co			48	67	35	10	6
Solids, Total	mg/L			227	260	190	24	6
Solids, Total Dissolved	mg/L			198	220	180	15	6
Solids, Total Suspended	mg/L			23	50	3	16	6
Turbidity	NTU	≤	29	9.2	18	5.7	4.3	6
Chloride	mg/L			16	17	13	2	6
Fluoride, Soluble	mg/L	≤	10	1.97	2.90	1.40	0.45	6
Sulfate	mg/L			38.2	45.0	30.0	5.2	6
Sodium	mg/L			20	21	19	1	6
Calcium	mg/L			23	26	21	2	6
Magnesium	mg/L			12.2	14.0	11.0	1.1	6
Total Anions	meq/L			1.65	2.70	1.10	0.52	6
Total Cations	meq/L			2.89	3.30	1.90	0.47	6
Ammonia (un-ionized)	mg/L	≤	0.02	0.01	0.02	0.01	0.00	6
Nitrogen, Nitrate	mg/L			0	--	--	--	6
Nitrogen, Nitrite	mg/L			0	--	--	--	6
Nitrogen, Total Organic	mg/L			1.64	2.80	0.78	0.71	6
Nitrogen, Kjeldahl	mg/L			1.75	2.80	0.80	0.63	6
Phosphorus, Total	mg/L			0.47	0.81	0.25	0.19	6
Surfactants	mg/L	≤	0.5	0.03	0.05	0.01	0.01	6
5-day BOD	mg/L			9	10	8	1	6
Chemical Oxygen Demand	mg/L			58	70	47	8	5
Hydrogen Sulfide	mg/L			0.13	0.2	0.05	0.1	2
Other Metals								
Iron	mg/L	≤	1.0	0	--	--	--	6
Lead	µg/L	≤	2.9-3.6*	4.25	13	2.50	4	6
Manganese	µg/L			0	--	--	--	6
Silver	µg/L	≤	0.07	0.04	0.07	0.035	0.01	6
Zinc	mg/L	≤	0.10-0.11*	0	--	--	--	6
Radioactive Substances								
Radium 226	pCi/L	≤	5	1.4	7.1	0.30	2.8	6
Radium 228	pCi/L	≤	5	0	--	--	--	6
Gross Alpha	pCi/L	≤	15	2.1	4.0	1.0	1.4	6

Note: Analytes not detected during the monitoring program are not included in the table.
½ the method detection limit is used in place of not detected measurements to compute mean for analytes.
Zero (0) indicates all measurements were below method detection limit.

* Standard range is calculated using the hardness from each sampling period at the station from data collected by Tampa Electric Company.

Sources: ECT, 1992; TEC, 1992a.

Table 3.2.3-8. Statistical Summary--Surface Water Quality: SW-7

Analyte	Units	Class III Standard		Mean	Maxi-mum	Mini-mum	Standard Deviation	No.
In Situ Measurements								
Temperature	C			27.6	33.2	21.9	3.8	5
Specific Conductance	µmhos/cm			333	363	279	35	5
Hydrogen Ion Activity (pH)	su	from	6-8.5	8.4	9.4	8.0	--	5
Dissolved Oxygen (DO)	mg/L	≥	5.0	11.2	14.5	8.5	2.2	5
DO Saturation	%			140	164	104	22	5
Oxidation-Reduction Potential	V			0.014	0.071	-0.054	0.044	4
Classical								
Alkalinity, Total as CaCO3	mg/L	≥	20	67	84	39	16	5
Alkalinity, Bicarbonate	mg/L			55	80	33	15	5
Alkalinity, Carbonate	mg/L			11	26	0.5	9	6
Acidity, Total	mg/L			4	15	0.5	5	6
Hardness, Total as CaCO3	mg/L			108	120	89	11	6
Color	Pt-Co			111	150	75	23	6
Solids, Total	mg/L			270	290	240	19	6
Solids, Total Dissolved	mg/L			230	260	200	20	6
Solids, Total Suspended	mg/L			33	50	13	14	6
Turbidity	NTU	≤	29	22	27	15	4.6	6
Chloride	mg/L			14	16	12	1	6
Fluoride, Soluble	mg/L	≤	10	1.58	4.00	0.88	1.12	6
Sulfate	mg/L			58.0	68.0	42.0	7.9	6
Sodium	mg/L			25	27	23	1	6
Calcium	mg/L			22	26	17	4	6
Magnesium	mg/L			13.5	15.0	12.0	1.0	6
Total Anions	meq/L			2.02	2.40	1.70	0.22	6
Total Cations	meq/L			3.14	3.60	1.80	0.63	6
Ammonia (un-ionized)	mg/L	≤	0.02	0.09†	0.32†	0.01	0.12	6
Nitrogen, Nitrate	mg/L			0.88	1.70	0.50	0.54	6
Nitrogen, Nitrite	mg/L			0.24	1.40	0.01	0.52	6
Nitrogen, Total Organic	mg/L			2.73	3.40	2.18	0.46	6
Nitrogen, Kjeldahl	mg/L			2.97	4.10	2.20	0.73	6
Phosphorus, Total	mg/L			4.52	6.10	1.80	1.58	6
Surfactants	mg/L	≤	0.5	0.02	0.05	0.01	0.01	6
5-day BOD	mg/L			14	20	9	4	6
Chemical Oxygen Demand	mg/L			72	83	59	8	5
Hydrogen Sulfide	mg/L			0.13	0.20	0.05	0.08	2
Other Metals								
Iron	mg/L	≤	1.0	0	--	--	--	6
Lead	µg/L	≤	2.7-4.0*	4	13	2.50	4	6
Manganese	mg/L			0	--	--	--	6
Silver	µg/L	≤	0.07	0.04	0.06	0.04	0.01	6
Zinc	mg/L	≤	0.10-0.12*	0	--	--	--	6
Radioactive Substances								
Radium 226	pCi/L	≤	5	0.65	2.4	0.3	0.85	6
Radium 228	pCi/L	≤	5	1.0	3.5	0.5	1.20	6
Gross Alpha	pCi/L	≤	15	1.8	3.4	1.0	0.99	6

Note: Analytes not detected during the monitoring program are not included in the table.
½ the method detection limit is used in place of not detected measurements to compute mean for analytes.
Zero (0) indicates all measurements were below method detection limit.

* Standard range is calculated using the hardness from each sampling period at the station from data collected by Tampa Electric Company.

† Exceeds Class III water quality standard.

Sources: ECT, 1992; TEC, 1992a.

Extensive historical water quality data are available for the South Prong Alafia River and its tributaries. Specific sources include EPA's data from the South Prong Alafia River at Bethlehem Road and FDER/PSES, stations S3, S6 (Tampa Electric Company monitoring Station SW-3), and S9 (coincides with Tampa Electric Company Monitoring Station SW-2). Basic water quality statistics for the South Prong Alafia River at Bethlehem Road (Tampa Electric Company Monitoring Station SW-2) obtained from FDER/PSES and EPA are presented in Tables 3.2.3-9 and 3.2.3-10, respectively. EPA water quality statistics for Payne Creek near Bowling Green are presented in Table 3.2.3-11.

Analytes of particular interest are discussed in greater detail below, either because they are engineering parameters or they represent historical water quality problems.

Hardness

Water hardness (expressed as mg/L of calcium carbonate [$CaCO_3$]), although somewhat inexact in definition, is an important parameter for a number of reasons. Power plant design, especially water pretreatment systems, often rely on the degree of hardness of the proposed plant supply water. Because Tampa Electric Company intends to obtain most plant process water from groundwater, the hardness of surface waters is less important from an engineering standpoint. However, certain surface water quality standards are calculated based on the degree of hardness because toxicity of various materials to aquatic organisms is dependent on hardness.

According to Tampa Electric Company monitoring data, the mean water hardness for SW-2 and SW-3 was 138 and 153 mg/L, respectively. Hardness data collected by USGS between 1985 and 1991 downstream of SW-2 support these observations. Water within the South Prong Alafia River is considered hard using the classification scheme developed by Dufor and Becker (1964; TEC, 1992a). Water from the unnamed tributary to the South Prong Alafia River (SW-1) has a mean value of 44 mg/L and is classified as soft. This is not surprising given that the stream is short and is most likely supplied by runoff with little groundwater input.

The waters of Payne Creek (SW-4) and Little Payne Creek (SW-5), with mean hardness values of 81 and 117 mg/L, respectively, are classified as moderately hard according to Dufor and Becker (1964; TEC, 1992a). The maximum hardness measured at these two stations was 140 mg/L at station SW-5 on Little Payne Creek (TEC, 1992a).

SW-6 and SW-7 had similar hardness values with means of 104 and 108 mg/L, respectively. This water would be considered moderately hard by Dufor and Becker (1964; TEC, 1992a).

Temperature

Tampa Electric Company intends to discharge water from the proposed cooling reservoir to the reclaimed lake (SW-6) located to the east of the reservoir which flows to the Little Payne Creek system. Although the

Table 3.2.3-9. Surface Water Quality Statistics for South Prong of the Alafia River (FDER/PSES Intensive Survey, 1984-1985)

Parameter	Units	S9 (SW-2)					S3 (Upstream of PPS)					S6 (SW-3)				
		Mean	Max.	Min.	Std.	No.	Mean	Max.	Min.	Std.	No.	Mean	Max.	Min.	Std.	No.
Time	LMT		1120	925		12		1210	1014		9		1200	1040		4
Water Temperature	C	21.0	27.2	8.7	5.4	12	20.1	26.3	7.1	6.1	9	22.3	27.5	14.2	5.0	4
Hydrogen Ion Activity (pH)	su	6.8	7.8	6.2		12	6.8	7.6	6.5		9	6.7	7.6	6.4		4
Specific Conductivity	µmhos/cm	392	492	280	73	12	511	639	372	75	9	498	562	391	65	4
Dissolved Oxygen	mg/L	7.6	10.5	4.0	1.8	12	5.1	11.6	0.7	3.0	9	5.1	8.8	1.3	2.7	4
Total-Phosphorus*	mg/L	3.05	8.20	1.34	2.10	12	6.88	16.40	3.98	3.85	8	3.59	3.92	3.26	0.33	2
Ortho-Phosphorus*	mg/L	2.70	7.39	1.29	1.82	12	6.06	14.10	3.82	3.31	8	3.75	4.10	3.40	0.35	2
Total Kjeldahl Nitrogen†	mg/L	0.65	1.26	0.38	0.25	12	1.01	1.33	0.75	0.21	8	1.08	1.42	0.73	0.35	2
Ammonia (as N)†	mg/L	0.06	0.10	0.02	0.02	12	0.03	0.05	0.01	0.01	8	0.04	0.05	0.03	0.01	2
Organic Nitrogen†	mg/L	0.59	1.17	0.36	0.23	12	0.98	1.32	0.73	0.22	8	1.04	1.37	0.70	0.34	2
Nitrite+Nitrate†	mg/L	(1) 0.72	1.52	0.00	0.37	12	(2) 0.05	0.35	0.00	0.11	8	(3) 0.01	0.01	0.00	0.01	2
Carbonaceous BOD 5-day	mg/L	2.20	9.70	0.40	2.63	10	1.82	4.00	0.80	1.07	6	0.90	1.20	0.60	0.30	2
Corrected Chlorophyll *a*	µg/L	1.42	2.20	0.60	0.57	5	8.09	32.90	0.60	11.17	6	3.55	4.30	2.80	0.75	2
Phaeophytin	µg/L	5.34	10.50	0.40	4.11	7	6.08	10.20	0.50	3.52	4	4.70	9.20	0.20	4.50	2
Alkalinity	mg/L	90	109	77	9	12	101	123	79	16	8	87	96	78	9	2
Fluoride	mg/L	2.49	3.91	1.28	0.99	12	5.79	6.72	4.28	0.81	8	5.04	6.07	4.01	1.03	2
Chloride	mg/L	17	20	15	2	12	24	33	19	5	8	28	34	21	7	2
Sulfate	mg/L	95	139	64	22	12	140	176	106	27	8	146	189	103	43	2
Cadmium	µg/L	ND	ND	ND	ND	4	ND	ND	ND	ND	3	ND	ND	ND	ND	1
Copper	µg/L	ND	ND	ND	ND	4	ND	ND	ND	ND	3	ND	ND	ND	ND	1
Chromium	µg/L	ND	ND	ND	ND	4	ND	ND	ND	ND	3	ND	ND	ND	ND	1
Iron	µg/L	245	367	71	122	4	122	202	51	62	3	537	537	537	0	1
Zinc	µg/L	ND	ND	ND	ND	4	ND	ND	ND	ND	3	ND	ND	ND	ND	1
Silver	µg/L	ND	ND	ND	ND	4	ND	ND	ND	ND	3	ND	ND	ND	ND	1
Arsenic	µg/L	ND	ND	ND	ND	4	ND	ND	ND	ND	3	ND	ND	ND	ND	1
Aluminum	µg/L	ND	ND	ND	ND	4	ND	ND	ND	ND	3	ND	ND	ND	ND	1
Nickel	µg/L	ND	ND	ND	ND	4	ND	ND	ND	ND	3	ND	ND	ND	ND	1
Selenium	µg/L	ND	ND	ND	ND	4	ND	ND	ND	ND	3	ND	ND	ND	ND	1
Lead	µg/L	ND	ND	ND	ND	4	ND	ND	ND	ND	3	ND	ND	ND	ND	1
Mercury	µg/L	(4) 0.06	0.23	0.00	0.10	4	ND	ND	ND	ND	3	ND	ND	ND	ND	1

Notes: ND = none detected.
* Phosphorous forms are assumed to be reported as P.
† Nitrogen forms are assumed to be reported as N.
(1) reported mean contains 1 zero for non-detect.
(2) reported mean contains 5 zero for non-detect.
(3) reported mean contains 1 zero for non-detect.
(4) reported mean contains 3 zero for non-detect.

Sources: FDER/PSES, 1989; ECT, 1992; TEC, 1992a.

Table 3.2.3-10. Surface Water Quality Statistics for South Prong of the Alafia River at Bethlehem Road (EPA STORET Data Collected from 1981 to 1985)

Parameter	Unit	Mean	Max	Min	No.
Time	LMT		1443	910	56
Water Temperature	C	24.1	30.0	11.8	55
Field Turbidity	FTU	5	14	1	55
Color	Pt-Co	50	140	15	56
Field Conductivity	µmhos/cm	390	950	120	25
Specific Conductivity	µmhos/cm	680	1178	200	30
Dissolved Oxygen (DO)	mg/L	6.8	11.3	2.1	56
DO Saturation	%	79	116	26	55
5-day Biochemical Oxygen Demand	mg/L	1.4	7.1	0.1	56
Field Hydrogen Ion Activity (pH)	su	7.2	8.0	6.6	24
Total Solids	mg/L	255	585	167	49
Total Dissolved Solids	mg/L	251	584	163	49
Total Suspended Solids	mg/L	4	20	1	53
Total Nitrogen	mg/L	1.50	3.25	0.74	54
Total Organic Nitrogen	mg/L	0.81	2.87	0.10	53
Total Ammonia+Ammonium	mg/L	0.19	1.25	0.03	52
Un-ionized Ammonia	mg/L	0.0038	0.025	0.0001	52
Total Kjeldahl Nitrogen	mg/L	0.91	2.95	0.26	55
Total Nitrite+Nitrate	mg/L	0.01	0.02	0.01	22
Dissolved Nitrite+Nitrate	mg/L	0.6	1.6	0.1	34
Total Phosphorus	mg/L	2.81	6.44	0.31	56
Dissolved (ortho) Phosphorus	mg/L	2.11	4.40	0.80	9
Total Organic Carbon	mg/L	13.0	28.8	1.1	50
Total Chloride	mg/L	16	32	6	54
Total Sulfate	mg/L	87	153	49	51
Dissolved Fluoride	mg/L	2.48	5.81	0.20	51
Total Coliform	#/100 mL	752	5500	100	56
Fecal Coliform	#/100 mL	191	2000	100	56
Chlorophyll *a*	µg/L	4.3	25.9	1.4	56
Chlorophyll *b*	µg/L	1.7	15.1	0.1	56
Chlorophyll *c*	µg/L	5.5	40.4	0.5	56
Total Chlorophyll	µg/L	11.6	81.5	2.6	55

Note: LMT = local mean time.
FTU = field turbidity unit.

Sources: EPA, 1991b.
ECT, 1991.
TEC, 1992a.

Table 3.2.3-11. Surface Water Quality Statistics for Payne Creek near Bowling Green (EPA STORET Data Collected From 1979 to 1983)

Parameter	Units	Mean	Max.	Min.	No.
Time	LMT		1639	900	25
Water Temperature	C	21.7	27.5	11.0	25
Field Turbidity	FTU	2.7	4.8	1.0	3
Color	Pt-Co	80	140	20	3
Specific Conductivity	µmhos/cm	286	400	188	25
Dissolved Oxygen (DO)	mg/L	7.8	9.8	5.7	25
DO Saturation	%	87	100	70	25
5-day Biochemical Oxygen Demand	mg/L	0.9	1.4	0.4	5
Hydrogen Ion Activity (pH)	su	6.8	7.9	6.1	24
Carbon Dioxide	mg/L	4.8	4.8	4.8	1
Total Alkalinity as CaCO3	mg/L	62	62	62	1
Bicarbonate	mg/L	75	75	75	1
Total Dissolved Solids	mg/L	195	195	195	1
Total Suspended Solids	mg/L	3.4	9.0	0.2	3
Total Volatile Suspended Solids	mg/L	3	5	1	3
Total Nitrogen	mg/L	2.15	2.42	1.88	2
Total Organic Nitrogen	mg/L	1.2	1.4	1.0	2
Total Ammonia+Ammonium	mg/L	0.09	0.21	0.02	3
Un-ionized Ammonia	mg/L	0.0008	0.0010	0.0006	3
Total Nitrite	mg/L	0.01	0.02	0.01	3
Total Nitrate	mg/L	0.81	0.96	0.65	2
Total Kjeldahl Nitrogen	mg/L	1.07	1.45	0.55	3
Total Nitrite+Nitrate	mg/L	1.12	1.71	0.67	3
Total Phosphorus	mg/L	0.70	0.75	0.60	3
Ortho Phosphorus	mg/L	0.65	0.75	0.48	3
Total Organic Carbon	mg/L	11.5	16.0	7.8	7
Total Chloride	mg/L	13	17	8	3
Total Sulfate	mg/L	42	59	30	3
Dissolved Fluoride	mg/L	1.1	1.3	0.9	3
Beta-D as Cs 137	pCi/L	2.3	2.3	2.3	2
Alpha-D as U	µg/L	4.7	5.6	3.7	2
Beta-D as Sr 90	pCi/L	2.2	2.2	2.2	2
Alpha-S as U	pCi/L	0.6	0.6	0.6	1
Beta-S as Cs 137	pCi/L	0.4	0.4	0.4	1
Alpha-S as U	µg/L	0.9	0.9	0.9	1
Beta-S as Sr 90	pCi/L	0.4	0.4	0.4	1

Sources: EPA, 1991b.
ECT, 1991.
TEC, 1992a.

reservoir is designed to prevent significant thermal impacts, water temperature fluctuation still remains important for evaluating biological data and stresses on aquatic systems. The 5 years of data from EPA STORET (EPA, 1991b) show that temperature on the South Prong Alafia River at Bethlehem Road (Tampa Electric Company monitoring station SW-2) ranges from 11.8 to 30.0 degrees Celsius (°C) with a mean value of 24.1°C (Figure 3.2.3-1). The mean temperature data for Tampa Electric Company monitoring stations SW-1 through SW-3 at the South Prong Alafia River are generally about 1.0°C higher than the historical data at Bethlehem Road. This higher mean temperature is most likely the result of temperature anomaly during the monitoring period. The lowest temperature observed by Tampa Electric Company's monitoring program was 19.4°C at Station SW-4 (Payne Creek), and the maximum temperature was 30.4°C at SW-3. The temperature statistics for SW-2, based on long-term data, are probably representative of SW-3 because of their close proximity.

According to the EPA STORET data (EPA, 1991; TEC, 1992a), temperature has ranged from 11.0 to 27.5°C in Payne Creek near Bowling Green, Florida. The mean temperature was 21.7°C. Mean temperatures measured at Tampa Electric Company monitoring stations SW-4 (Payne Creek) and SW-5 (Little Payne Creek) were 25.6 and 27.0°C, respectively. Maximum temperatures of about 30°C were recorded at both stations.

Temperature data collected from Payne Creek and South Prong Alafia during 1981 through 1983 are presented in Figure 3.2.3-1. A comparison of the two streams during this period show similar seasonal variations; however, water temperature at the Payne Creek station during this period was generally cooler than at the Little Payne Creek station (TEC, 1992a).

The temperatures at SW-6 and SW-7 were quite similar, having mean values of 27.5°C and 27.6°C, respectively, according to the monitoring data. The temperature fluctuations in these two impoundments are relatively small, with a recorded range of less than 1.4°C during the monitoring period.

<u>Dissolved Oxygen</u>

DO concentration is often used as an indicator of the overall health of a water body. According to Class III water quality standards, DO concentrations shall not be less than 5 mg/L in predominantly fresh waters. DO was measured once at each station during each field trip. Because DO concentration is a function of a number of variables including temperature, photosynthetic, and respiratory activity, DO fluctuates daily as well as seasonally. To quantify daily variation, Tampa Electric Company conducted diurnal sampling during July and

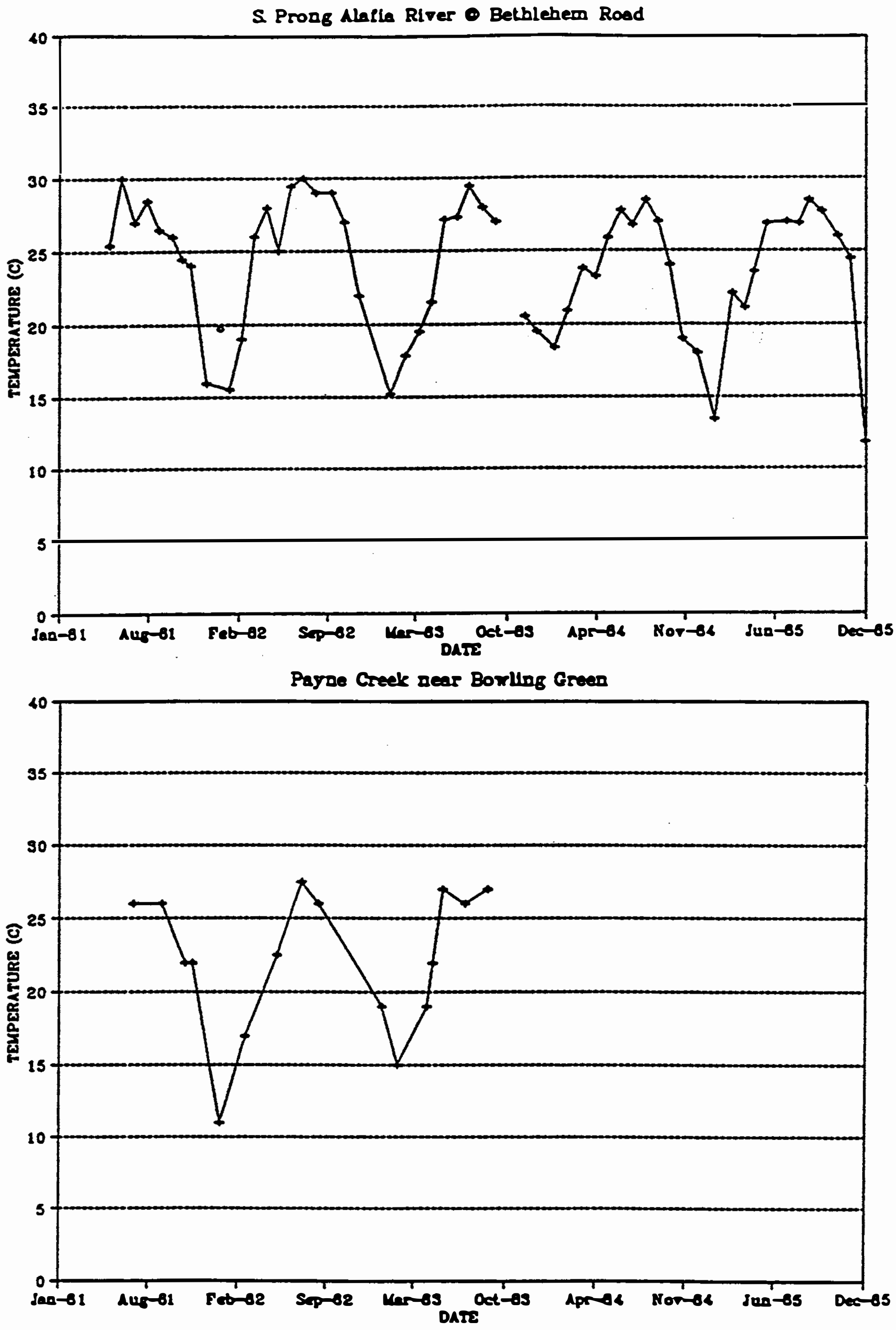

FIGURE 3.2.3-1.
Historical Water Temperature Data for South Prong Alafia River and Payne Creek.

SOURCES: EPA, 1991b; ECT, 1992; TEC, 1992a.

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August 1991. This diurnal sampling commenced before sunrise and concluded after sunset to obtain the envelopes of the daily maximum and minimum concentrations.

The results of the diurnal surveys for all Tampa Electric Company monitoring stations for July and August are presented in Figures 3.2.3-2 and 3.2.3-3. Because flowing streams and ponded waters exhibit different characteristic fluctuations in DO concentration, the results have been segregated into streams (Figure 3.2.3-2) and ponded water or waters with minimal observed flow (Figure 3.2.3-3) to aid in comparing similar types of water bodies. Although SW-4 is technically a stream, being in the headwaters of Payne Creek, the water was ponded at the time of the sampling. Therefore, the data for SW-4 are presented with the data from other ponded water stations (SW-6 and SW-7) located in impoundment areas. The summary of the DO diurnal data is shown in Table 3.2.3-12.

The diurnal DO concentration at SW-2 on July 2, 1991, ranged from 4.0 to 7.8 mg/L in the South Prong Alafia River, while DO concentrations at SW-3 ranged from 1.6 to 5.7 mg/L. The DO values at SW-1 were the highest among the stream stations with average values of 6.9 mg/L on July 2, 1991, and 6.4 mg/L on August 7, 1991. The high DO concentrations at SW-1 were probably due to the shallow depths (less than 6 inches). The DO fluctuation in stream stations on August 7, 1991, was less than that of July data. The DO concentrations remained at 4.8 mg/L most of the day at SW-2, and DO concentrations ranged from 3.3 to 4.9 mg/L at SW-3 on August 7, 1991.

The ponding of Payne Creek at SW-4 near its headwaters and the high organic content, evident from water color, probably account for the lowest DO concentrations recorded during the Tampa Electric Company water quality monitoring, including periods during which Payne Creek was anoxic. Diurnal DO concentrations at SW-4 ranged from 0.0 to 2.6 mg/L. The diurnal DO at Little Payne Creek (SW-5) fluctuated from 0.9 to 5.6 mg/L. The range of DO at SW-5 was noticeably higher than SW-4, probably due to presence of flowing water. Large fluctuations were observed at stations SW-6 (0.8 to 16.9 mg/L) and SW-7 (4.0 to 10.5 mg/L), the lake stations. The maximum values were observed during the afternoon when plant communities are producing oxygen. Low values occurred at early morning hours after a night of oxygen uptake by both plant and animal communities. These broad fluctuations indicate a very rich or possibly eutrophic aquatic system.

Monthly data at SW-6 and SW-7 showed high concentrations with mean values of 9.3 mg/L and 11.2 mg/L, respectively. These high concentrations are probably due to daytime sampling when photosynthetic activity is producing DO.

Historical DO data from STORET (EPA, 1991b; TEC, 1992a) for the South Prong Alafia River at Bethlehem Road and Payne Creek near Bowling Green are presented in Figure 3.2.3-4. DO concentrations exhibit a seasonal trend with lower concentrations occurring during the summer when higher water temperatures

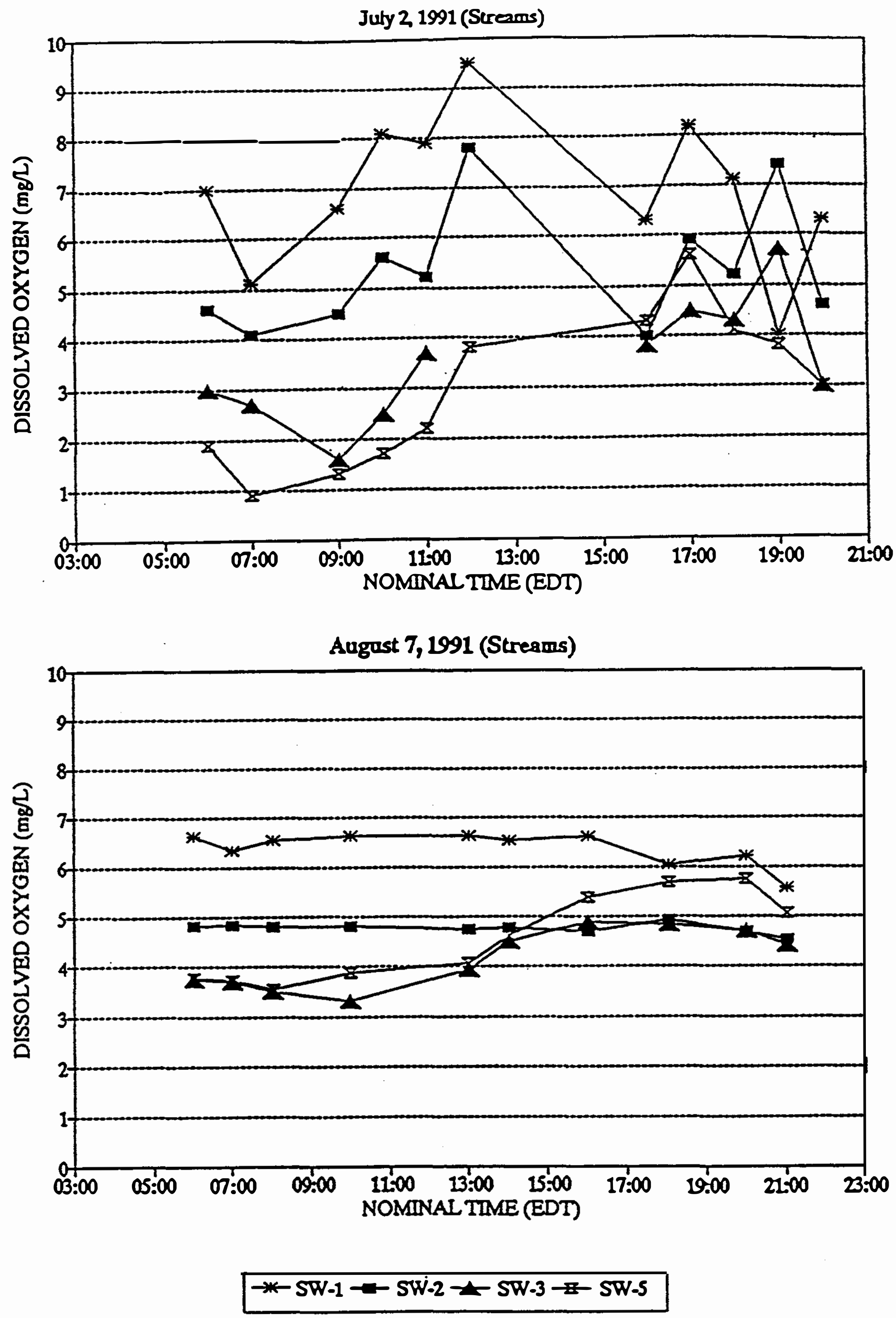

FIGURE 3.2.3-2.
Diurnal DO Concentrations at SW-1, SW-2, SW-3, and SW-5 (July, August 1991).

SOURCES: ECT, 1992; TEC, 1992a.

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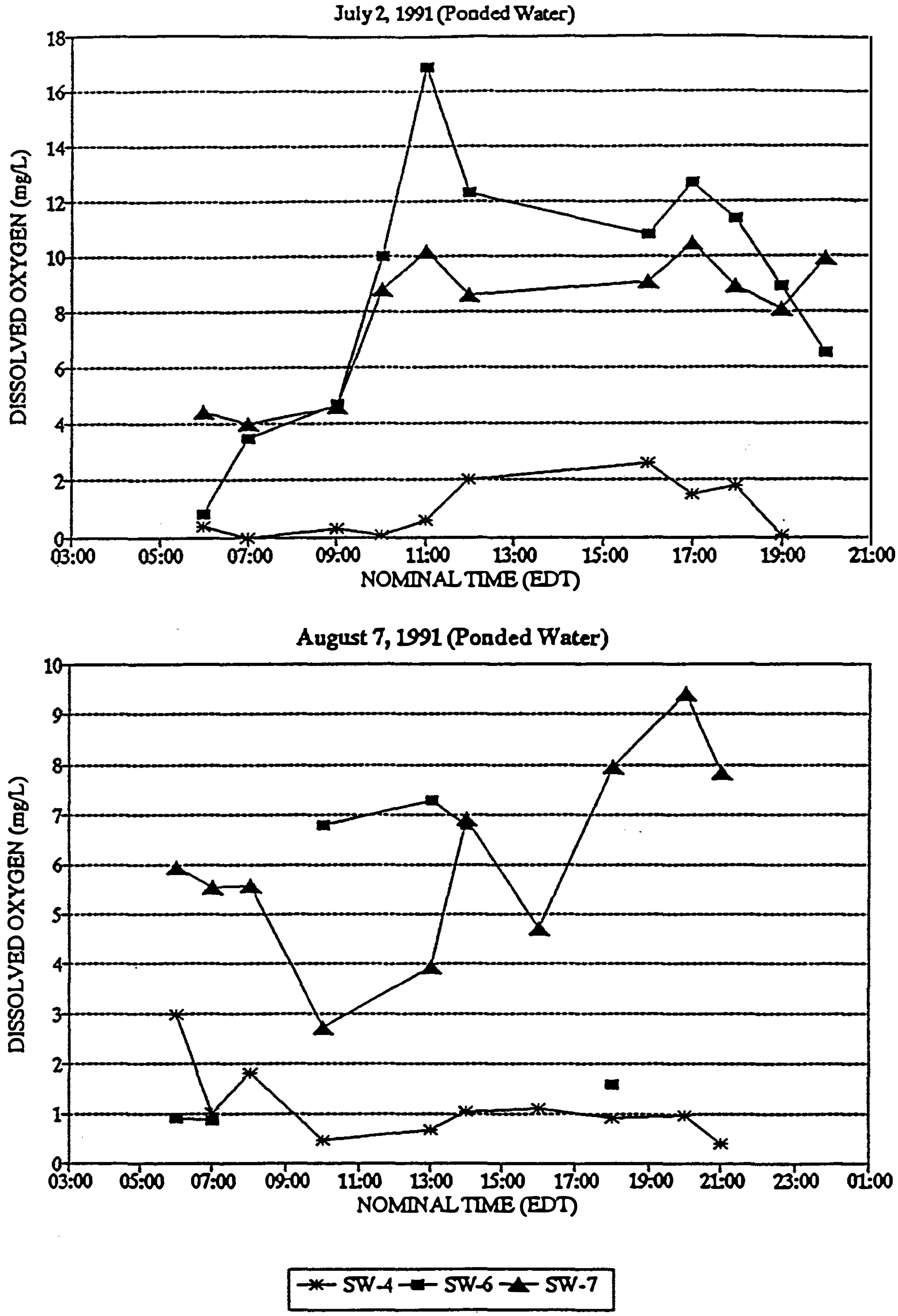

FIGURE 3.2.3-3.
Diurnal DO Concentrations at SW-4, SW-6, and SW-7 (July, August 1991).

SOURCES: ECT, 1992; TEC, 1992a.

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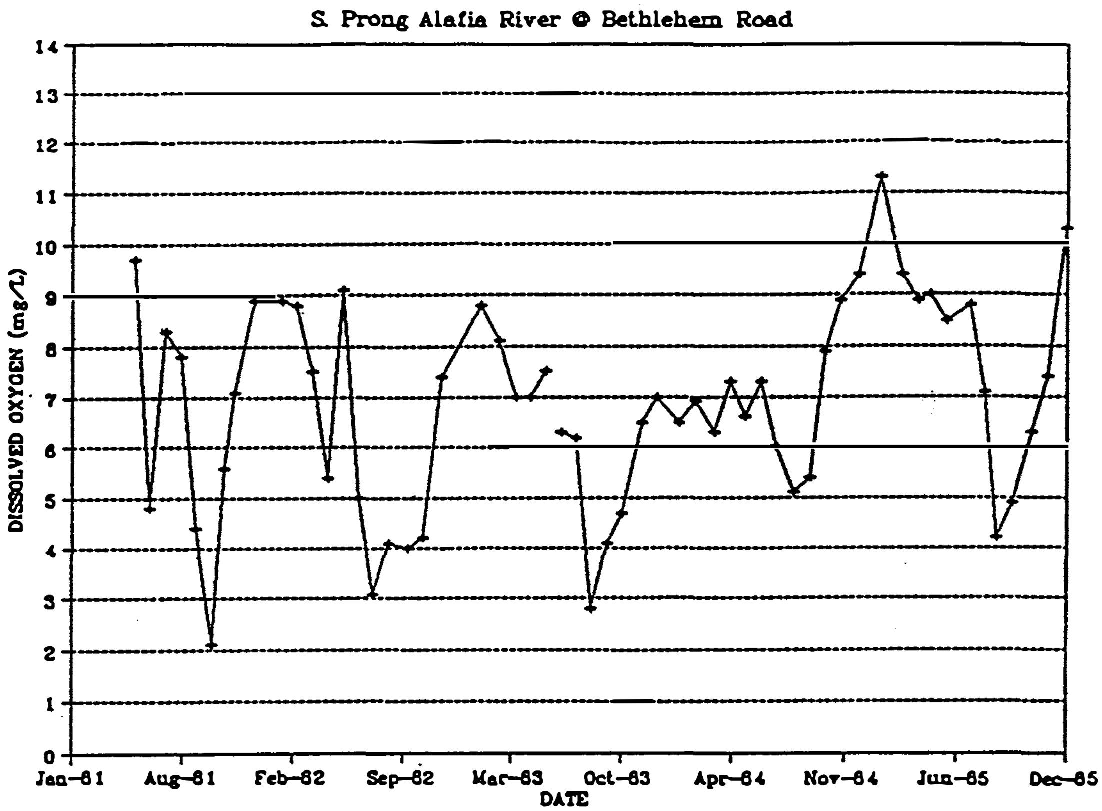
Table 3.2.3-12. Summary of DO Diurnal Data (mg/L)

	July 2, 1991			August 7, 1991		
Station	Average	Minimum	Maximum	Average	Minimum	Maximum
SW-1	6.9	4.0	9.5	6.4	5.6	6.6
SW-2	5.4	4.0	7.8	4.8	4.5	4.9
SW-3	3.5	1.6	5.7	4.2	3.3	4.9
SW-4	1.0	0.0	2.6	1.1	0.5	3.0
SW-5	3.0	0.9	5.6	4.6	3.6	5.8
SW-6	9.1	0.8	16.9	3.7	0.9	7.3
SW-7	8.1	4.0	10.5	6.1	2.7	9.4

Sources: ECT, 1992; TEC, 1992a.



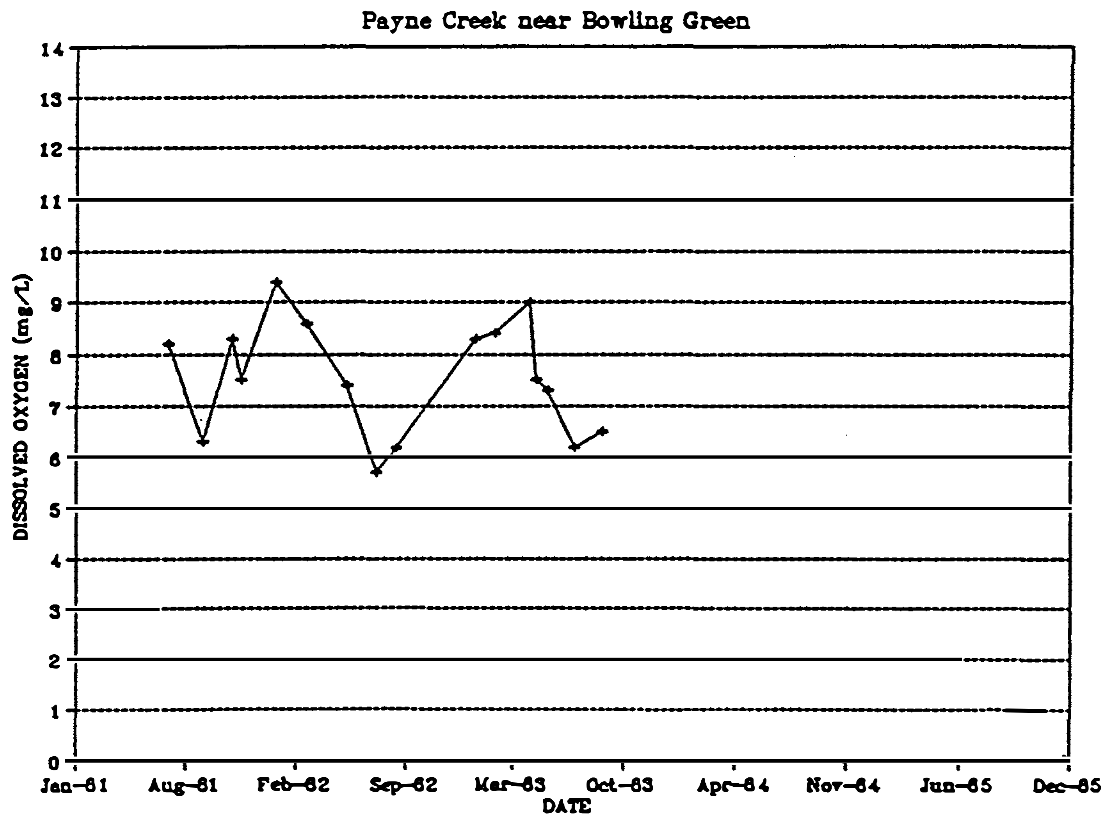


FIGURE 3.2.3-4. Historical DO Concentrations for the South Prong Alafia River and Payne Creek. SOURCES: EPA, 1991b; ECT, 1992; TEC, 1992a.	**U.S. Environmental Protection Agency, Region IV** ***Environmental Impact Statement***	**Polk Power Station** **Polk Count , Florida**

decrease oxygen solubility in water. Historical data for the South Prong Alafia River exhibit much greater variability than Tampa Electric Company monthly data, with DO concentrations ranging from about 2 to over 11 mg/L. Figure 3.2.3-4 showed that the DO concentration in Payne Creek near Bowling Green was relatively higher than South Prong Alafia River. South Prong Alafia River DO concentrations ranged from about 2 to 10 mg/L from June 1981 through August 1983, while the DO range at Payne Creek was about 5.7 to 9.4 mg/L. Although DO concentrations below 5 mg/L were observed ten times on the South Prong Alafia River, no DO values below 5 mg/L were observed in Payne Creek.

Biochemical and Chemical Oxygen Demand

Biochemical oxygen demand (BOD) is a measure of the quantity of DO required by microbial organisms as they decompose organic matter that occurs naturally or is generated by human activities over a 5-day incubation period. High BOD is normally indicative of poor water quality. The 5-day BOD data for Tampa Electric Company monitoring stations SW-1 through SW-7 are summarized in Tables 3.2.3-2 through 3.2.3-8.

According to FDEP (FDER, 1989; TEC, 1992a), the median BOD for Florida streams is 1.5 mg/L. The maximum (95th) percentile corresponds to a 5-day BOD of 7.0 mg/L. At stations SW-1 and SW-2, the mean 5-day BOD levels of 3 mg/L are near FDEP's 80th percentile for Florida streams. The mean 5-day BOD at SW-3, 4 mg/L, falls into the 90th percentile for Florida streams. Maximum 5-day BODs for the South Prong Alafia River ranged from 7 mg/L (SW-2) to 10 mg/L (SW-3), both of which are at or beyond the 95th percentile rank. FDER/PSES reported maximum values for SW-2 and SW-3 of 9.7 and 1.2 mg/L, (30th and 40th percentile), respectively. The lower value of 1.2 mg/L, however, is based on only two samples. EPA (1991) reported a maximum BOD of 7.1 mg/L on the South Prong Alafia River at Bethlehem Road (SW-2).

The mean 5-day BOD at SW-4 of 4 mg/L, while between the 80th and 90th percentile for Florida streams (FDER, 1989; TEC, 1992a), is only in the middle of the range of BODs observed by Tampa Electric Company. BOD alone probably does not account for the low DO concentrations measured in Payne Creek at SW-4. The highest color and acidity levels were observed at SW-4, which would inhibit photosynthesis. The observed high chemical oxygen demand (COD) also would contribute to the low DO concentrations. Although the mean 5-day BOD in Little Payne Creek at SW-5 of 7 mg/L was higher than the mean BOD at SW-4, the mean DO concentration of 4.9 mg/L was considerably higher. Little Payne Creek at SW-5, however, is a flowing stream with the lowest mean color and lower acidity and COD values and, therefore, higher DO concentrations (TEC, 1992a).

Mean 5-day BOD levels were considerably higher at SW-7 (14 mg/L) than at SW-6 (9 mg/L). Both of these values are beyond the 95th percentile for Florida lakes. The maximum BOD at SW-7 (20 mg/L), and in fact the highest 5-day BOD observed at any station, was twice as high as the maximum observed at SW-6. CODs were also higher at SW-7 with a mean of 72 mg/L compared with SW-6 (58 mg/L).

Hydrogen Ion Activity (pH)

The pH of water in the South Prong Alafia River ranged between 6.0 and 7.6. The unnamed tributary to the South Prong typically had lower pH values, ranging between 4.5 and 6.7.

Because pH represents the common log of the concentration of the hydrogen ion, the mean must be calculated from the anti-log of the individual pHs (TEC, 1992a). Using this approach, the mean pH for SW-2 and SW-3 was 6.7 and 6.5, respectively; the mean pH for SW-1 was 5.2. Although the pH values measured at SW-1 are lower than 6.0 (the minimum numerical FDEP Class III standard for pH) 40 percent of the time, it could be demonstrated that the natural background pH is best represented by the mean value of 5.2. Therefore, a violation of the standard would occur only when pH was less than 5.2, based on Tampa Electric Company's monitoring data. According to FDEP (FDER, 1989; TEC, 1992a), pH values between 4 and 5 are not unusual in Florida's blackwater streams, as exhibited by SW-1. These low pH values result from the decomposition of organic matter to form the so-called humic acids or complex organic acids.

On the Payne Creek (SW-4) and Little Payne Creek (SW-5) the mean pH was 6.5 and 6.3, respectively. The observed pH values consistently fell within the range of 6.0 to 8.5. This was not the case at stations SW-6 and SW-7 where maximum pH values of 9.4 were observed at both stations. The mean pH values, however, were 8.5 and 8.4 for stations SW-6 and SW-7, respectively.

Alkalinity

Alkalinity is a measurement of the components in water that tend to elevate pH and act as buffers against increases in acidity. The basic components which contribute to alkalinity in water are carbonate, bicarbonates, phosphates, and hydroxides. Except for waters with high pH values (i.e., greater than 9.5) or other unusual waters, the alkalinity of water can be considered the result of dissolved bicarbonate and carbonate. Normally alkalinity is reported in terms of the equivalent amount of $CaCO_3$ (mg/L as $CaCO_3$).

The lowest alkalinity values were measured on the unnamed tributary to the South Prong Alafia River (SW-1). Alkalinity at this station ranged between 3 and 17 mg/L with a mean value of 10 mg/L. All five measurements at SW-1 were lower than the Class III standard of greater or equal to 20 mg/L. Alkalinity values at all of the remaining stations were above the Class III standard. The mean alkalinity values at the two South Prong Alafia River stations SW-2 and SW-3 were 75 and 84 mg/L, respectively.

Payne Creek (SW-4) alkalinity values ranged between 26 and 93 mg/L with a mean value of 66 mg/L. Little Payne Creek (SW-5) had higher alkalinity values with a mean of 92 mg/L.

The mean alkalinity values in the reclaimed lake (SW-6) and the old mine cut (SW-7) were 82 and 67 mg/L, respectively.

Color

The coloration of surface waters occurs naturally as a result of decomposition of organic matter. The median color in Florida's streams is 70 Platinum Cobalt (Pt-Co) color units; color in excess of about 140 Pt-Co units occurs 20 percent of the time (FDER, 1989; TEC, 1992a). Mean color at SW-2 and SW-3 was 77 and 89 Pt-Co units, respectively. The mean color of 144 Pt-Co units at SW-1 falls within the 80th percentile. Organic decomposition and limited agricultural activities in the vicinity of SW-1 are probable causes of elevated color observed at this station.

The highest mean color (263 Pt-Co units) and maximum color (400 Pt-Co units) values were observed in the headwaters of Payne Creek at SW-4, indicating a high organic content at this station. These values are well above the median color (140 Pt-Co units) reported for Florida's streams by FDEP (FDER, 1989). Conversely, SW-5, along with SW-6 discussed below, had the lowest color values observed. The mean and maximum color values for SW-5 were 43 and 75 Pt-Co units, respectively. These low color values indicate relatively low organic content and, given the fact that these waters drain from mined out areas, is expected.

Color was significantly different between stations SW-6 and SW-7. SW-7 was more colored with a mean color of 111 Pt-Co units compared with SW-6 with a mean color of 48 Pt-Co units. This suggests that there was more organic material in the waters of the old mine cut (SW-7).

Total Suspended Solids

According to FDEP (FDER, 1990a; TEC, 1992a), TSS have been identified as a problem in the South Prong Alafia River. Moreover, without mitigative measures, TSS could be affected during construction. Based on the data collected by Tampa Electric Company (TEC, 1992a), it is apparent that, although TSS were usually below about 40 mg/L, concentrations as high as 120 mg/L were observed. The highest TSS concentration was observed at station SW-3 located on the South Prong Alafia River.

FDEP (FDER, 1990a; TEC, 1992a) data indicate that TSS are not a problem for Payne Creek and Little Payne Creek. The mean values observed by Tampa Electric Company, 18 and 6 mg/L for SW-4 and SW-5, respectively, support this assessment. Nevertheless, the value for SW-4 is in the 80th percentile for Florida's streams (FDER, 1989; TEC, 1992a) and the mean value for SW-5 is in the 40th percentile.

The mean TSS concentration of 23 and 33 mg/L for SW-6 and SW-7 were higher than some of the other Tampa Electric Company stations. The maximum of 50 mg/L at these stations, however, was well below the maximum value of 120 mg/L observed by Tampa Electric Company at SW-3.

Nutrients and Chlorophyll

Nutrients are mentioned consistently by FDEP (FDER, 1990a; TEC, 1992a) as contributing to water quality problems in surface waters near the proposed Polk Power Station site, including the South Prong Alafia River and Payne Creek systems. According to 5 years of STORET data (EPA, 1991b; TEC, 1992a) for the South Prong Alafia River at Bethlehem Road (SW-2), the mean total nitrogen concentration, which includes organic nitrogen, nitrates, nitrites, and ammonia, was 1.50 mg/L, which falls within the 65th percentile for Florida streams (FDER, 1989; TEC, 1992a). According to the EPA STORET data and Tampa Electric Company's data, nitrates or nitrates plus nitrites and total organic nitrogen were the primary nitrogen species present. Mean nitrate concentrations at SW-2 and SW-3 were 0.9 and 0.6 mg/L, respectively. Although there was very little nitrogen measured as nitrite at SW-2, nitrite was a major component at SW-3 with a mean concentration of 0.28 mg/L. Time series plots of total organic nitrogen and ammonia for the South Prong Alafia River are presented in Figure 3.2.3-5.

Phosphate mining activities in the region have contributed to the elevated phosphorus concentrations observed in the vicinity of the South Prong Alafia River. Mean concentrations measured by Tampa Electric Company range from 0.82 (SW-1) to 1.28 mg/L (SW-3). These values fall within the 90th percentile of FDEP's data (FDER, 1989; TEC, 1992a). The median values reported by FDEP for Florida streams was 0.11 mg/L. Total phosphorus (TP) concentrations considerably higher than the maximum recorded by Tampa Electric Company, 1.70 mg/L (SW-2), have been reported by EPA (1991b; TEC, 1992a). The highest concentration reported by FDER/PSES, 16.4 mg/L, is nearly an order of magnitude higher than TP reported by Tampa Electric Company for the South Prong Alafia River (SW-2).

Chlorophyll was not measured by Tampa Electric Company. According to long-term historical data compiled from the STORET database (EPA, 1991b; TEC, 1992a), the mean chlorophyll *a* concentration in the South Prong Alafia River at Bethlehem Road was 4.3 micrograms per liter (µg/L); the mean total chlorophyll concentration was 10.4 µg/L. FDER/PSES reports a lower mean chlorophyll *a* value of 1.42 µg/L at this same location; however, this mean is based on only five samples. At FDER/PSES Station S3, which is upstream of the proposed Polk Power Station site, chlorophyll *a* values as high as 32.90 µg/L were reported. A time-series plot of total chlorophyll, along with selected nutrients, is presented in Figure 3.2.3-5.

The mean TP concentration on Payne Creek at SW-4 (0.71 mg/L) was about twice as high as the mean for the Little Payne Creek station SW-5 (0.49 mg/L). Mean total organic nitrogen values for SW-4 and SW-5 were 1.34 and 1.01 mg/L, respectively. These values are consistent with the STORET data (EPA, 1991b; TEC, 1992a) with mean TP and organic nitrogen concentrations for Payne Creek near Bowling Green of 0.70 and 1.2 mg/L, respectively. These means, however, are based on only three and two samples.

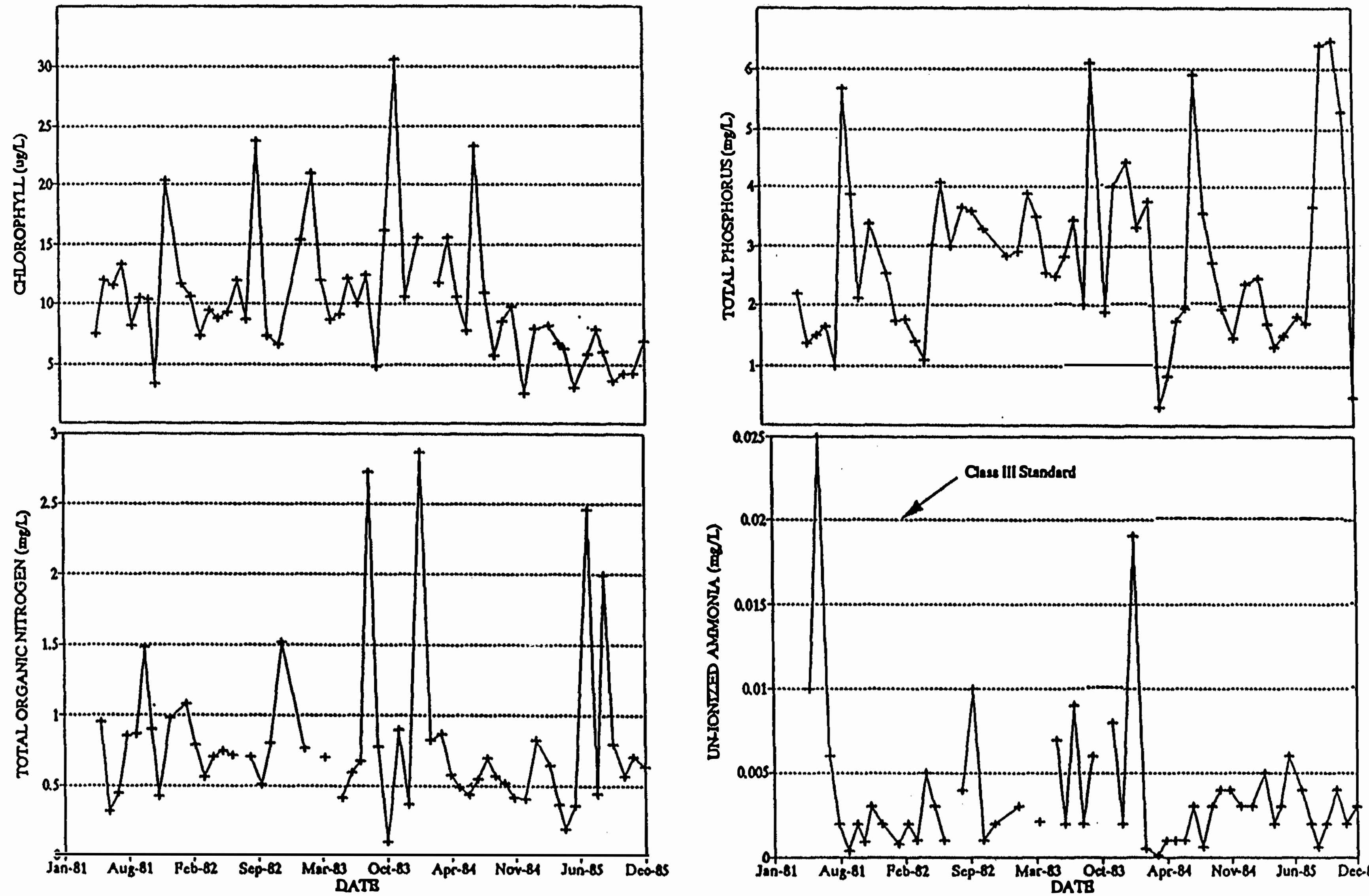


FIGURE 3.2.3-5.
Historical Chlorophyll and Nutrient (Total Organic Nitrogen, Un-Ionized Ammonia, and Total Phosphorus) Concentrations on the South Prong Alafia River at Bethlehem Road.

SOURCES: EPA, 1991b; ECT, 1992; TEC, 1992a.

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The most significant difference between SW-7 and SW-6 and, for that matter, any of the other Tampa Electric Company monitoring stations, is the total organic nitrogen and TP levels. The mean total organic nitrogen concentration for SW-7 of 2.73 mg/L is 1.5 times greater than the next highest mean concentration of 1.64 mg/L (SW-6). The difference in TP concentration is even more pronounced with the mean concentration at SW-7 of 4.52 mg/L, over 3.5 times higher than the next highest mean TP concentration (SW-3).

The concentration of un-ionized NH_3 at SW-7, in three occasions exceeded Florida Class III water quality standards. Other nutrient forms do not have numerical standards, but are prohibited from causing nuisance conditions under Rules 17-302.500 and 17-302.510, FAC. None were observed during the monitoring period.

Metals

For the most part, metals were below the method detection limits; however, there were occasional exceptions. For example, iron, which was generally below the method detection limit at most of the stations, was occasionally above the method detection limit at SW-1 and SW-3 (Tables 3.2.3-2 and 3.2.3-4), but well below the Class III water quality standard of 1.0 mg/L.

Of the trace metals, only lead and silver were observed above the method detection limits at stations SW-1, SW-2, and SW-3 (Table 3.2.3-2 through 3.2.3-4). The Class III standard for lead was exceeded at all stations at least once. The maximum silver concentrations at stations SW-1 through SW-3 were either at or just below the Class III standard for silver (0.07 μg/L).

Tampa Electric Company station at Payne Creek (SW-4) consistently had iron concentrations above the method detection limit (Table 3.2.3-5). Both the maximum and mean exceed the Class III standard. Normally, iron precipitates readily in the presence of oxygen; however, given the low DO concentrations and high acidity and color, iron is more soluble. The high organic content of the water at SW-4, as indicated by high color, would tend to stabilize this soluble iron. At SW-5 (Little Payne Creek), iron was consistently below the method detection limits. Manganese was observed only at SW-4 and only once in March 1991 (0.07 mg/L).

Like the South Prong Alafia River stations (SW-1 through SW-3), lead and silver were the only trace metals observed in Payne Creek and Little Payne Creek (SW-4 and SW-5). Lead was observed at these stations, and all other stations, only during March and silver only during February. During the months in question, the method detection limits were significantly lower than the standard. There were violations of the lead standard at both stations. At SW-4 in February, silver was above the Class III standard of 0.07 μg/L. This was the only time at any station that silver exceeded the Class III standard.

Iron was below the method detection limits at stations SW-6 and SW-7. Like the other Tampa Electric Company stations, silver and lead were above the method detection limit only during February and March, respectively. Lead exceeded the Class III standard at SW-6 and SW-7.

Other Priority Pollutants, Organic Compounds, and Pesticides

Other than the aforementioned trace metals, all other priority pollutants at all Tampa Electric Company stations were below the method detection limits. A special sampling was conducted in March 1992 to sample surface waters for cyanide. The analytical technique used incorporated the latest sampling and analysis methods outlined by FDEP. According to the results from this sampling, cyanide was below the method detection limit of 0.02 mg/L. Organics such as phenols, phthalates, polychlorinated biphenyls (PCBs), and pesticides also were below the method detection limits.

Bacteria

Tampa Electric Company did not sample for bacteria and thus, relied solely on long-term historical data to characterize this group of organisms. The geometric mean for total and fecal coliform bacteria on the South Prong Alafia River at Bethlehem Road is 752 and 191 per 100 milliliters (mL) (Table 3.2.3-10). Compared with coliform data for streams provided by FDEP (FDER, 1989; TEC, 1992a), the total and fecal coliform values lie between the 50th and 60th percentiles and the 60th and 70th percentiles, respectively.

Radioactive Substances

The mean values for Radium 226 ranged from 0.5 to 1.4 pico Curies per Liter (pCi/L); for Radium 228, 1.0 to 1.3 pCi/L, and for gross alpha 1.7 to 3 pCi/L. The Radium 226 standard was exceeded one time at SW-6. The standard for Radium 228 was exceeded once at SW-2, SW-3, and SW-4. There were no violations of the gross alpha standard.

3.3 GROUNDWATER RESOURCES

This section describes the existing groundwater resources in the Polk County area and in the vicinity of the proposed Polk Power Station site.

3.3.1 Regional Groundwater Systems

The groundwater aquifer systems in Polk County include, in descending order, the surficial aquifer (usually unconfined), intermediate aquifer (usually semi-confined to confined), and the Floridan aquifer (usually confined). The confining units of the intermediate aquifer system separate the aquifers from one another, including the upper and lower intermediate aquifers. In southwest Polk County, the surficial aquifer and upper intermediate are hydraulically interconnected as are the lower intermediate and Floridan aquifers. However, the two upper aquifers are not in good hydraulic connection to the two lower aquifers (TEC, 1992a).

3.3.2 Site Groundwater Systems and Quality

3.3.2.1 Shallow Aquifer

The surficial aquifer is composed of the undifferentiated sands and clays, plus the upper sandy section of the Bone Valley member of the Peace River Formation. Precipitation at the site averages approximately 53 inches per year. The amount of precipitation that serves to recharge the surficial aquifer is affected by storm water runoff and evapotranspiration. Runoff and evapotranspiration may account for more than 90 percent of the precipitation received by the land surface, the remainder recharges the surficial aquifer.

A network of five polyvinyl chloride (PVC) observation wells (three 4-inch diameter monitor wells and two 2-inch diameter piezometers) were used by Tampa Electric Company (TEC, 1992a) to monitor the groundwater levels within the surficial aquifer of the proposed Polk Power Station site. Figure 3.3.2-1 shows the locations of the groundwater monitoring stations. The site observation wells were all located east of SR 37. These wells had either 10- or 15-ft screens that were placed to intercept the water table. Groundwater levels across the site ranged from approximately 130 to 144 ft-NGVD. The water table fluctuation was approximately 4 to 6 ft from the end of the dry season to the end of the wet season. The hydrograph presented in Figure 3.3.2-2 shows the time-dependent surficial aquifer water level fluctuations from the five observation wells. Figure 3.3.2-3 shows the groundwater contours for the surficial aquifer on May 20, 1991. Table 3.3.2-1 summarizes the groundwater level measurements for all observation wells and aquifers monitored. Permeability tests (short duration pump and recovery tests) were conducted on all 4-inch diameter monitor wells within the surficial and intermediate aquifer systems. Table 3.3.2-2 summarizes the permeability test and hydraulic conductivity calculations for the surficial aquifer. The hydraulic conductivity data ranged from 5 to 11 feet per day (ft/day).

In addition to the groundwater contours, Figure 3.3.2-3 illustrates the approximate location of a historic groundwater divide. The groundwater divide location is roughly colocated with a surface water drainage

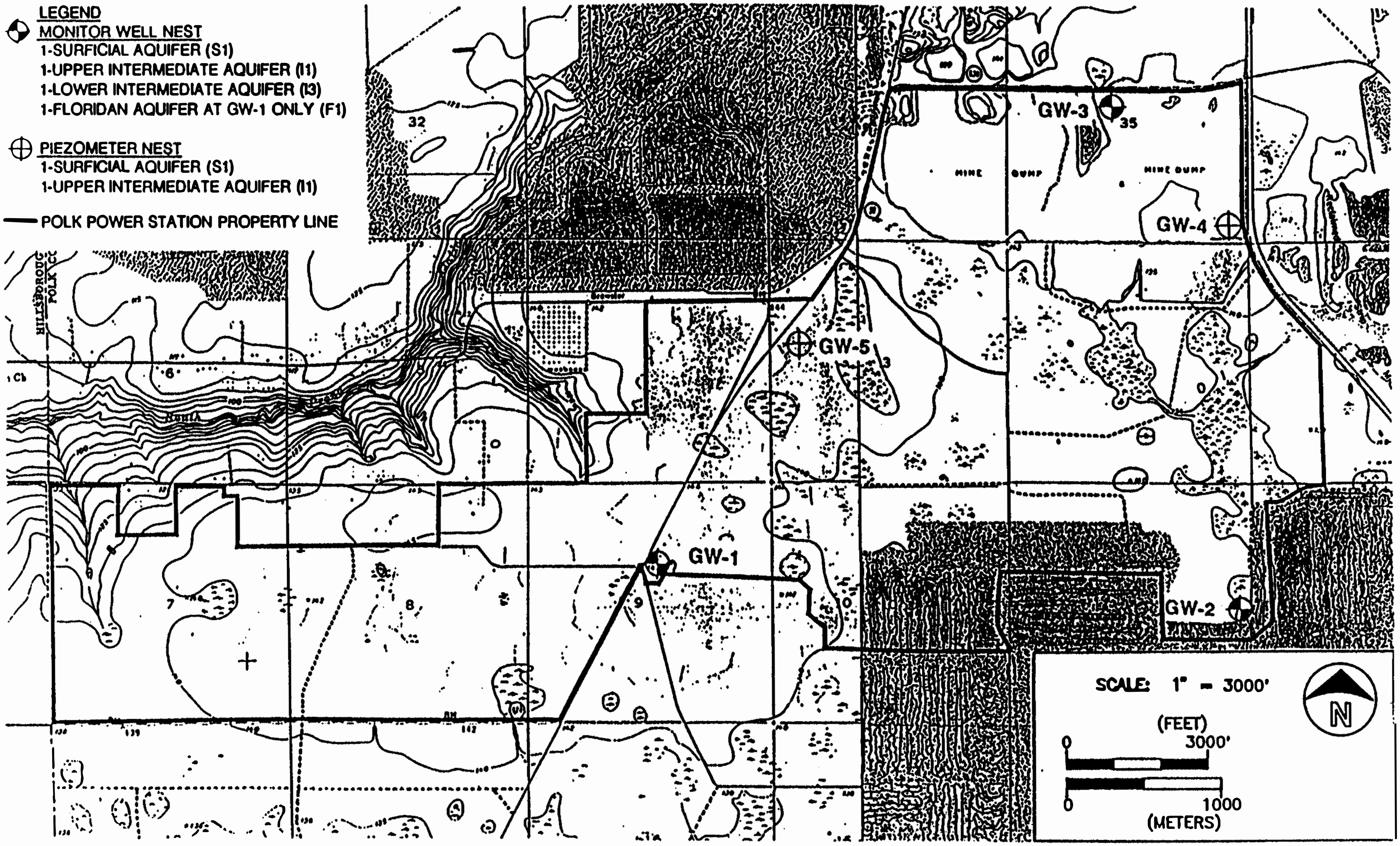

FIGURE 3.3.2-1.
Groundwater Monitoring Station Location Map.

SOURCES: USGS Duette NE, FL, 1972; Baird, FL, 1987; ECT, 1992; TEC, 1992a.

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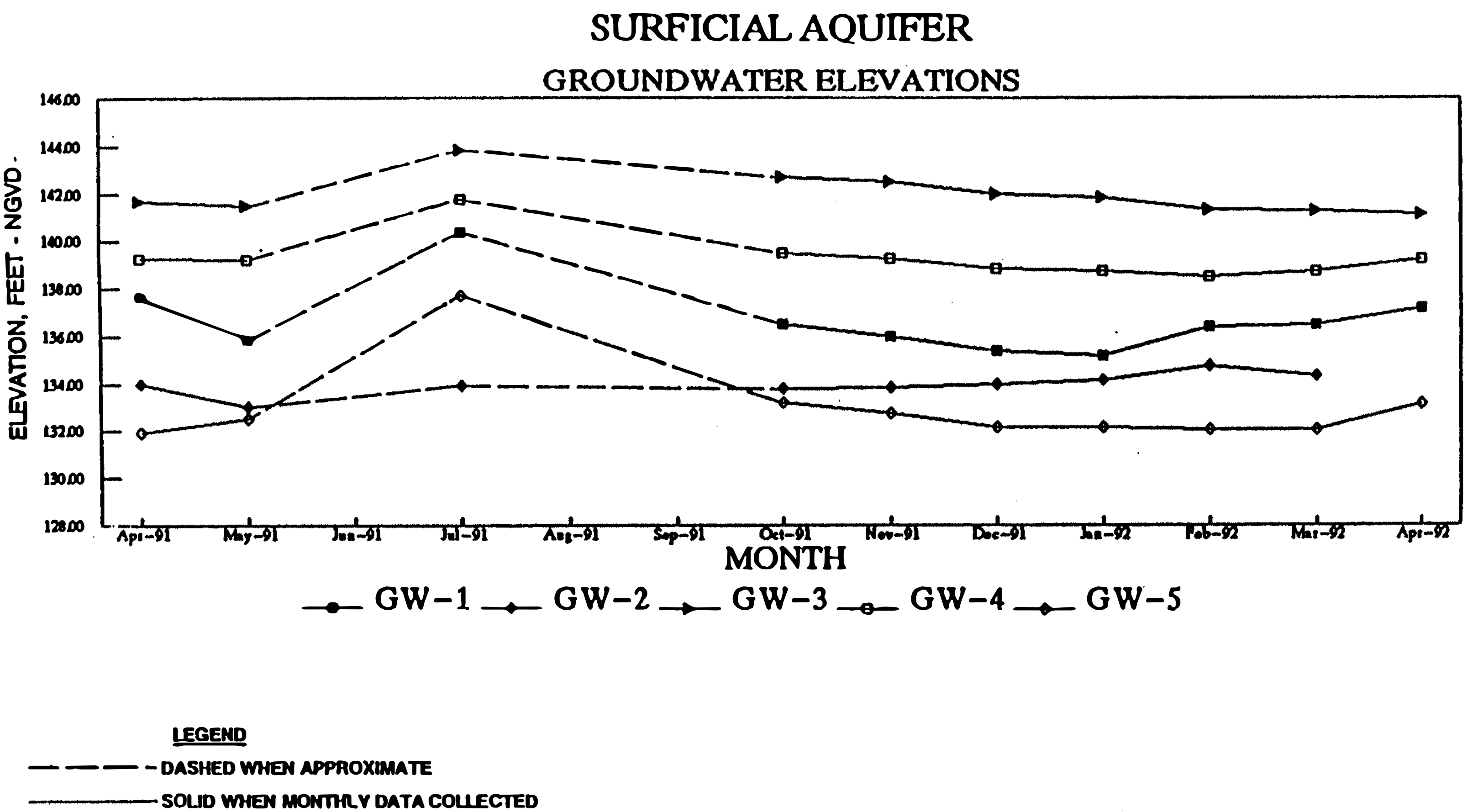

FIGURE 3.3.2-2.
Hydrograph for Surficial Aquifer.

SOURCES: ECT, 1992; TEC 1992a.

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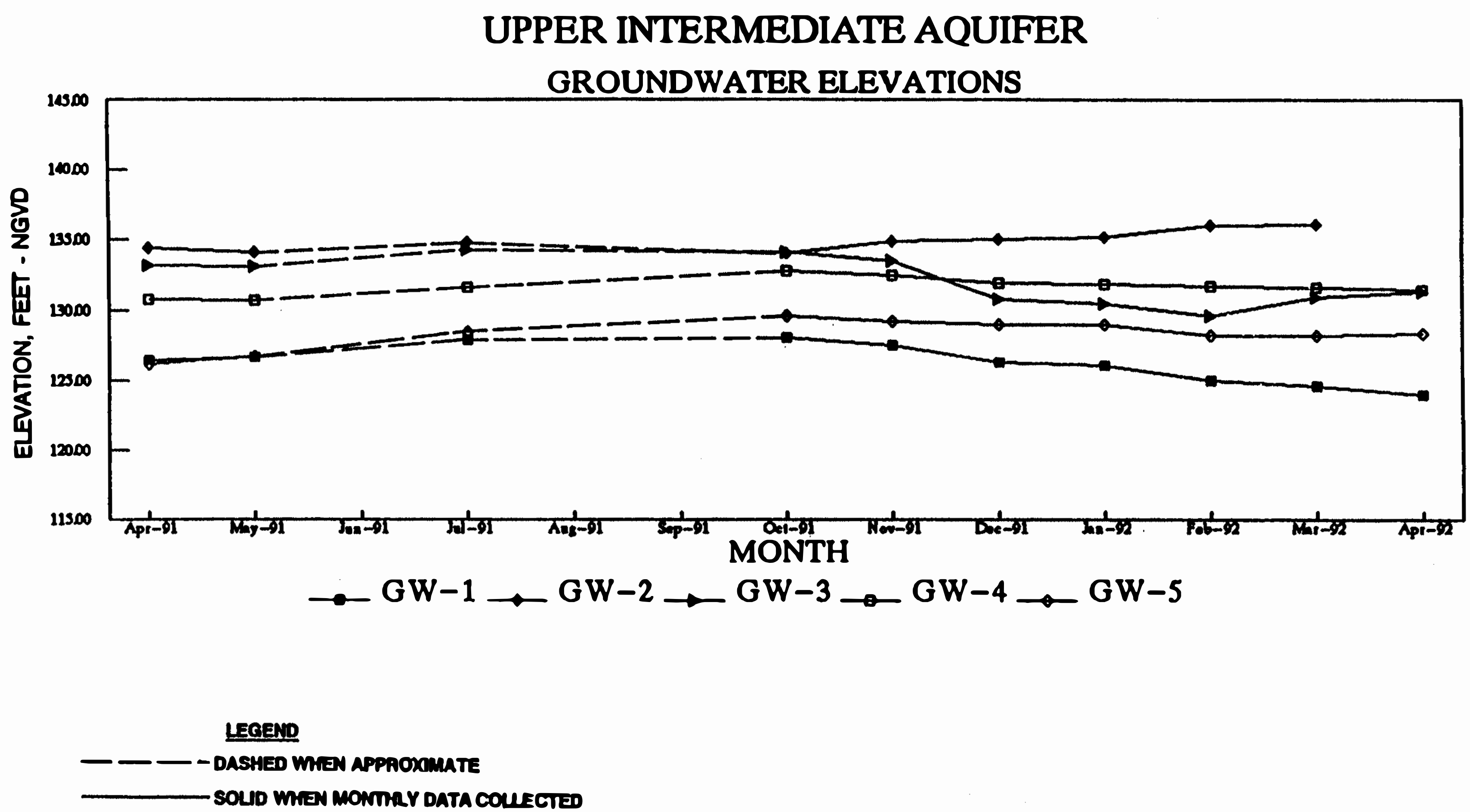

FIGURE 3.3.2-4.
Hydrograph for Upper Intermediate Aquifer.

SOURCES: ECT, 1992; TEC, 1992a.

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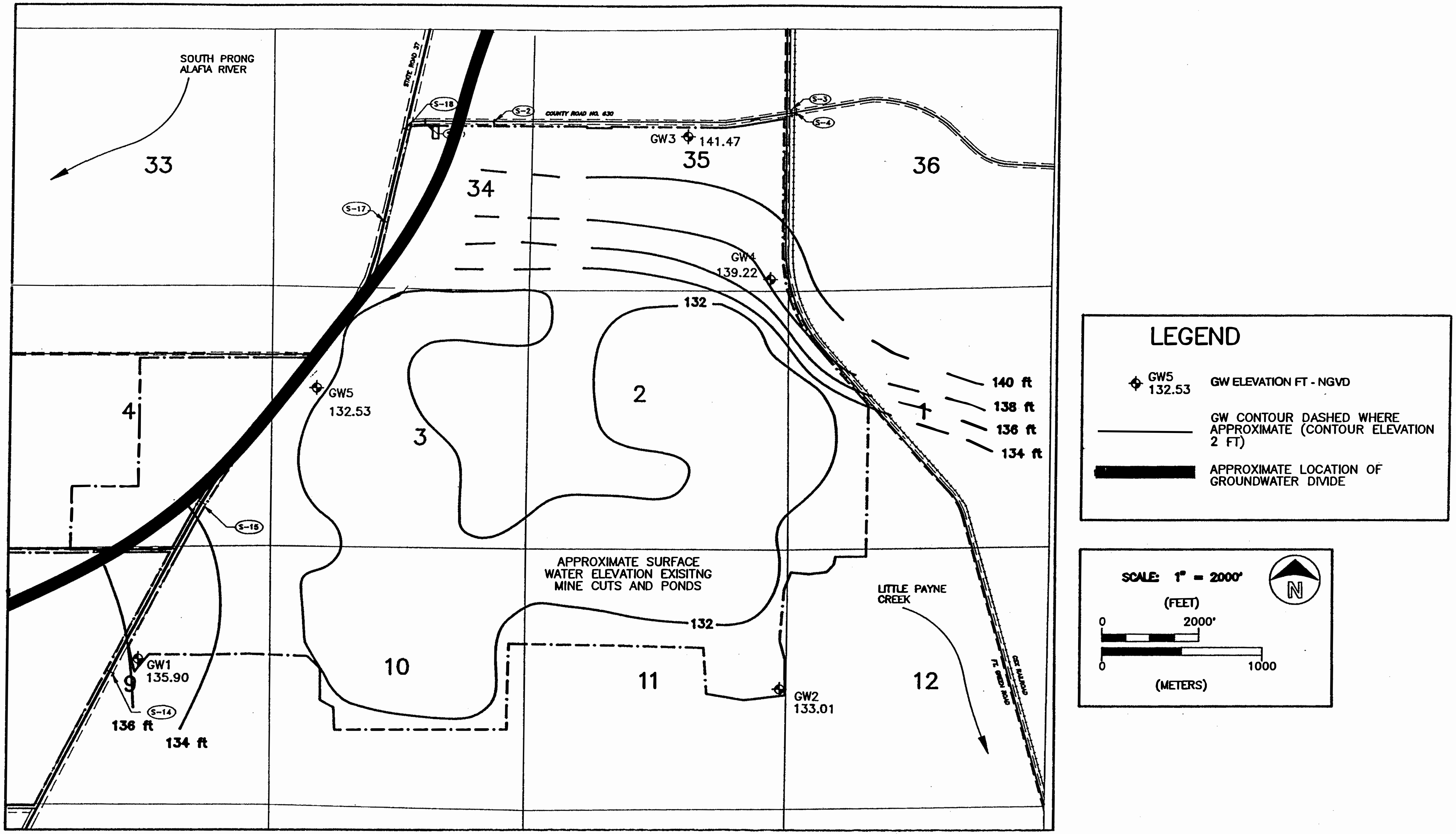

FIGURE 3.3.2-3.
Groundwater Contour Map of Surficial Aquifer - May 1991.

SOURCES: ECT, 1992; TEC 1992a.

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Table 3.3.2-2. Summary of Hydraulic Conductivity Results

Monitor Well		Flow (gpm)	Flow (cfm)	Change in Head - dh (ft)	Change in Time - dt (minutes)	Transmissivity (ft^2/min)	Transmissivity (ft^2/day)	Aquifer Thickness (ft)	Hydraulic Conductivity (ft/day)	Method of Analysis
GW1	S1-R			6.43	0.0 to 6.5		238.0	34.0	7.0	Bouwer and Rice
	I1-D	2.70	0.36	6.07	0.2 to 2.0	$1.1x10^{-2}$	15.7			Jacob St. Line
	I1-R	2.70	0.36	6.33	1.0 to 10.0	$1.0x10^{-2}$	15.0			Jacob St. Line
	I3-D	*								
	I3-R	*								
GW2	S1-R			3.99	0.0 to 7.0		189.0	35.0	5.4	Bouwer and Rice
	I1-D	4.30	0.57	61.50	2.0 to 20.0	$1.7x10^{-3}$	2.5			Jacob St. Line
	I1-R	4.30	0.57	39.00	5.0 to 50.0	$2.7x10^{-3}$	3.9			Jacob St. Line
	I3-D	*								
	I3-R	*								
GW3	S1-R			3.99	0.0 to 7.0		328.6	31.0	10.6	Bouwer and Rice
	I1-D	3.00	0.40	35.80	2.0 to 20.0	$2.1x10^{-3}$	3.0			Jacob St. Line
	I1-R	3.00	0.40	24.00	20.0 to 200.0	$3.1x10^{-3}$	4.4			Jacob St. Line
	I3-D	3.30	0.44	31.20	2.0 to 20.0	$2.6 x 10^{-3}$	3.7			Jacob St. Line
	I3-R	3.30	0.44	26.90	4.0 to 40.0	$3x10^{-3}$	4.3			Jacob St. Line

Note: cfm = cubic feet per minute.
ft^2/min = square feet per minute.
S1 = surficial aquifer.
I1 = upper intermediate aquifer.
I3 = lower intermediate aquifer.
R = recovery test.
D = drawdown test.

* Erratic data due to electronic interference, unable to analyze.

Sources: ECT, 1992; TEC, 1992a.

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divide. The surface/ground water divide, as shown, does not agree completely with the groundwater contours, particularly where it approaches the 132-ft depressional contour that encircles the existing mine cuts on the Polk Power Station site. The divide and contours are intended to be only approximate in location. Groundwater north of the divide flows to the South Prong Alafia River. Groundwater south of the divide flows to Little Payne Creek. Hydraulic gradients within the surficial aquifer ranged from approximately 0.0007 to 0.007 foot per foot (ft/ft). The estimated linear groundwater flow velocities for the surficial aquifer may range from approximately 0.001 to 1.0 ft/day (SWFWMD, 1987).

Average aquifer characteristics from 10 surficial aquifer tests within a 15-mile radius of the site were obtained from SWFWMD (1988; TEC, 1992a) and summarized in Table 3.3.2-3. In accordance with guidance from SWFWMD, the arithmetic mean was used to characterize the aquifer. For the surficial aquifer, average values of transmissivity and specific yield are 1,223 square feet per day (ft^2/day) and 0.11 or 11 percent, respectively. The horizontal conductivity may range from 10 to 100 times greater than vertical hydraulic conductivities.

The surficial aquifer is subject to FDEP Class G-II groundwater quality criteria (Chapters 17-520 and 17-550, FAC). The groundwater quality of the surficial (water table) aquifer is dependent on the chemical constituents within the rainfall and surficial sediments. Based on the Ambient Groundwater Quality Monitoring Program conducted by SWFWMD (1988; TEC, 1992a), several regional trends were presented by Tampa Electric Company (TEC, 1992a) for background quality:

- Total dissolved solids (TDS), <250 mg/L;
- Total hardness, <25 mg/L;
- Chlorides, <25 mg/L; and
- Sulfates, <25 mg/L.

Additional background groundwater quality data for Polk County was obtained from the FDEP groundwater quality monitoring program. The data for the surficial aquifer is summarized in Table 3.3.2-4. Site-specific groundwater quality from the surficial aquifer was determined by Tampa Electric Company (TEC, 1992a) from a sampling event in May 1991. The groundwater quality results for the surficial aquifer are summarized in Table 3.3.2-5. Exceedances of the primary and secondary drinking water standards included lead, iron (GW1, GW2, and GW3), and gross alpha with Radium 226 and 228 (GW2 and GW3). The FDEP data for Polk County (TEC, 1992a) also indicated exceedances of the lead and iron standards as well as the standards for cadmium and mercury. The mean concentration of lead at the site was less than the mean for the FDEP report, and the concentration for iron was less than the mean plus one standard deviation in the county report. It is not known whether the conditions leading to these water quality exceedances are natural or man-induced.

Table 3.3.2-3. Aquifer Characteristic Test Data (15-mile radius)

Aquifer	Minimum	Maximum	Average
Surficial (10 tests)			
Transmissivity (ft^2/day)	254	2,393	1,223
Specific yield (ND)	5×10^{-3}	0.20	0.11
Intermediate (9 tests)			
Transmissivity (ft^2/day)	160	3,837	808
Storage coefficient (ND)	4.0×10^{-5}	3×10^{-4}	1.3×10^{-4}
Leakance (ft^3/day/ft^3)	8.0×10^{-7}	3×10^{-4}	1.5×10^{-4}
Floridan (10 tests)			
Transmissivity (ft^2/day)	103,610	735,294	292,850
Storage coefficient (ND)	4.0×10^{-4}	3×10^{-3}	1×10^{-3}
Leakance (ft^3/day/ft^3)	1.0×10^{-5}	3×10^{-4}	2.1×10^{-4}

Note: ND = non-dimensional.

Sources: SWFWMD, 1988; TEC, 1992a.

Table 3.3.2-4. FDEP Surficial Aquifer Groundwater Quality Monitoring Program--Polk County (Page 1 of 2)

Surficial Aquifer Parameters	Units	Groundwater Quality Standard*	Average Value	Standard Deviation	Range Minimum	Range Maximum
In situ Measurements						
pH	su		6.0292	0.941	4.700	8.600
Classical						
Arsenic	mg/L	0.05	0.0004	0.001	0.000	0.003
Arsenic (dissolved)	µg/L	--	0.0000	0.000	0.000	0.000
Chloride	mg/L	250	14.0484	10.135	4.000	38.000
Fluoride	mg/L	2.0	0.1819	0.180	0.000	0.576
Nitrate	mg/L	10.0	0.6204	1.220	0.000	3.610
Selenium	mg/L	0.05	0.0000	0.000	0.000	0.000
Selenium (dissolved)	µg/L	--	2.5000	3.075	0.000	7.500
Sodium	mg/L	160	7.3760	5.591	2.000	27.000
Sulfate	mg/L	250	38.2300	48.896	0.000	148.000
TDS	mg/L	500	182.1250	121.180	23.000	454.000
Other Metals						
Barium	mg/L	2.0	0.0041	0.012	0.000	0.380
Barium (dissolved)	µg/L	--	0.0000	0.000	0.000	0.000
Cadmium	mg/L	0.005	0.0036	0.005	0.000	0.014
Cadmium (dissolved)	µg/L	--	1.0000	2.236	0.000	5.000
Chromium (total)	mg/L	0.1	0.0057	0.012	0.000	0.032
Chromium (dissolved)	µg/L	--	0.0000	0.000	0.000	0.000
Copper	mg/L	1.0	0.0076	0.012	0.000	0.032
Copper (dissolved)	µg/L	--	0.0000	0.000	0.000	0.000
Iron	mg/L	0.3	3.9685	5.195	0.030	19.300
Iron (dissolved)	µg/L	--	0.6107	0.910	0.000	2.910
Lead	mg/L	0.015	0.0661	0.113	0.000	0.369
Manganese	mg/L	0.05	0.1368	0.182	0.001	0.438
Manganese (dissolved)	µg/L	--	27.7500	26.735	0.000	72.000
Mercury	mg/L	0.002	0.0003	0.001	0.000	0.003
Silver	mg/L	0.1	0.0000	0.000	0.000	0.001
Zinc	mg/L	5.0	0.0388	0.077	0.000	0.295
Zinc (dissolved)	µg/L	--	4.0000	6.856	0.000	15.000

Table 3.3.2-4. FDEP Surficial Aquifer Groundwater Quality Monitoring Program--Polk County (Page 2 of 2)

Surficial Aquifer Parameters	Units	Groundwater Quality Standard*	Average Value	Standard Deviation	Range	
					Minimum	Maximum
Organics						
Endrin	μg/L	2.0	0.0000	0.000	0.000	0.000
Methoxychlor	μg/L	40.0	0.0000	0.000	0.000	0.000
Toxaphene	μg/L	3.0	0.0000	0.000	0.000	0.000
2,4-D	μg/L	70.0	0.0000	0.000	0.000	0.000
2,4,5-TP, silvex	μg/L	50.0	0.0000	0.000	0.000	0.000
Benzene	μg/L	1.0	0.0238	0.109	0.000	0.500
Carbon tetrachloride	μg/L	3.0	0.0238	0.109	0.000	0.500
Ethylene dibromide	μg/L	0.02	0.0000	0.000	0.000	0.000
Tetrachloroethene	μg/L	3.0	0.0238	0.109	0.000	0.500
Trichloroethene	μg/L	3.0	0.0312	0.125	0.000	0.500
Vinyl chloride	μg/L	1.0	0.0238	0.109	0.000	0.500
1,2-Dichloroethane	μg/L	3.0	0.0238	0.109	0.000	0.500
1,1,1-Trichloroethane	μg/L	200.0	0.0312	0.125	0.000	0.500

Note: su = standard units.
-- = no data available.

* Standards from Chapter 17-520 and 17-550, F.A.C., 1-26-93

Source: TEC, 1992a.

Table 3.3.2-5. Groundwater Quality Summary for Surficial Aquifer (Page 1 of 2)

Parameter	Units	Groundwater* Quality Standard	GW1-S1	GW2-S1	GW3-S1	Mean	Maximum	Minimum	Standard Deviation
pH (*in situ*)	su	6.5-8.5	7.0	5.4	8.1	5.9	8.1	5.4	--
Arsenic EPA 206.2	µg/L	50.0	<10.000	<10.000	<10.000	0	--	--	--
Barium	mg/L	2.0	<0.300	<0.300	<0.300	0	--	--	--
Cadmium	µg/L	5.0	1.6	<0.800	3.8	1.9	3.8	0.4	1.7
Chromium	mg/L	0.10	<0.050	<0.050	<0.050	0	--	--	--
Lead	µg/L	15.0	19	<5.000	14	11.8	19	2.5	8.5
Mercury	µg/L	2.0	<0.200	<0.200	<0.200	0	--	--	--
Nitrogen, nitrate	mg/L	10.0	<1.000	<1.000	<1.000	0	--	--	--
Silver	µg/L	100.0	<0.070	<0.070	<0.070	0	--	--	--
Chloride	mg/L	250.0	11	17	3.2	10.4	17	3.2	5.7
Color	Pt-Co	15	5	500	75	193	500	5	219
Copper	mg/L	1.0	<0.030	<0.030	<0.030	0	--	--	--
Fluoride	mg/L	2.0	0.1	0.26	1.6	0.65	1.6	0.1	0.67
Iron	mg/L	0.3	0.9	7.4	2.3	3.5	7.4	0.9	2.7
Manganese	mg/L	0.05	<0.050	<0.050	<0.050	0	--	--	--
Sodium	mg/L	160.0	10	12	3	8	12	3	4
Sulfate	mg/L	250	<5.000	<5.000	27	10.7	27	2.5	14.1
Surfactants	mg/L	0.5	0.038	<0.020	<0.020	0.019	0.038	0.01	0.016
TDS	mg/L	500	70	200	86	119	200	70	58
Endrin	µg/L	2.0	<0.080	<0.080	<0.080	0	--	--	--
Methoxychlor	µg/L	40.0	<100.000	<100.000	<100.000†	0	--	--	--
Toxaphene	µg/L	3.0	<3.000	<3.000	<3.000	0	--	--	--
2,4-D	µg/L	70.0	<10.000	<10.000	<10.000	0	--	--	--
2,4,5-Trichlorophenol	µg/L	50.0	<1.000	<1.000	<1.000	0	--	--	--
Benzene	µg/L	1.0	<0.600	<1.200	<0.600	0	--	--	--
Carbon tetrachloride	µg/L	3.0	<0.500	<1.000	<0.500	0	--	--	--
1,2-Dibromoethane	µg/L	0.02	<0.020	<0.020	<0.020	0	--	--	--
Tetrachloroethylene	µg/L	3.0	<5.000	<5.000	<5.000	0	--	--	--
Trichloroethylene	µg/L	3.0	<5.000	<5.000	<5.000	0	--	--	--
Chloroform	µg/L	‡	<0.400	<0.800	<0.400	0	--	--	--

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Table 3.3.2-5. Groundwater Quality Summary for Surficial Aquifer (Page 2 of 2)

Parameter	Units	Groundwater Quality Standard	GW1-S1	GW2-S1	GW3-S1	Mean	Maximum	Minimum	Standard Deviation
Bromodichloromethane	µg/L	‡	<0.600	<1.200	<0.600	0	--	--	--
Dibromochloromethane	µg/L	‡	<1.000	<2.000	<1.000	0	--	--	--
Bromoform	µg/L	‡	<2.000	<4.000	<2.000	0	--	--	--
Vinyl chloride	µg/L	1.0	<0.800	<1.600	<0.800	0	--	--	--
1,2-Dichloroethane	µg/L	3.0	<1.000	<2.000	<1.000	0	--	--	--
1,1,1-Trichloroethane	µg/L	200.0	<0.800	<1.600	<0.800	0	--	--	--
Turbidity (monthly avg)	NTU	1	110	510	190	270	510	110	173
Gross alpha	pCi/L	15	13.5 ±6.8	44 ±6.6	16.6 ±6.4	24.7	44	13.5	13.7
Radium 226	pCi/L	§	2.2 ±0.5	8.9 ±1.0	8.5 ±1.0	6.5	8.9	2.2	3.1
Radium 228	pCi/L	§	1.4 ±1.2	<1.0	1.3 ±1.1	1.1	1.4	0.5	0.5

Note: Pt-Co = platinum-cobalt units.
NTU = nephelometric turbidity units.
pCi/L = picoCuries per liter.
MDL = method detection limit.
1/2 MDL is used as minimum and to compute mean value where parameter detected in at least one sample.

* Chapters 17-520 and 17-550, F.A.C. (1-26-93)
† The standard was decreased from 100 µg/L to 40 µg/L (1/26/93) after analysis.
‡ Total trihalomethane water quality standard is 100 mg/L.
§ Combined Radium 226 and 228 water quality standard is 5 pCi/L.

Sources: ECT, 1992; TEC, 1992a.

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Radiation within the groundwater is a result of weathering of uranium-bearing phosphatic soils and rock. The radionuclides of general concern include Radium 226, Radon 222, and Polonium 210. While other radioactive isotopes may exist, they are not considered to be hazardous. The presence of the phosphatic soils and rock can cause gross alpha activities to exceed state and federal drinking water standards. These high activity levels are generally the result of natural releases from phosphatic material and are not considered to be a direct result of mining activities (Upchurch, 1986; TEC, 1992a). However, mining activities may act to redistribute or disturb the radioactive materials. Numerous studies have been conducted regarding uranium and its daughter products in groundwater systems and potential relationship to mining/industrial activities. One study by Kaufmann and Bliss (1977; TEC, 1992a) compared radium in groundwater from the mining district and the coastal areas. The study reported that the elevated radium in coastal areas was not related to the industrial or mining activities, but was rather a natural condition for the geologic setting (TEC, 1992a).

Analytical results from the May 1991 sampling event indicated that the radionuclide emissions exceeding primary drinking water standards were detected within the surficial aquifer at Stations GW2 and GW3 and the intermediate aquifer at Station GW1 (Table 3.3.2-6). These samples were not filtered prior to analysis and had total solids concentrations greater than 250 mg/L, which may have contributed to the elevated radionuclide emissions (TEC, 1992a).

In March 1992, both unfiltered and field filtered groundwater samples were collected. The field filtration was performed using an in-line 0.45-micron filter. The groundwater samples were analyzed for gross alpha, Radium 226, and Radium 228 emissions plus total solids and TSS concentrations (Table 3.3.2-6). Gross alpha emissions were substantially lower (at least 30 percent) in the filtered samples for each well. Radium 226 and 228 emissions were reduced in filtered samples at one well each, with increased emissions in the remaining two wells (TEC, 1992a).

An engineering test was conducted by Tampa Electric Company (TEC, 1992a) using a modified Method 1312, Synthetic Precipitation Leaching Procedure. This test evaluated potential groundwater impacts related to excavating cooling reservoirs from existing mine cuts. This test was conducted to support two theories: first, that elevated radionuclide emissions are related to the amount of solids present within the groundwater samples; and second, that the aquifer matrix (soil) will act to filter out solids and reduce the radionuclide emissions from the groundwater. The sample results are presented in Table 3.3.2-6. The data supports both theories presented. The samples with less total solids typically have lower radioactive emissions, and a thin layer of aquifer material was able to reduce radioactive emissions (TEC, 1992a).

3.3.2.2 Intermediate Aquifer

The intermediate aquifer system consists of portions of the Peace River and Arcadia Formations of the Hawthorn Group. At the proposed Polk Power Station site, this aquifer has two producing zones that are

Table 3.3.2-6. Summary of Radionuclide Emission Results (Page 1 of 2)

Laboratory Report Date	Sample Location	Field Filtered or Unfiltered	Date Sampled	Gross Alpha (pCi/L)	Radium 226 (pCi/L)	Radium 228 (pCi/L)	Total Solids (mg/L)	TSS (mg/L)	TDS (mg/L)
07/19/91	GW1-S1	Unfiltered	05/21/91	13.5 ±6.8	2.2 ±0.5	1.4 ±1.2	94	24	70
	GW2-S1	Unfiltered	05/22/91	44 ±6.6	8.9 ±1	ND	264	64	200
	GW3-S1	Unfiltered	05/20/91	16.6 ±6.4	8.5 ±1	1.3 ±1	376	290	86
	GW1-I1	Unfiltered	05/21/91	4.8 ±6.9	6.2 ±0.9	1.4 ±3	362	42	320
	GW2-I1	Unfiltered	05/22/91	ND	0.6 ±0.3	ND	270	ND	270
	GW3-I1	Unfiltered	05/20/91	ND	ND	ND	295	55	240
	GW1-I3	Unfiltered	05/21/91	ND	0.7 ±0.3	3.4 ±3.2	296	16	280
	GW2-I3	Unfiltered	05/23/91	ND	1.2 ±0.4	ND	640	40	600
	GW3-I3	Unfiltered	05/20/91	ND	ND	ND	299	69	230
	GW1-F1	Unfiltered	05/22/91	ND	1 ±0.4	ND	253	33	220
04/21/92	GW1-S1	Unfiltered	03/03/92	9.4 ±1.9	2 ±0.1	5 ±3.5	80	18	62
	GW2-S1	Unfiltered	03/03/92	119 ±11.3	5.9 ±0.1	ND ±1.3	280	58	222
	GW3-S1	Unfiltered	03/03/92	3.3 ±1.4	0.4 ±0.08	ND ±2.5	91	7	84
	GW1-S1	Filtered	03/03/92	6.6 ±1.7	19.7 ±0.3	0.6 ±2.9	47	ND	47
	GW2-S1	Filtered	03/03/92	59 ±6.5	2.1 ±0.08	1.6 ±2.6	140	ND	140
	GW3-S1	Filtered	03/03/92	ND ±0.9	0.9 ±0.09	2.2 ±2.9	91	ND	91
05/07/92	Sample 1		03/03/92	3.5 ±2.6	0.8 ±1.3	ND ±1.1	360	12	348
	Sample 2		03/03/92	2,990 ±517	15.4 ±3.4	0.3 ±1	49,000	70,000	*
	Sample 3		03/03/92	2.1 ±3.1	1.4 ±1.4	ND ±1	330	ND	330

Table 3.3.2-6. Summary of Radionuclide Emission Results (Page 2 of 2)

Laboratory Report Date	Sample Location	Field Filtered or Unfiltered	Date Sampled	Gross Alpha (pCi/L)	Radium 226 (pCi/L)	Radium 228 (pCi/L)	Total Solids (mg/L)	TSS (mg/L)	TDS (mg/L)
	Sample 4		03/03/92	450 ±125	23.6 ±4	6.4 ±1.2	14,000	6,200	7,800
	Sample 5		03/03/92	1.1 ±2.4	2.2 ±1.8	ND ±1	300	ND	300
	Sample 6		03/03/92	191 ±37.6	12.7 ±3.4	0.8 ±1.1	2,800	1,800	1,000

Note: S1 =surficial aquifer.
I1 =upper intermediate aquifer.
I3 =lower intermediate aquifer.
F1 =Floridan aquifer.
ND =not detected at or above the method detection limits (see laboratory reports, Appendices 11.7.3 and 11.7.4 of the SCA).
Descriptions for Samples 1 through 6 are provided in Table 3.3.2-8.

* An erroneous TDS value has resulted from a high concentration of total solids and TSS. These concentrations exceed the normal concentration range for this analysis.

Sources: ECT, 1992; TEC, 1992a.

separated by confining units. The primary recharge to the upper intermediate aquifer is leakage from the surficial aquifer system. The amount of recharge received by the upper intermediate aquifer system ranges from zero to greater than 10 inches per year (SWFWMD, 1988; TEC, 1992a). The rate of recharge into and through the intermediate aquifer is dependent on the potential head difference between the aquifers (or producing zones) and the thickness and conductivity of the confining units within the intermediate system (TEC, 1992a). The intermediate aquifer is typically in hydraulic communication with the larger rivers in southwestern Polk County.

A network of wells within the upper and lower intermediate aquifers was established by Tampa Electric Company (TEC, 1992a). Five PVC observation wells (three 4-inch diameter monitor wells and two 2-inch diameter piezometers) were placed and used to monitor the groundwater levels within the upper intermediate aquifer (Figure 3.3.2-1). Three 4-inch diameter monitor wells were placed into the lower intermediate aquifer system to monitor the groundwater levels. Wells intercepting the upper and lower intermediate aquifer were constructed with 5- and 10-ft of screening, respectively.

The screen depth intervals for the upper and lower intermediate aquifers were approximately between 90 and 105 feet below land surface (ft-bls) and 235 to 240 ft-bls, respectively.

The hydrographs illustrated in Figures 3.3.2-4 and 3.3.2-5 show the time-dependent fluctuations of the potentiometric surfaces for the upper and lower intermediate aquifer systems, respectively. The potentiometric surface of the upper intermediate aquifer across the Polk Power Station site ranged from approximately 126 to 135 ft-NGVD. The potentiometric surface fluctuated approximately 2 to 4.5 ft from the end of the dry season (April 1991) to the end of the wet season (October 1991). The potentiometric surface of the lower intermediate aquifer has ranged from approximately 48 to 68 ft-NGVD across the site. The potentiometric surface fluctuated approximately 13 to 14 ft from the end of the dry season to the end of the wet season in 1991. Table 3.3.2-1 provides a summary of the groundwater level measurements taken on the upper and lower intermediate aquifers.

Recent regional potentiometric surface maps (May and September 1990) of the upper intermediate aquifer indicate that the potentiometric surface fluctuated between 115 ft-msl during the dry season (Figure 3.3.2-6) to 125 ft-msl during the wet season (Figure 3.3.2-7). The proposed Polk Power Station site is located over a potentiometric high for the intermediate aquifer so the groundwater flow direction for the intermediate aquifer system is radially outward from beneath the site. Permeability tests were conducted on the 4-inch monitor wells completed into the upper and lower intermediate aquifers. The resulting hydraulic conductivity values are summarized in Table 3.3.2-2.

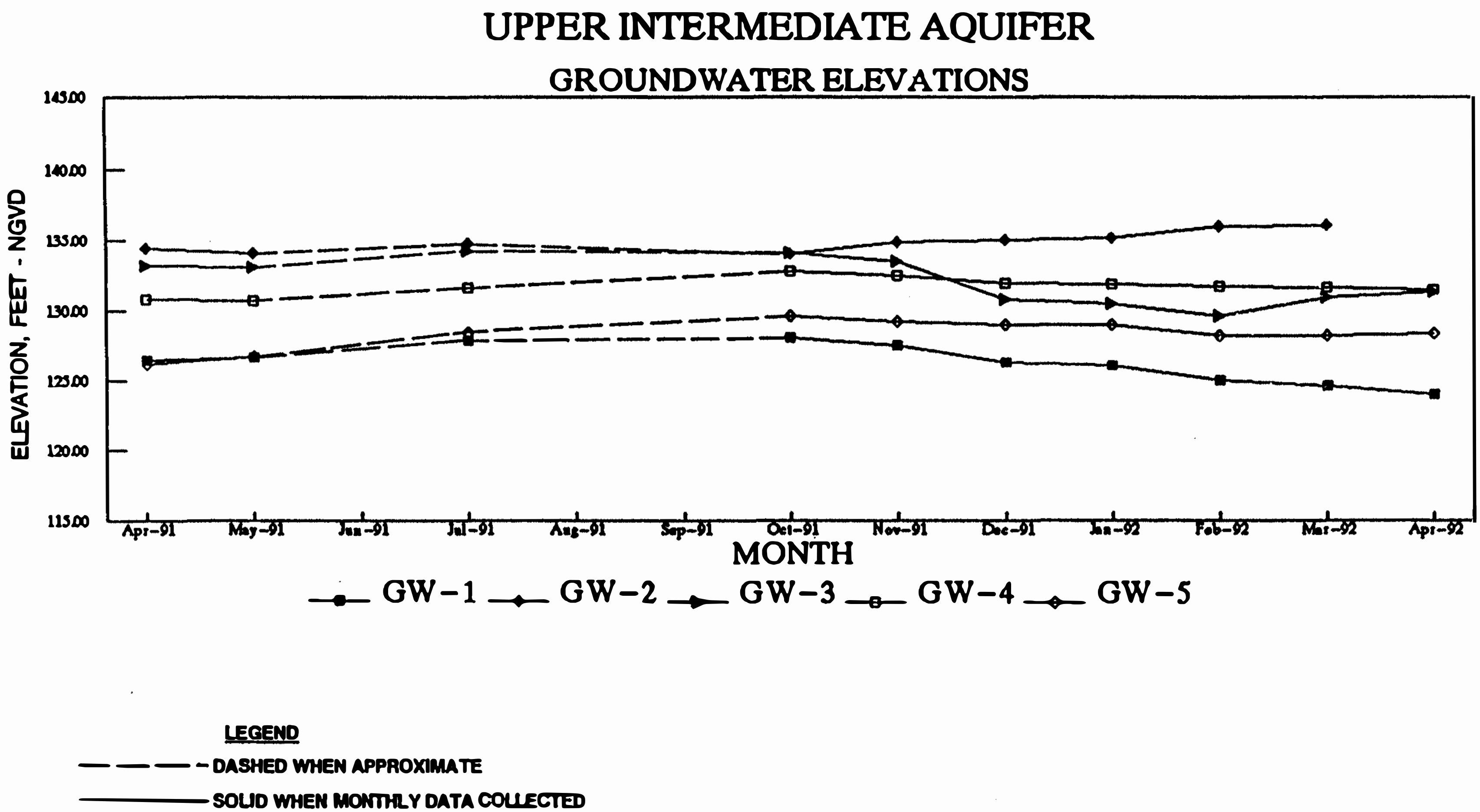

FIGURE 3.3.2-4.
Hydrograph for Upper Intermediate Aquifer.

SOURCES: ECT, 1992; TEC, 1992a.

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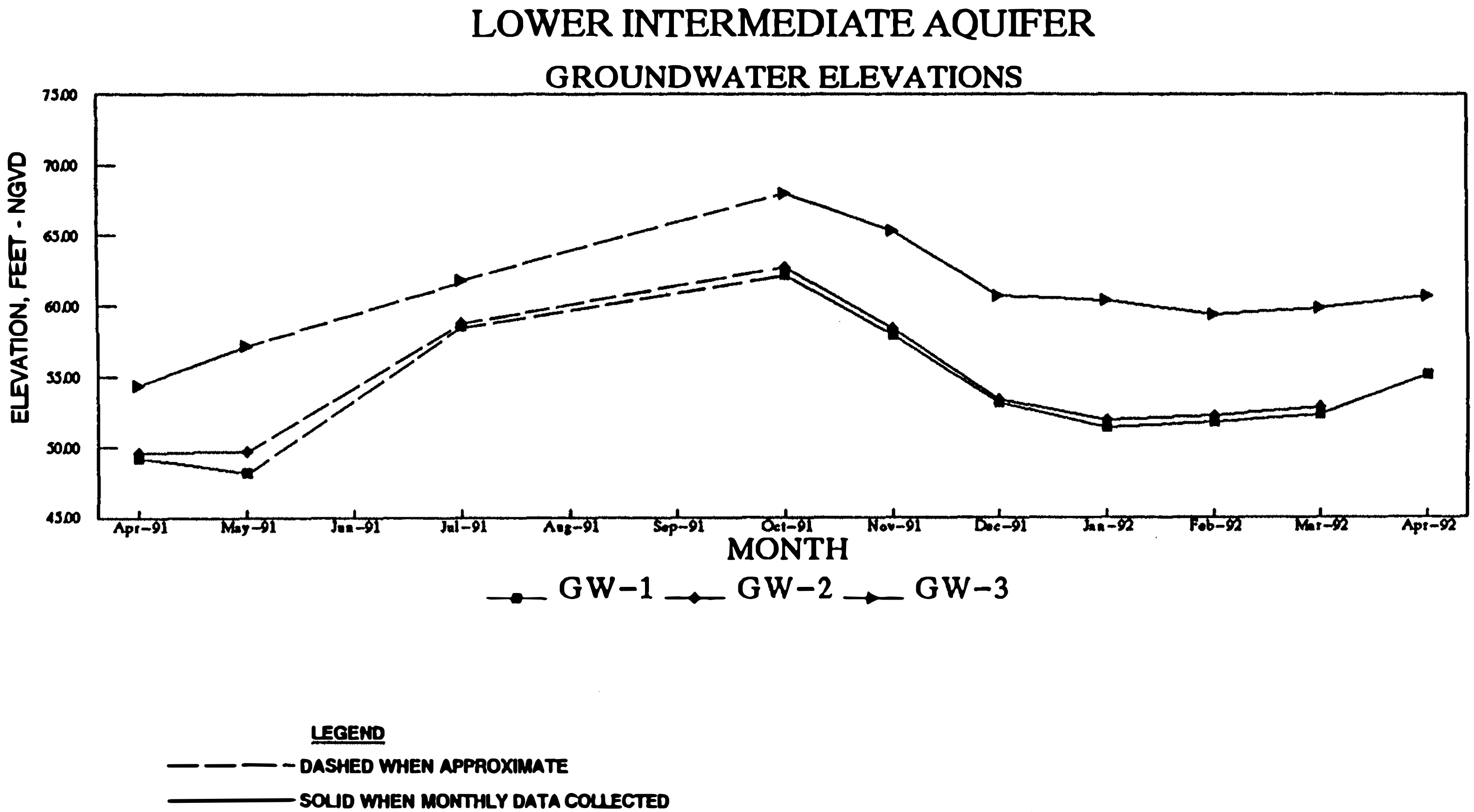

FIGURE 3.3.2-5.
Hydrograph for Lower Intermediate Aquifer.

SOURCES: ECT, 1992; TEC, 1992a.

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Hydraulic gradients within the intermediate aquifer system ranged from approximately 0.0004 to 0.004 ft/ft. Linear groundwater flow velocities for the intermediate aquifer system range between 0.002 to 0.2 ft/day (TEC, 1992a).

Nine aquifer tests for the intermediate aquifer (SWFWMD, 1988; TEC, 1992a) were performed within a 15-mile radius of the site. The average aquifer characteristics from these tests were determined and are summarized in Table 3.3.2-3. For the intermediate aquifer, average values of transmissivity, storage coefficient, and leakance are 808 ft^2/day, 0.00013, and 0.00015 cubic foot per day per cubic foot (ft^3/day/ft^3), respectively. Horizontal conductivity typically ranged 2 to 3 orders of magnitude greater than vertical hydraulic conductivity.

The groundwater quality of the intermediate aquifer system is subject to FDEP Class G-II water quality standards (Chapter 17-520 and 17-550, FAC). The water quality of the intermediate aquifer is dependent on the chemical constituents of the aquifer matrix and the quality of the water percolating down from the surficial aquifer (TEC, 1992a). The Ambient Groundwater Quality Monitoring Program of SWFWMD (1988; TEC, 1992a) presents the following regional trends:

- TDS, 200 to 300 mg/L;
- Total hardness, <120 mg/L;
- Chlorides, <25 mg/L;
- Sulfates, <25 mg/L.

Additional background groundwater quality data for Polk County was obtained by Tampa Electric Company (TEC, 1992a) from the FDEP Groundwater Monitoring Program. The data for the intermediate aquifer is summarized in Table 3.3.2-7. The data for maximum concentrations of TDS, iron, lead, and manganese indicate violations of the Class G-II (primary and secondary drinking water) standards occur within the vicinity. Site-specific groundwater quality from the intermediate aquifer was assessed from the results of a sampling event in May 1991. The groundwater quality data for the upper and lower intermediate aquifer systems are summarized in Tables 3.3.2-8 and 3.3.2-9, respectively. With the exception of Radium 226 (GW1-I1) and TDS (GW2-I3), the intermediate aquifer meets primary and secondary drinking water standards.

3.3.2.3 Floridan Aquifer

The Floridan aquifer in the vicinity of the proposed Polk Power Station site includes the Suwannee Limestone, Ocala Group, Avon Park Formation, and a portion of the Oldsmar Formation. At the proposed Polk Power Station site, the Floridan aquifer has two highly transmissive and producing zones: the Suwannee Limestone and Avon Park Formation. Recharge to this area of the Floridan aquifer occurs at the physiographic ridge areas to the north and east of the proposed Polk Power Station site. Recharge from the intermediate aquifer

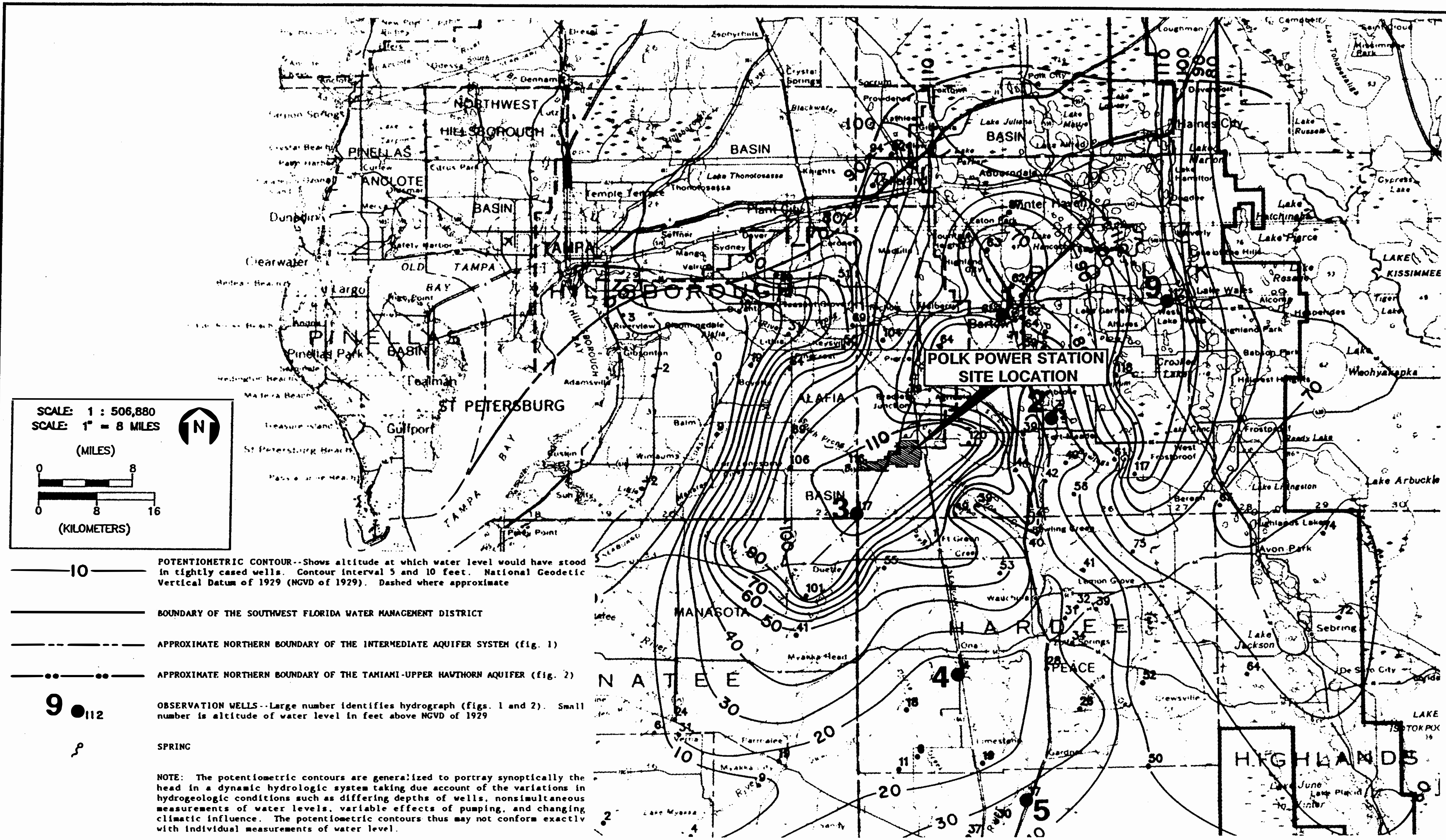

FIGURE 3.3.2-6.
Potentiometric Surface of the Intermediate Aquifer System, West-Central Florida - May 1990.

SOURCES: L.A. Knochenmus, 1990; TEC 1992a.

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Table 3.3.2-7. FDEP Intermediate Aquifer Groundwater Quality Monitoring Program--Polk County (Page 1 of 2)

Intermediate Aquifer Parameters	Units	Groundwater Quality Standard*	Average Value	Standard Deviation	Range	
					Minimum	Maximum
<u>In situ Measurements</u>						
pH	su		7.4944	0.331	7.100	8.200
<u>Classical</u>						
Arsenic	mg/L	0.05	0.0006	0.002	0.000	0.005
Arsenic (dissolved)	µg/L	--	0.0000	0.000	0.000	0.000
Chloride	mg/L	250	17.4380	17.644	4.200	64.100
Fluoride	mg/L	2.0	0.3665	0.147	0.193	0.685
Nitrate	mg/L	10.0	0.0215	0.029	0.000	0.075
Selenium	mg/L	0.05	0.0000	0.000	0.000	0.000
Selenium (dissolved)	µg/L	--	0.0000	0.000	0.000	0.000
Sodium	mg/L	160	14.2150	13.420	2.900	45.000
Sulfate	mg/L	250	26.2900	60.319	0.000	205.000
TDS	mg/L	500	259.8000	159.503	44.000	640.000
<u>Other Metals</u>						
Barium	mg/L	2.0	0.0096	0.019	0.000	0.050
Barium (dissolved)	µg/L	--	0.0000	0.000	0.000	0.000
Cadmium	mg/L	0.005	0.0004	0.001	0.000	0.002
Cadmium (dissolved)	µg/L	--	0.0000	0.000	0.000	0.000
Chromium (total)	mg/L	0.1	0.0028	0.009	0.000	0.028
Chromium (dissolved)	µg/L	--	0.0000	0.000	0.000	0.000
Copper	mg/L	1.0	0.0030	0.005	0.000	0.016
Copper (dissolved)	µg/L	--	30.0000	0.000	30.000	30.000
Iron	mg/L	0.3	2.9767	2.559	0.000	7.280
Iron (dissolved)	µg/L	--	0.0000	0.000	0.000	0.000
Lead	mg/L	0.015	0.0120	0.026	0.000	0.070
Manganese	mg/L	0.05	0.0301	0.036	0.000	0.114
Manganese (dissolved)	µg/L	--	0.0000	0.000	0.000	0.000
Mercury	mg/L	0.002	0.0000	0.000	0.000	0.000
Silver	mg/L	0.1	0.0000	0.000	0.000	0.000
Zinc	mg/L	5.0	0.0389	0.045	0.000	0.130
Zinc (dissolved)	µg/L	--	0.0000	0.000	0.000	0.000

Table 3.3.2-7. FDEP Intermediate Aquifer Groundwater Quality Monitoring Program--Polk County (Page 2 of 2)

Intermediate Aquifer Parameters	Units	Groundwater Quality Standard*	Average Value	Standard Deviation	Range	
					Minimum	Maximum
Organics						
Endrin	µg/L	2.0	0.0000	0.000	0.000	0.000
Methoxychlor	µg/L	40.0	0.0000	0.000	0.000	0.000
Toxaphene	µg/L	3.0	0.0000	0.000	0.000	0.000
2,4-D	µg/L	70.0	0.0000	0.000	0.000	0.000
2,4,5-TP, silvex	µg/L	50.0	0.0000	0.000	0.000	0.000
Benzene	µg/L	1.0	1.6330	4.081	0.000	13.200
Carbon tetrachloride	µg/L	3.0	0.0000	0.000	0.000	0.000
Ethylene dibromide	µg/L	0.02	0.0000	0.000	0.000	0.000
Tetrachloroethene	µg/L	3.0	0.0000	0.000	0.000	0.000
Trichloroethene	µg/L	3.0	0.0000	0.000	0.000	0.000
Vinyl chloride	µg/L	1.0	0.0000	0.000	0.000	0.000
1,2-Dichloroethane	µg/L	3.0	0.0000	0.000	0.000	0.000
1,1,1-Trichloroethane	µg/L	200.0	0.0000	0.000	0.000	0.000

Note: -- = no data available.

* Standards from Chapter 17-520 and 17-550, F.A.C., 1-26-93

Source: TEC, 1992a.

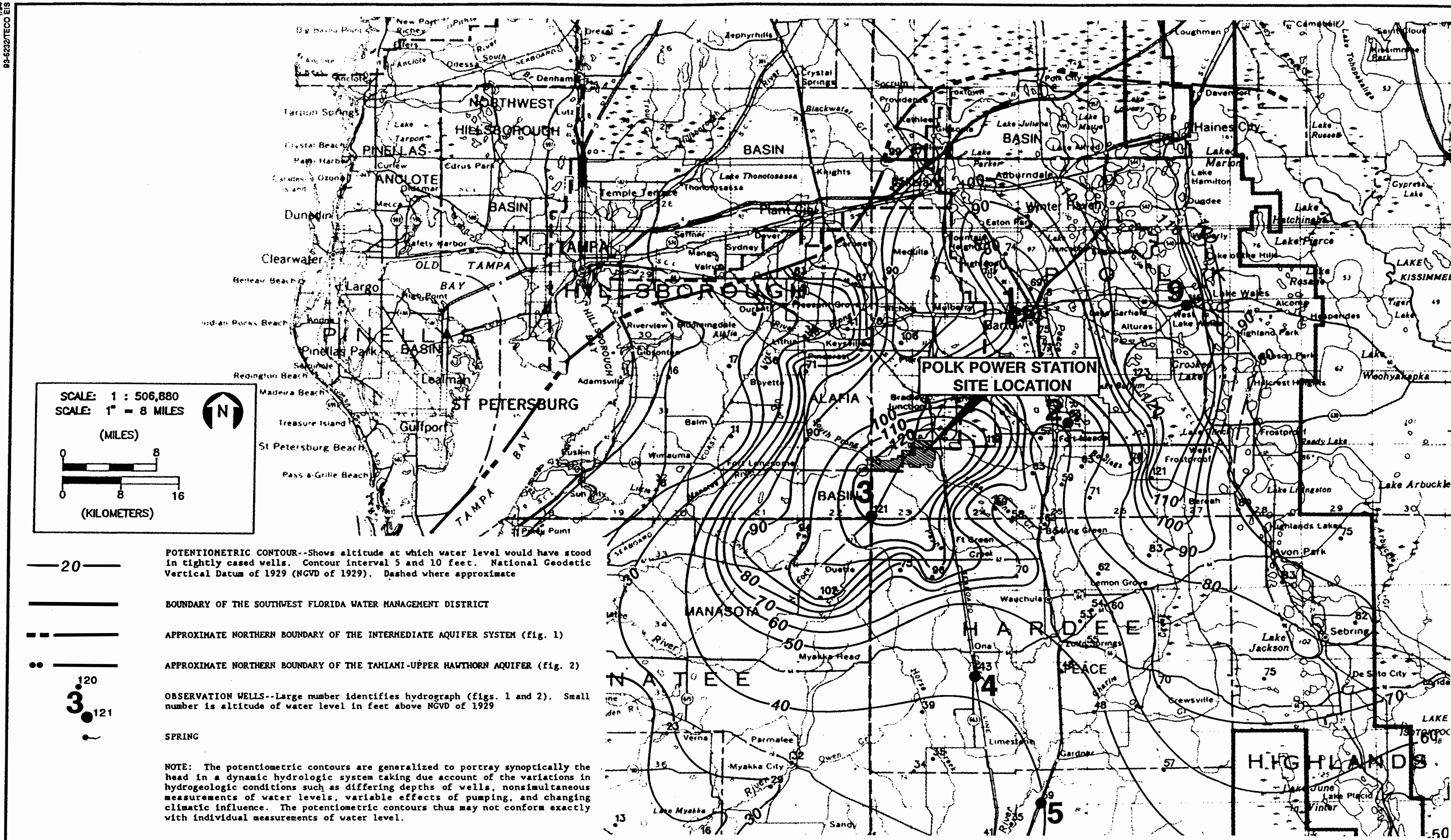

FIGURE 3.3.2-7.
Potentiometric Surface of the Intermediate Aquifer System, West-Central Florida - September 1990.

SOURCES: R.A. Mularoni and L.A. Knochenmus, 1991; TEC, 1992a.

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Table 3.3.2-8. Groundwater Quality Summary for Upper Intermediate Aquifer (Page 1 of 2)

Parameter	Units	Groundwater Quality Standard	GW1-I1	GW2-I1	GW3-I1	Mean	Maximum	Minimum	Standard Deviation
pH (*in situ*)	su	6.5-8.5	8.4	8.2	7.4	7.8	8.4	7.4	--
Arsenic EPA 206.2	µg/L	50.0	<10.000	<10.000	21	10	21	5	8.7
Barium	mg/L	2.0	<0.300	<0.300	<0.300	0	--	--	--
Cadmium	µg/L	5.0	<0.800	<0.800	<0.800	0	--	--	--
Chromium	mg/L	0.10	<0.050	<0.050	<0.050	0	--	--	--
Lead EPA 239.2	µg/L	15.0	<5.000	<5.000	<5.000	0	--	--	--
Mercury EPA 245.1	µg/L	2.0	<0.200	<0.200	<0.200	0	--	--	--
Nitrogen, nitrate	mg/L	10.0	<1.000	<1.000	<1.000	0	--	--	--
Silver	µg/L	100.0	<0.070	<0.070	<0.070	0	--	--	--
Chloride	mg/L	250.0	5.7	16	14	11.9	16	5.7	4.5
Color	Pt-Co	15	15	20	15	17	20	15	2
Copper	mg/L	1.0	<0.030	<0.030	<0.030	0	--	--	--
Fluoride, soluble	mg/L	2.0	0.53	1	1	0.84	1	0.53	0.22
Iron	mg/L	0.3	<0.300	<0.300	<0.300	0	--	--	--
Manganese	mg/L	0.05	<0.050	<0.050	<0.050	0	--	--	--
Sodium	mg/L	160.0	22	30	20	24	30	20	4
Sulfate	mg/L	250	5.2	38	7.8	17	38	5.2	14.9
Surfactants	mg/L	0.5	0.063	0.02	0.1	0.061	0.1	0.02	0.033
TDS	mg/L	500	320	270	240	277	320	240	33
Endrin	µg/L	2.0	<0.080	<0.080	<0.080	0	--	--	--
Methoxychlor	µg/L	40.0	<100.000	<100.000	<100.000*	0	--	--	--
Toxaphene	µg/L	3.0	<3.000	<3.000	<3.000	0	--	--	--
2,4-D	µg/L	70.0	<10.000	<10.000	<10.000	0	--	--	--
2,4,5-Trichlorophenol	µg/L	50.0	<1.000	<1.000	<1.000	0	--	--	--
Benzene	µg/L	1.0	<0.600	<0.600	<0.600	0	--	--	--
Carbon tetrachloride	µg/L	3.0	<0.500	<0.500	<0.500	0	--	--	--
1,2-Dibromoethane	µg/L	0.02	<0.020	<0.020	<0.020	0	--	--	--
Tetrachloroethylene	µg/L	3.0	<5.000	<5.000	<5.000	0	--	--	--
Trichloroethylene	µg/L	3.0	<5.000	<5.000	<5.000	0	--	--	--

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Table 3.3.2-8. Groundwater Quality Summary for Upper Intermediate Aquifer (Page 2 of 2)

Parameter	Units	Groundwater Quality Standard	GW1-I1	GW2-I1	GW3-I1	Mean	Maximum	Minimum	Standard Deviation
Chloroform	µg/L	†	<0.400	<0.400	<0.400	0	--	--	--
Bromodichloromethane	µg/L	†	<0.600	<0.600	<0.600	0	--	--	--
Dibromochloromethane	µg/L	†	<1.000	<1.000	<1.000	0	--	--	--
Bromoform	µg/L	†	<2.000	<2.000	<2.000	0	--	--	--
Vinyl chloride	µg/L	1.0	<0.800	<0.800	<0.800	0	--	--	--
1,2-Dichloroethane	µg/L	3.0	<1.000	<1.000	<1.000	0	--	--	--
1,1,1-Trichloroethane	µg/L	200.0	<0.800	<0.800	<0.800	0	--	--	--
Turbidity	NTU	1	7.4	<1.000	20	9.3	20	0.5	9.9
Gross alpha	pCi/L	15	4.8 ±6.9	<2.0	<2.0	2.3	4.8	1.0	2.2
Radium 226	pCi/L	‡	6.2 ±0.9	0.6 ±0.3	<0.6	2.4	6.2	0.3	3.3
Radium 228	pCi/L	‡	1.4 ±3.0	<1.0	<1.0	0.8	1.4	0.5	0.5

Note: 1/2 MDL is used as minimum and to compute mean value where parameter detected in at least one sample.

* The standard was decreased from 100 µg/L to 40 µg/L (1/26/93) after analysis.
† Total trihalomethane water quality standard is 100 mg/L.
‡ Combined Radium 226 and 228 water quality standard is 5 pCi/L.

Sources: Modified from ECT, 1992; TEC, 1992a.

Table 3.3.2-9. Groundwater Quality Summary for Lower Intermediate Aquifer (Page 1 of 2)

Parameter	Units	Groundwater Quality Standard	GW1-I3	GW2-I3	GW3-I3	Mean	Maximum	Minimum	Standard Deviation
pH (*in situ*)	s.u.	6.5-8.5	8.6	8.1	8.5	8.3	8.6	8.1	--
Arsenic EPA 206.2	µg/L	50.0	<10.000	<10.000	<10.000	0	--	--	--
Barium	mg/L	2.0	<0.300	<0.300	<0.300	0	--	--	--
Cadmium	µg/L	5.0	1.3	<0.500	<0.800	0.7	1.3	0.25	0.6
Chromium	mg/L	.010	<0.050	<0.050	<0.050	0	--	--	--
Lead EPA 239.2	µg/L	15.0	9	<5.000	<5.000	4.7	9	2.5	3.8
Mercury EPA 245.1	µg/L	2.0	<0.200	<0.200	<0.200	0	--	--	--
Nitrogen, nitrate	mg/L	10.0	<1.000	<1.000	<1.000	0	--	--	--
Silver	µg/L	100.0	<0.070	<0.070	<0.070	0	--	--	--
Chloride	mg/L	250.0	18	23	11	17	23	11	5
Color	Pt-Co	15	15	10	10	12	15	10	2
Copper	mg/L	1.0	<0.030	<0.030	<0.030	0	--	--	--
Fluoride, soluble	mg/L	2.0	1	0.81	1.7	1.17	1.7	0.81	0.38
Iron	mg/L	0.3	<0.300	<0.300	<0.300	0	--	--	--
Manganese	mg/L	0.05	<0.050	<0.050	<0.050	0	--	--	--
Sodium	mg/L	160.0	22	58	22	34	58	22	17
Sulfate	mg/L	250	45	54	5.5	34.8	54	5.5	21.1
Surfactants	mg/L	0.5	0.043	0.04	0.06	0.048	0.06	0.04	0.009
TDS	mg/L	500	280	600	230	370	600	230	164
Endrin	µg/L	2.0	<0.080	<0.080	<0.080	0	--	--	--
Methoxychlor	µg/L	40.0	<100.000	<100.000	<100.000*	0	--	--	--
Toxaphene	µg/L	3.0	<3.000	<3.000	<3.000	0	--	--	--
2,4-D	µg/L	70.0	<10.000	<10.000	<10.000	0	--	--	--
2,4,5-Trichlorophenol	µg/L	50.0	<1.000	<1.000	<1.000	0	--	--	--
Benzene	µg/L	1.0	<0.600	<0.600	<0.600	0	--	--	--
Carbon tetrachloride	µg/L	3.0	<0.500	<0.500	<0.500	0	--	--	--
1,2-Dibromoethane	µg/L	0.02	<0.020	<0.020	<0.020	0	--	--	--
Tetrachloroethylene	µg/L	3.0	<5.000	<5.000	<5.000	0	--	--	--
Trichloroethylene	µg/L	3.0	<5.000	<5.000	<5.000	0	--	--	--
Chloroform	µg/L	†	<0.400	<0.400	<0.400	0	--	--	--

Table 3.3.2-9. Groundwater Quality Summary for Lower Intermediate Aquifer (Page 2 of 2)

Parameter	Units	Groundwater Quality Standard	GW1-I3	GW2-I3	GW3-I3	Mean	Maximum	Minimum	Standard Deviation
Bromodichloromethane	µg/L	†	<0.600	<0.600	<0.600	0	--	--	--
Dibromochloromethane	µg/L	†	<1.000	<1.000	<1.000	0	--	--	--
Bromoform	µg/L	†	<2.000	<2.000	<2.000	0	--	--	--
Vinyl chloride	µg/L	1.0	<0.800	<0.800	<0.800	0	--	--	--
1,2-Dichloroethane	µg/L	3.0	<1.000	<1.000	<1.000	0	--	--	--
1,1,1-Trichloroethane	µg/L	200.0	<0.800	<0.800	<0.800	0	--	--	--
Turbidity	NTU	1	49	15	8.5	24.2	49	8.5	17.8
Gross alpha	pCi/L	15	<2.0	<2.0	<2.0	0	--	--	--
Radium 226	pCi/L	‡	0.7 ±0.3	1.2 ±0.4	1.2 ±0.4	1.0	1.2	0.7	0.2
Radium 228	pCi/L	‡	3.4 ±3.2	<1.0	<1.0	1.5	3.4	0.5	1.7

Note: 1/2 MDL is used as minimum and to compute mean value where parameter detected in at least one sample.

* The standard was decreased from 100 µg/L to 40 µg/L (1/26/93) after analysis.
† Total trihalomethane water quality standard is 100 mg/L.
‡ Combined Radium 226 and 228 water quality standard is 5 pCi/L.

Sources: Modified from ECT, 1992; TEC, 1992a.

system to the Floridan aquifer ranges from zero to greater than 10 inches per year (SWFWMD, 1988; TEC, 1992a).

One 4-inch diameter monitor well was completed into the Suwannee Limestone within the Floridan aquifer. This well was used to monitor the changes in the groundwater level of the Floridan aquifer. A 35-ft screen was placed at approximately 300 to 335 ft-bls. The potentiometric surface of the Floridan aquifer at the proposed Polk Power Station site ranged from approximately 40 to 53 ft-NGVD from the end of the dry season (May 1991) to the end of the wet season (October 1991). Table 3.3.2-1 provides a summary of the groundwater level measurements taken from the Floridan aquifer. The hydrograph illustrated as Figure 3.3.2-8 presents the time-dependent fluctuation of the potentiometric surface for the Floridan aquifer. Recent regional potentiometric surface maps (May and September 1990) of the Floridan aquifer indicate that the potentiometric surface ranges from 20 to 30 ft-NGVD across the site for the dry season (Figure 3.3.2-9) and from 40 to 50 ft-NGVD across the site for the wet season (Figure 3.3.2-10). The groundwater flow direction for the Floridan aquifer is from the northeast toward the southwest. Hydraulic gradients for this aquifer range from approximately 0.0003 to 0.001 ft/ft.

The results of ten aquifer tests for the Floridan aquifer performed within a 15-mile radius of the site are summarized in Table 3.3.2-3. The average aquifer characteristics for the Floridan aquifer are a transmissivity value of approximately 293,000 ft^2/day, a storage coefficient of 0.001, and a leakance value of approximately 0.00021 ft^3/day/ft^3.

The specific capacity of a well is the well yield in gallons per minute divided by the amount of drawdown in the pumping well, in feet (gallons per minute per foot [gpm/ft] of drawdown) determined over a test pumping period of 24 hours. This parameter provides a means to estimate the aquifer transmissivity. The average specific capacity for the Floridan aquifer from more than 70 aquifer tests presented by Stewart (1966; TEC, 1992a) was approximately 380 gpm/ft of drawdown with a range of 31 to greater than 2,500 gpm/ft of drawdown.

Based on the SWFWMD ambient groundwater quality monitoring program, several background trends are presented (SWFWMD, 1988; TEC, 1992a):

- TDS, 200 to 300 mg/L
- Total hardness, <120 mg/L
- Chlorides, <25 mg/L
- Sulfates, 25 to 250 mg/L

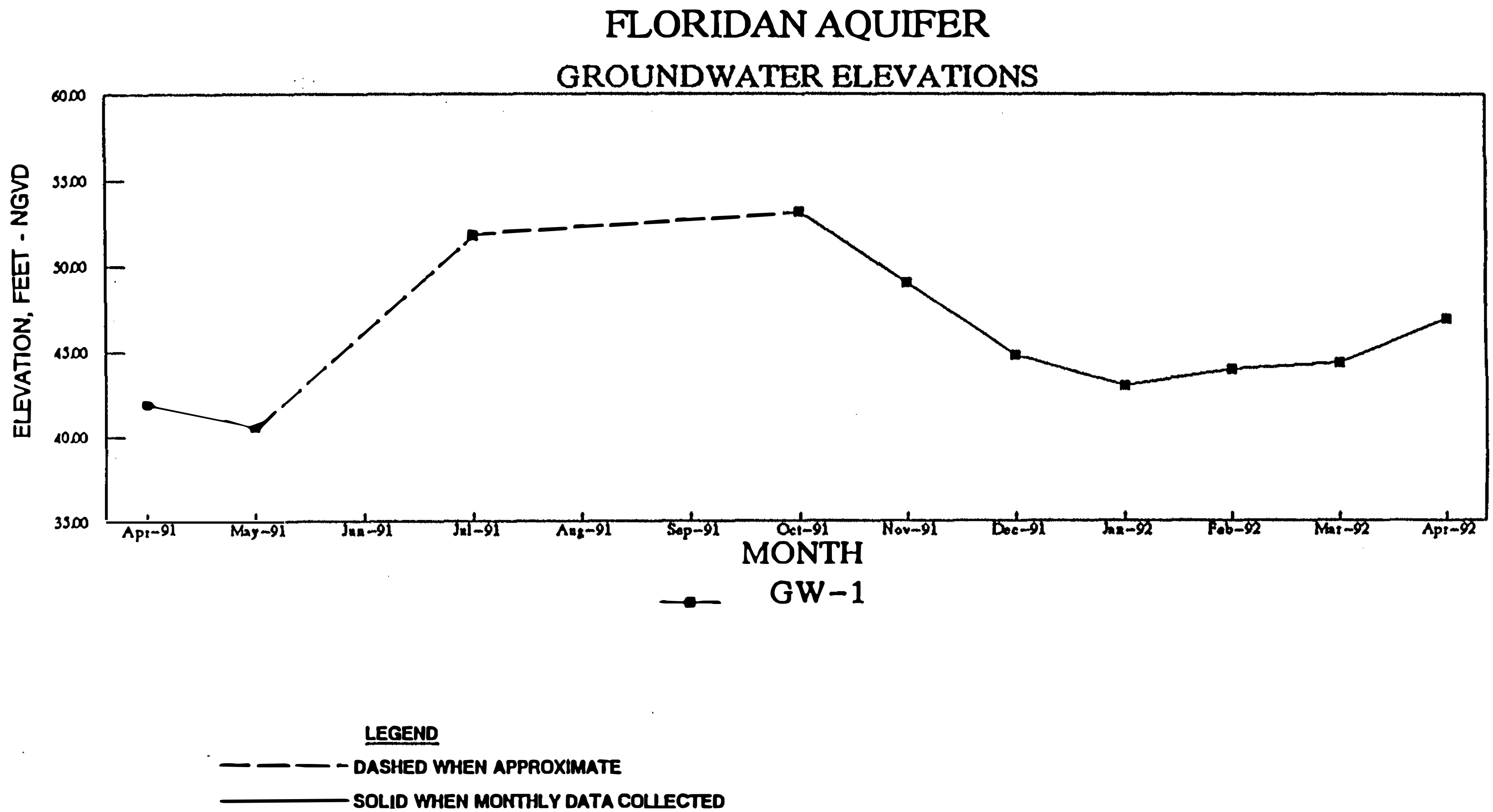

FIGURE 3.3.2-8.
Hydrograph for Floridan Aquifer.

SOURCES: ECT, 1992; TEC, 1992a.

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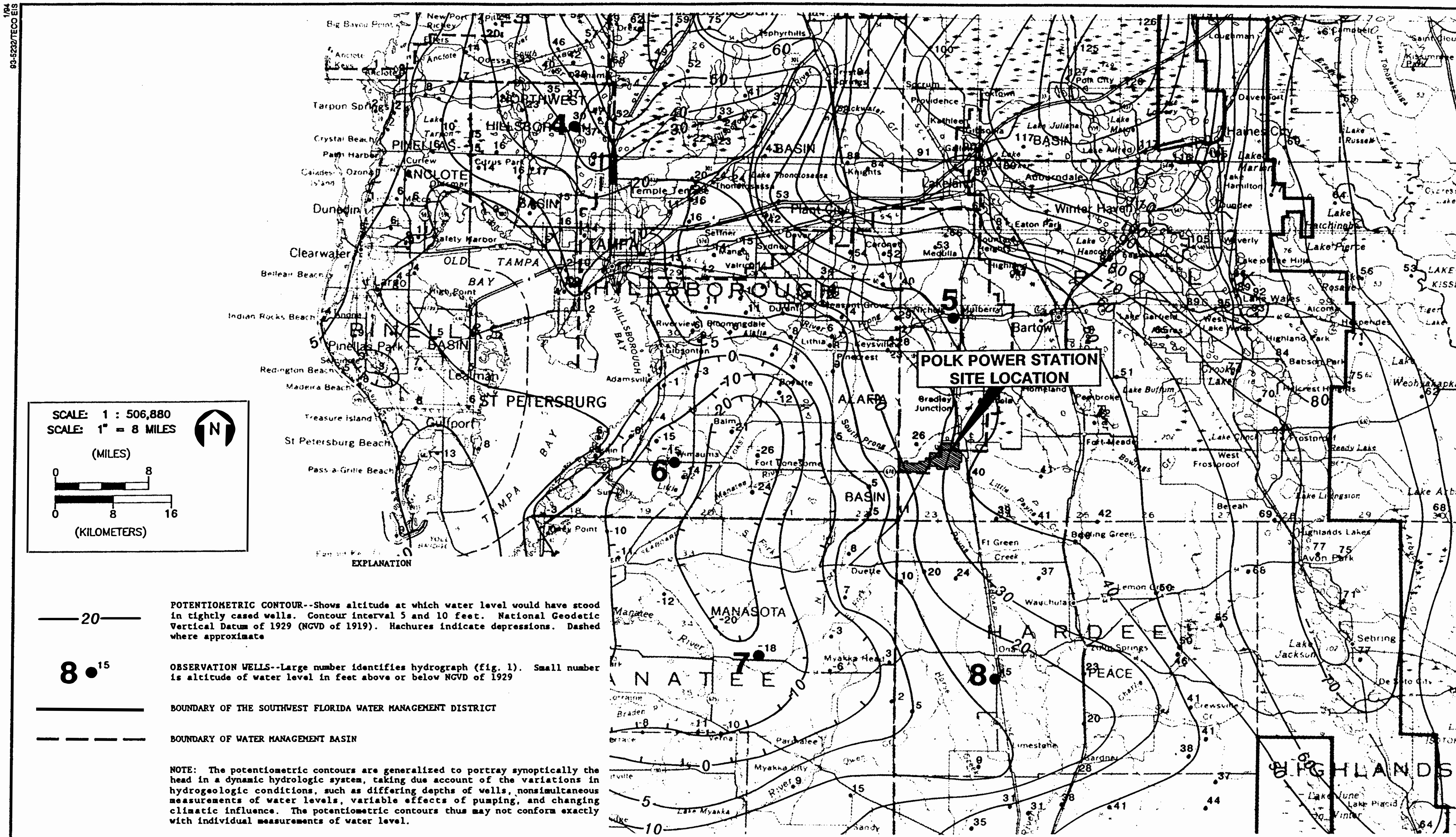

FIGURE 3.3.2-9.
Potentiometric Surface of the Upper Floridan Aquifer, West-Central Florida - May 1990.

SOURCES: L.A. Knochenmus, 1990; TEC, 1992a.

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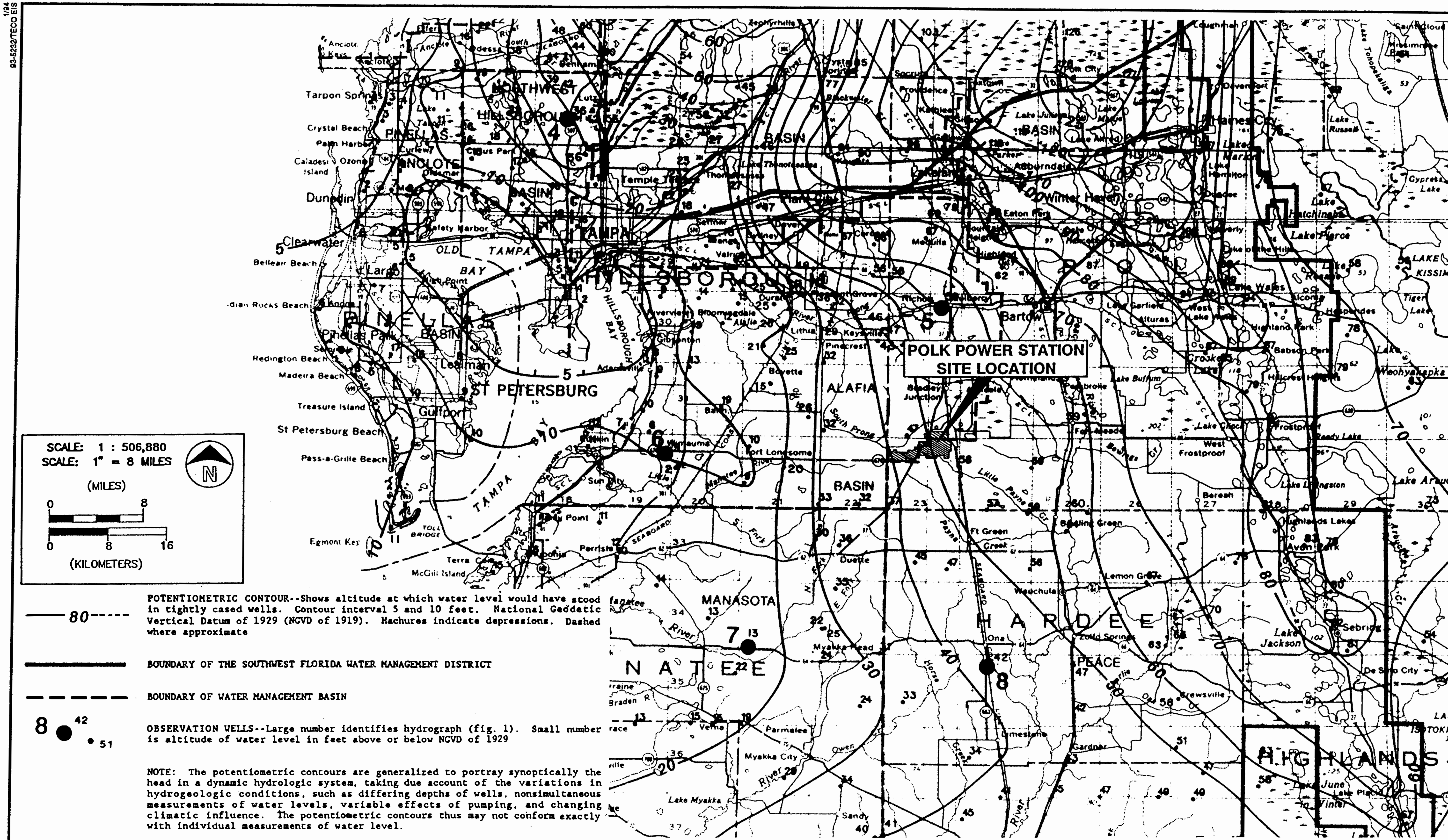

FIGURE 3.3.2-10.
Potentiometric Surface of the Upper Floridan Aquifer, West-Central Florida - September 1990.

SOURCES: R.A. Mularoni and L.A. Knochenmus, 1990; TEC, 1992a.

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Additional background water quality data was obtained by Tampa Electric Company (TEC, 1992a) from the FDEP Groundwater Monitoring Program. The background data for the Floridan aquifer is summarized in Table 3.3.2-10. Site-specific groundwater quality from the upper Floridan aquifer was assessed by Tampa Electric Company (TEC, 1992a) from a sampling event in May 1991. The groundwater quality data is summarized in Table 3.3.2-11, and indicates that Floridan aquifer water in the vicinity meets primary and secondary drinking water standards.

As rainwater percolates through the aquifer systems, the groundwater becomes mineralized as sediment constituents are dissolved into solution, while other compounds are removed from the water. Therefore, the groundwater quality varies between the three aquifer systems. Figure 3.3.2-11 presents the Stiff patterns for the three aquifer waters. Stiff (1951) determined that waters from the same area or aquifer typically display the same pattern when the concentrations of specific ions are plotted on the same scales, as shown in the figure. The groundwater quality of the intermediate and Floridan aquifer systems are similar, with the exception that lower concentrations of magnesium occur in the Floridan aquifer. Although not shown, elevated sulfate concentrations have been observed within the deep upper Floridan aquifer in certain areas of Polk County. The groundwater within the Floridan aquifer system is considered to be of good quality.

<u>Characteristic Confining Units</u>

As previously discussed, the intermediate aquifer system near the proposed Polk Power Station site is divided and bounded on top and bottom by confining units. The locations of hydrogeologic cross-sections near the proposed Polk Power Station site are shown in Figure 3.3.2-12. Two hydrogeologic cross-sections are provided as Figures 3.3.2-13 and 3.3.2-14. From these hydrogeologic cross-sections and Figure 3.3.2-15, the approximate thicknesses of the calcareous mudstone/clay confining units can be approximated as follows:

- Top confining unit, 20 to 30 ft
- Middle confining unit, 40 to 60 ft
- Bottom confining unit, 15 to 50 ft

These figures also illustrate the heterogeneous nature of the confining units in southwest Polk County. Hydrographs at each groundwater monitor station GW1 through GW5 are illustrated as Figures 3.3.2-16 through 3.3.2-20. By review and comparison of the water level fluctuations between the aquifer systems, the degree of their hydraulic connection and communication can be determined (TEC, 1992a). While all aquifers fluctuated in response to the wet and dry seasons, the surficial aquifer peaks earliest in the wet season, followed by the upper intermediate. The lower intermediate and Floridan lag behind the upper two by approximately 4 months. This progressively larger lag with aquifer depth is likely due to the slow percolation through the confining layers, and/or the long horizontal transport from distant recharge areas.

Table 3.3.2-10. FDEP Floridan Aquifer Groundwater Quality Monitoring Program--Polk County (Page 1 of 2)

Floridan Aquifer Parameters	Units	Groundwater Quality Standard*	Average Value	Standard Deviation	Range	
					Minimum	Maximum
In situ Measurements						
pH	SU		7.5749	0.488	6.400	8.300
Classical						
Arsenic	mg/L	0.05	0.0005	0.001	0.000	0.002
Arsenic (dissolved)	µg/L	--	0.0000	0.000	0.000	0.000
Chloride	mg/L	250	8.3770	3.151	4.460	17.500
Fluoride	mg/L	2.0	0.2069	0.150	0.000	0.589
Nitrate	mg/L	10.0	0.0139	0.024	0.000	0.110
Selenium	mg/L	0.05	0.0000	0.000	0.000	0.000
Selenium (dissolved)	µg/L	--	NA			
Sodium	mg/L	160	7.4638	5.652	3.000	32.600
Sulfate	mg/L	250	6.5738	14.434	0.000	81.500
TDS	mg/L	500	152.3439	61.543	58.000	289.000
Other Metals						
Barium	mg/L	2.0	0.0034	0.012	0.000	0.052
Barium (dissolved)	µg/L	--	NA			
Cadmium	mg/L	0.005	0.0005	0.001	0.000	0.003
Cadmium (dissolved)	µg/L	--	NA			
Chromium (total)	mg/L	0.1	0.0000	0.000	0.000	0.002
Chromium (dissolved)	µg/L	--	NA			
Copper	mg/L	1.0	0.0044	0.007	0.000	0.029
Copper (dissolved)	µg/L	--	0.1210	0.000	0.121	0.121
Iron	mg/L	0.3	0.6904	1.106	0.000	4.550
Iron (dissolved)	µg/L	--	0.0565	0.022	0.050	0.140
Lead	mg/L	0.015	0.0147	0.042	0.000	0.190
Manganese	mg/L	0.05	0.0193	0.029	0.000	0.110
Manganese (dissolved)	µg/L	--	12.6667	13.013	0.000	26.000
Mercury	mg/L	0.002	0.0001	0.000	0.000	0.001
Silver	mg/L	0.1	0.0006	0.003	0.000	0.014
Zinc	mg/L	5.0	0.0176	0.021	0.000	0.092
Zinc (dissolved)	µg/L	--	3.1600	5.473	0.000	9.480

Table 3.3.2-10. FDEP Floridan Aquifer Groundwater Quality Monitoring Program--Polk County (Page 2 of 2)

Floridan Aquifer Parameters	Units	Groundwater Quality Standard*	Average Value	Standard Deviation	Range	
					Minimum	Maximum
Organics						
Endrin	µg/L	2.0	0.0000	0.000	0.000	0.000
Methoxychlor	µg/L	40.0	0.0000	0.000	0.000	0.000
Toxaphene	µg/L	3.0	0.0000	0.000	0.000	0.000
2,4-D	µg/L	70.0	0.0000	0.000	0.000	0.000
2,4,5-TP, silvex	µg/L	50.0	0.0000	0.000	0.000	0.000
Benzene	µg/L	1.0	0.0649	0.321	0.000	1.900
Carbon tetrachloride	µg/L	3.0	0.0135	0.082	0.000	0.500
Ethylene dibromide	µg/L	0.02	0.0000	0.000	0.000	0.000
Tetrachloroethene	µg/L	3.0	0.0135	0.082	0.000	0.500
Trichloroethene	µg/L	3.0	0.0135	0.082	0.000	0.500
Vinyl chloride	µg/L	1.0	0.0135	0.082	0.000	0.500
1,2-Dichloroethane	µg/L	3.0	0.0135	0.082	0.000	0.500
1,1,1-Trichloroethane	µg/L	200.0	0.0135	0.082	0.000	0.500

Note: SU = standard units.
-- = no data available.

* Standards from Chapter 17-750 and 17-550, F.A.C., 1-26-93

Source: TEC, 1992a.

Table 3.3.2-11. Floridan Aquifer Groundwater Quality at GW1—Floridan Aquifer (Page 1 of 2)

Parameter	Units	Groundwater Quality Standards*	Minimum Detection Limit	GW1-F1 Floridan Aquifer
pH (*in situ*)	s.u.	6.5-8.5		8.1
Arsenic	µg/L	50.0	10	<10.000
Barium	mg/L	2.0	0.3	<0.300
Cadmium	µg/L	5.0	0.8	<0.800
Chromium	mg/L	0.05	0.05	<0.050
Lead	µg/L	0.1	5	<5.000
Mercury	µg/L	2.0	0.2	<0.200
Nitrogen, nitrate	mg/L	10.0	1	<1.000
Silver	µg/L	100.0	0.07	<0.070
Chloride	mg/L	250.0	1	11.00
Color	Pt-Co	15	5	20.00
Copper	mg/L	1.0	0.03	<0.030
Fluoride, soluble	mg/L	2.0	0.01	0.50
Iron	mg/L	0.3	0.03	<0.300
Manganese	mg/L	0.05	0.05	<0.050
Sodium	mg/L	160.0	1	15.00
Sulfate	mg/L	250	5	34.00
Surfactants	mg/L	0.5	0.02	0.06
Solids, total dissolved	mg/L	500	5	220.00
Endrin	µg/L	2.0	0.08	<0.080
Methoxychlor	µg/L	40.0	100	<100.000
Toxaphene	µg/L	3.0	3	<3.000
2,4-D	µg/L	70.0	10	<10.000
2,4,5-Trichlorophenol	µg/L	50.0	1	<1.000
Benzene	µg/L	1.0	0.6	<0.600
Carbon tetrachloride	µg/L	3.0	0.5	<0.500
1,2-Dibromoethane	µg/L	0.02	0.02	<0.020
Tetrachloroethylene	µg/L	3.0	5	<5.000
Trichloroethylene	µg/L	3.0	5	<5.000
Chloroform	µg/L	*	0.4	<0.400
Bromodichloromethane	µg/L	*	0.6	<0.600
Dibromochloromethane	µg/L	*	1	<1.000
Bromoform	µg/L	*	2	<2.000
Vinyl chloride	µg/L	1.0	0.8	<0.800
1,2-Dichloroethane	µg/L	3.0	1	<1.000
1,1,1-Trichloroethane	µg/L	200.0	0.08	<0.800
Turbidity	NTU	1		20.00

Table 3.3.2-11. Floridan Aquifer Groundwater Quality at GW1—Floridan Aquifer (Page 2 of 2)

Parameter	Units	Groundwater Quality Standards*	Minimum Detection Limit	GW1-F1 Floridan Aquifer
Gross alpha	pCi/L	15	2	<2.0
Radium 226	pCi/L	†	0.6	1.0 ± 0.4
Radium 228	pCi/L	†	1	<1.0

* Total trihalomethane water quality standard is 100 mg/L.
† Combined Radium 226 and 228 water quality standard is 5 pCi/L.

Sources: Modified from ECT, 1992; TEC 1992a.

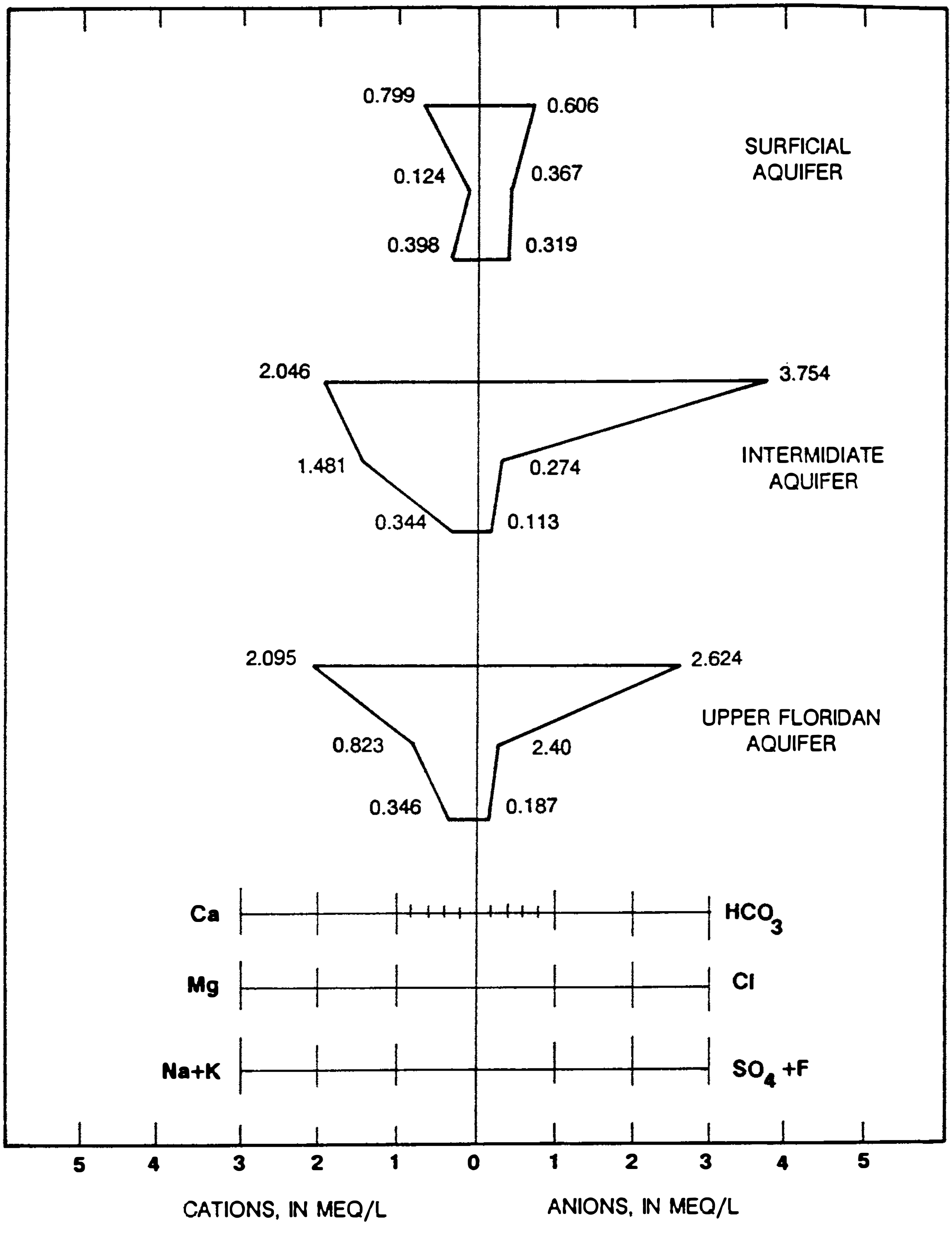

FIGURE 3.3.2-11. Median Quality of Water in the Surficial, Intermediate, and Upper Floridan Aquifers. SOURCES: Hutchinson, 1978; TEC, 1992a.	**U.S. Environmental Protection Agency, Region IV** ***Environmental Impact Statement***	**Polk Power Station** **Polk Count , Florida**

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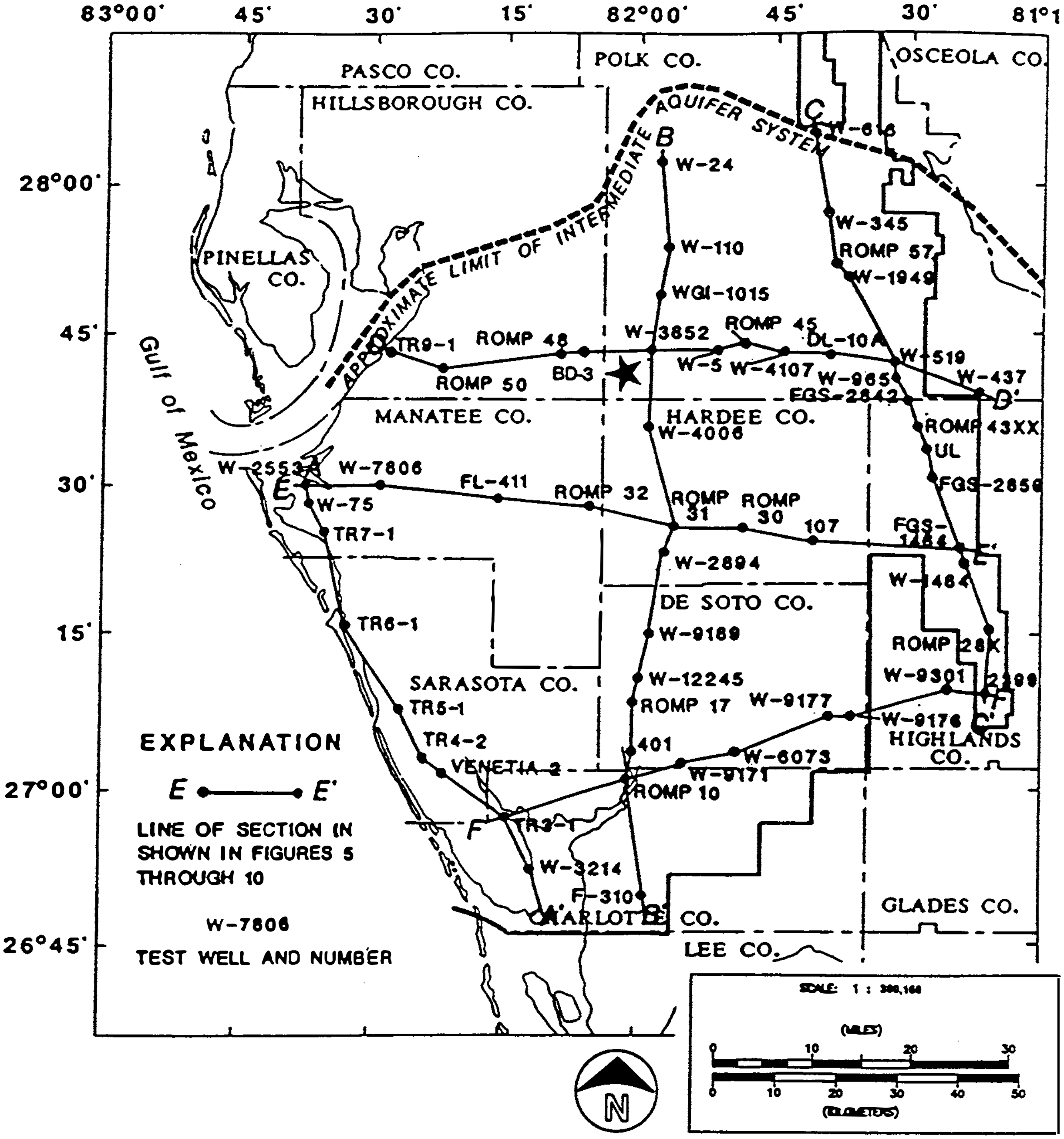

FIGURE 3.3.2-12.
Locations of Hydrogeological Cross Sections.

SOURCES: Modified from Duerr, 1988 (Fig. 6); ECT, 1992; TEC,1992a.

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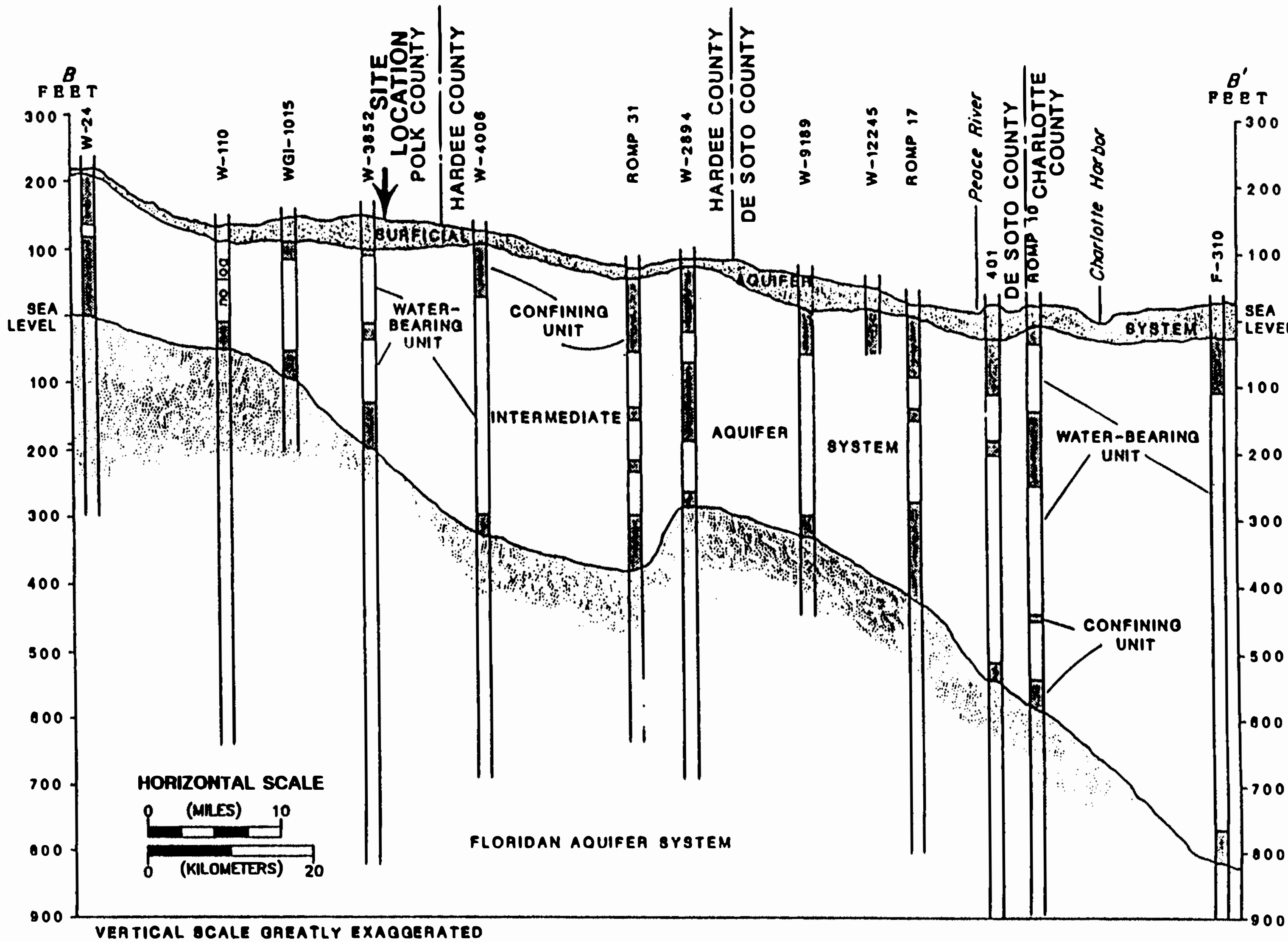

FIGURE 3.3.2-13.
Generalized Hydrogeologic Cross Section B - B'.

SOURCES: Modified from Duerr, 1988 (Fig. 6); ECT, 1992; TEC, 1992a.

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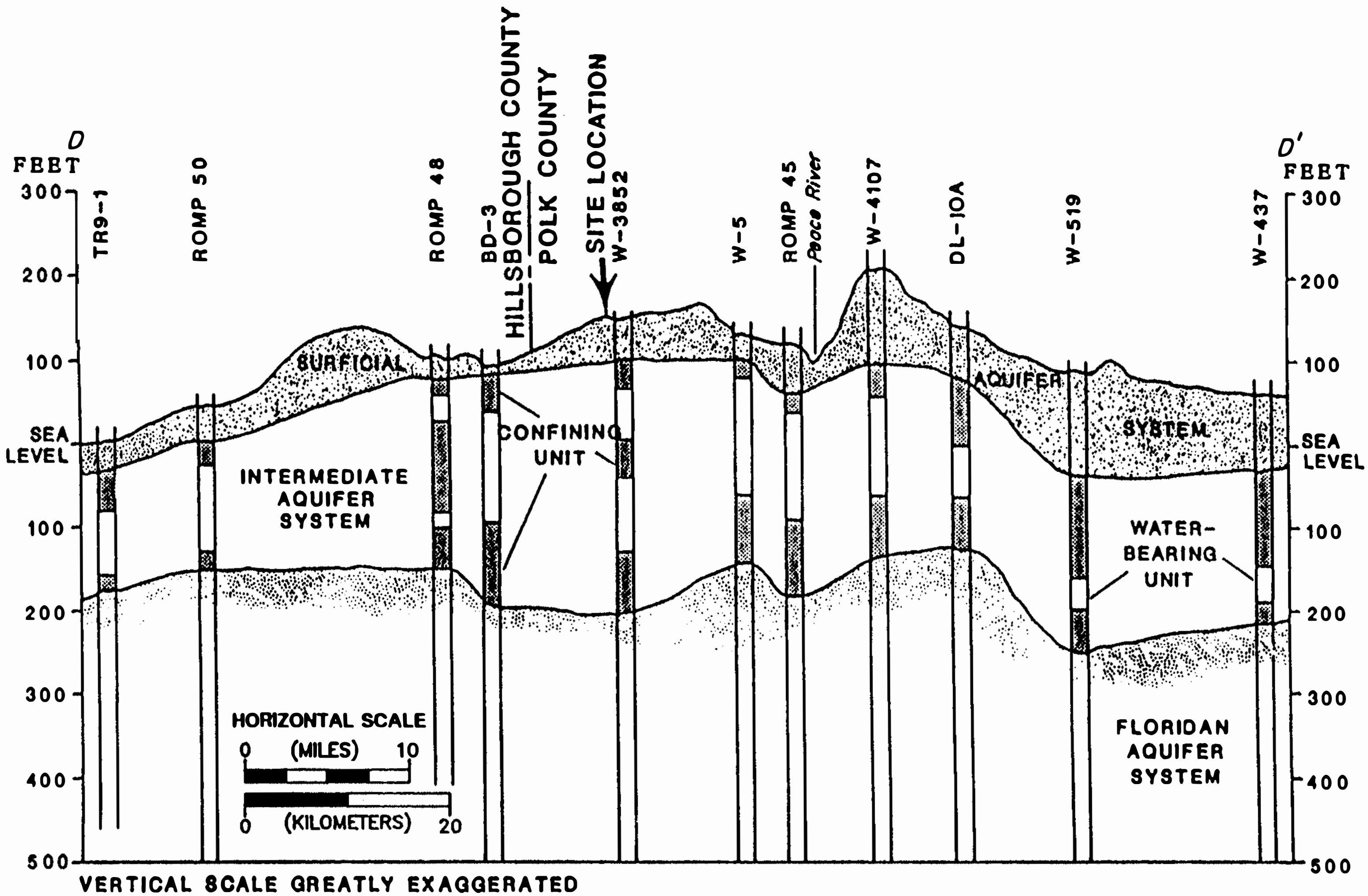

FIGURE 3.3.2-14.
Generalized Hydrogeologic Cross Section D - D'.

SOURCES: Modified from Duerr, 1988 (Fig. 4-5); ECT, 1992; TEC, 1992a.

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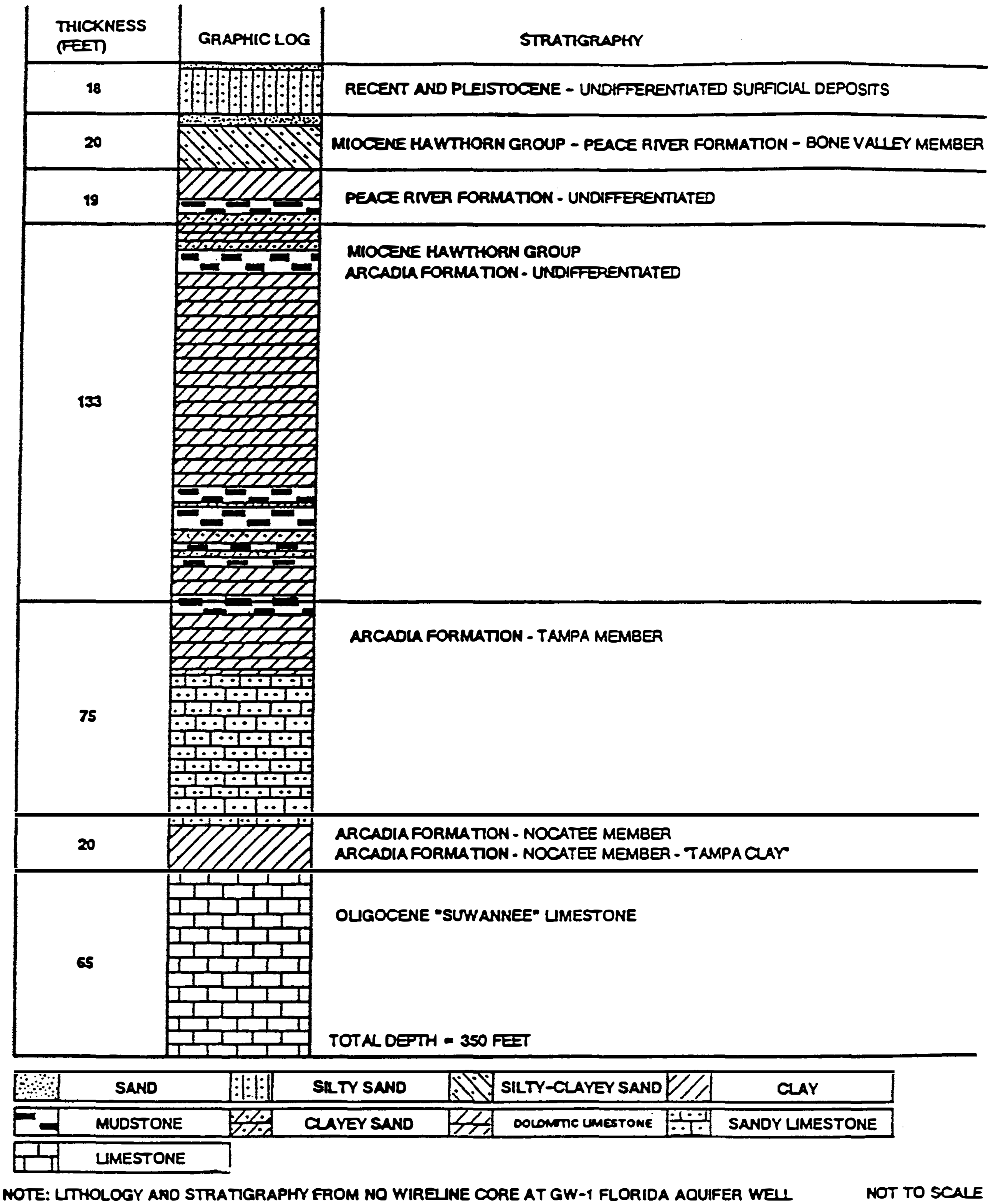

FIGURE 3.3.2-15.
Stratigraphic Column from NQ Wireline Core at GW-1.

SOURCES: ECT, 1992; TEC, 1992a.

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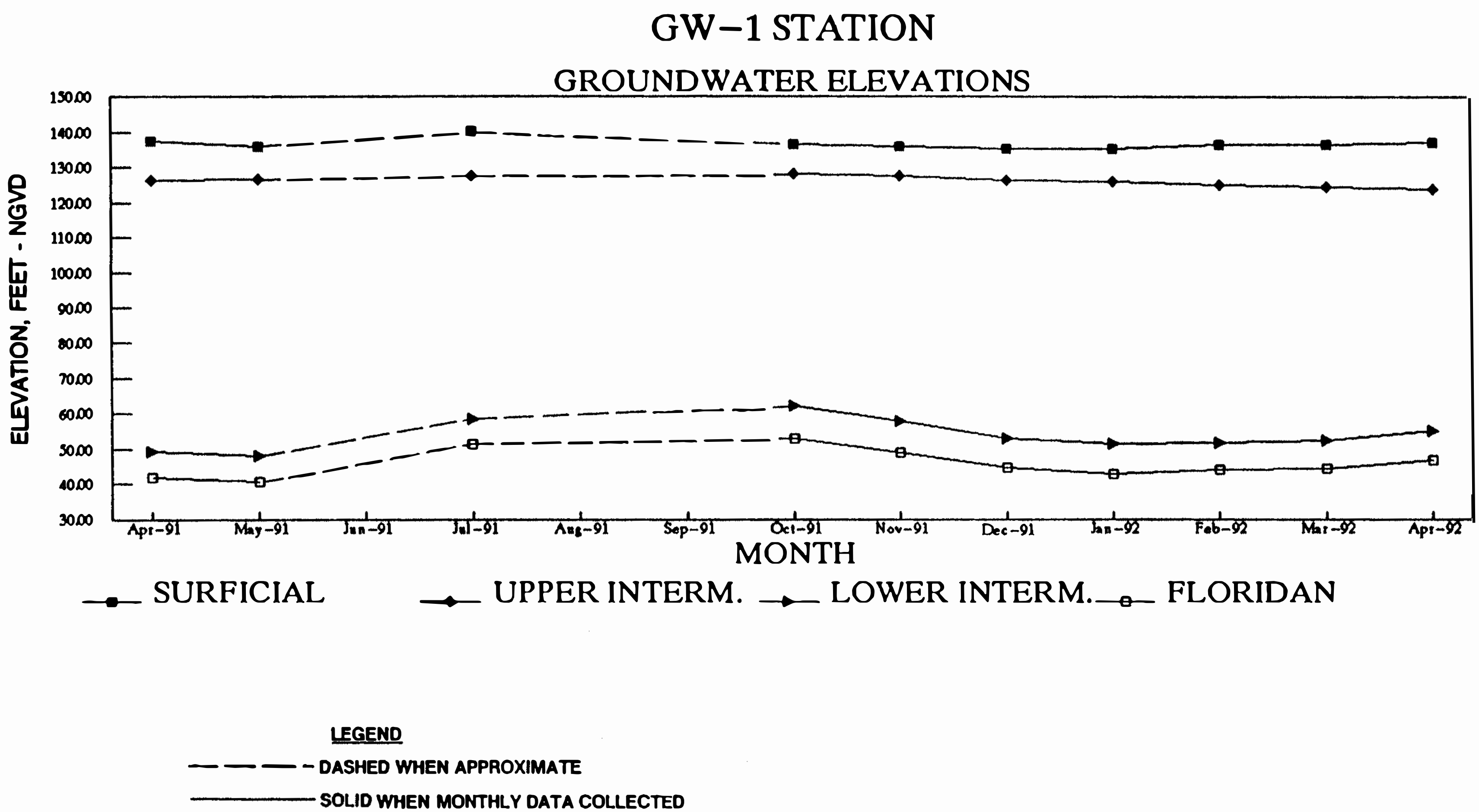

FIGURE 3.3.2-16.
Hydrograph for Groundwater Monitor Station GW-1.

SOURCES: ECT, 1992; TEC, 1992a.

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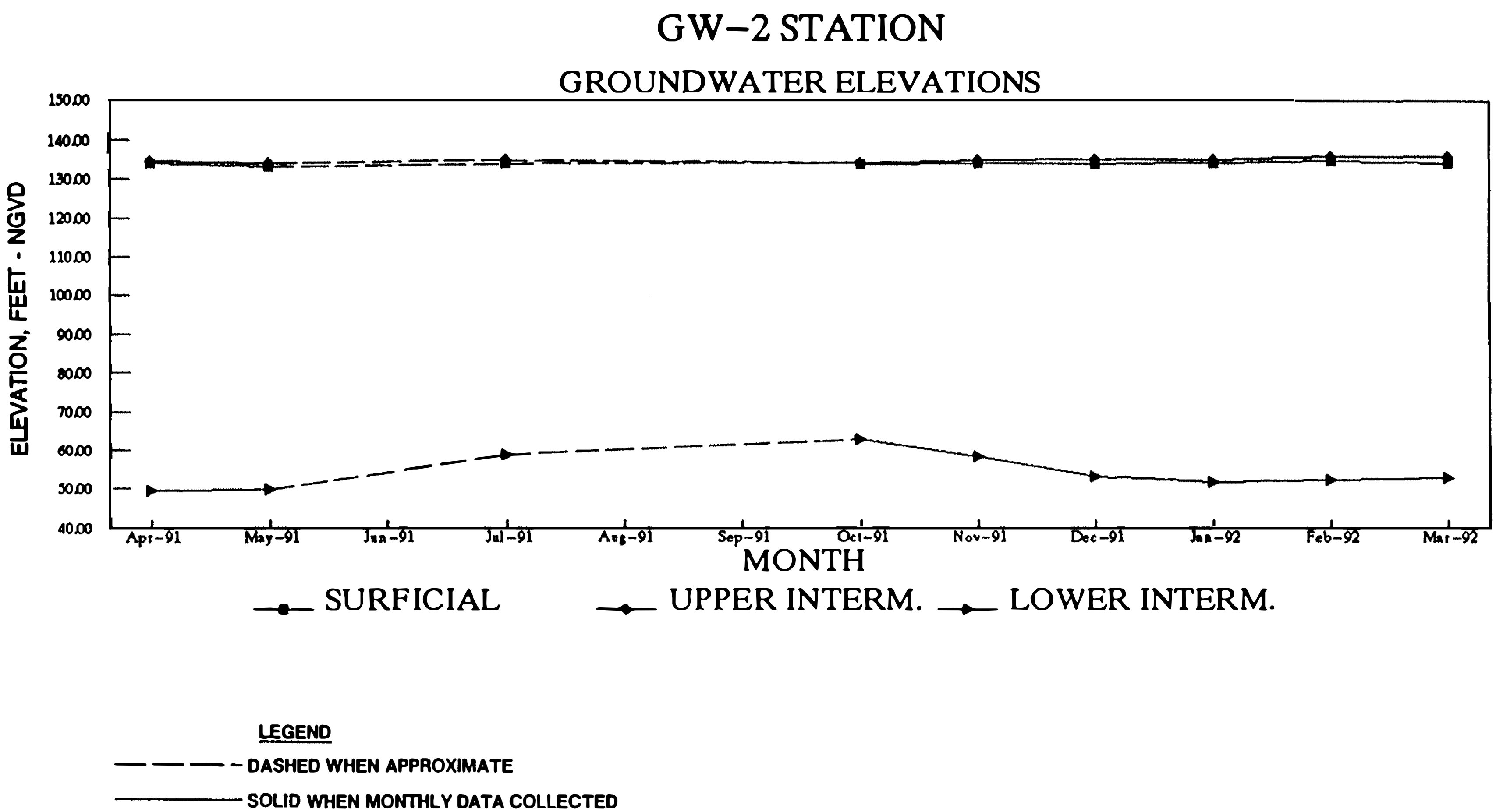

FIGURE 3.3.2-17.
Hydrograph for Groundwater Monitor Station GW-2.

SOURCES: ECT, 1992; TEC, 1992a.

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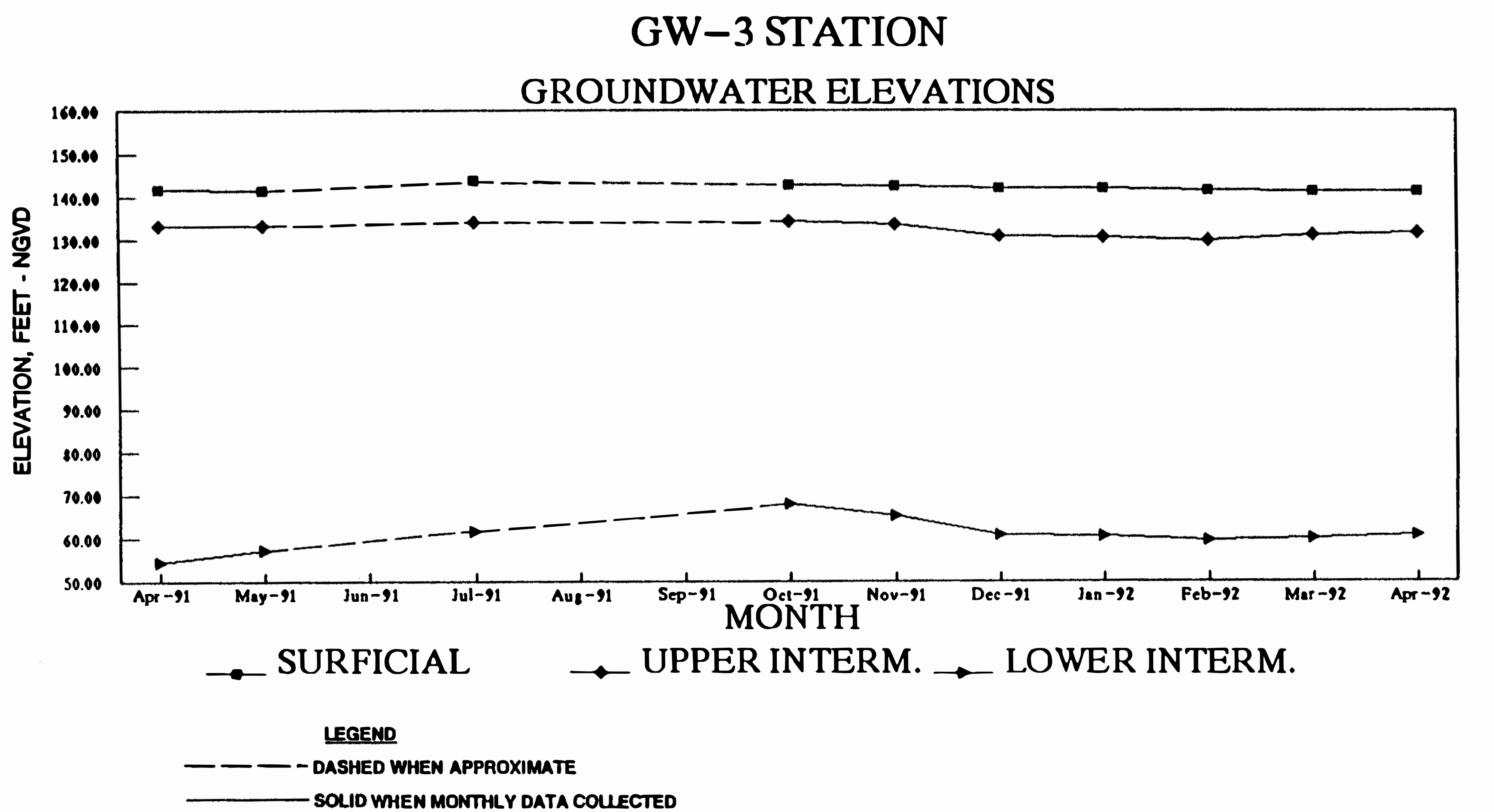

FIGURE 3.3.2-18.
Hydrograph for Groundwater Monitor Station GW-3.

SOURCES: ECT, 1992; TEC, 1992a.

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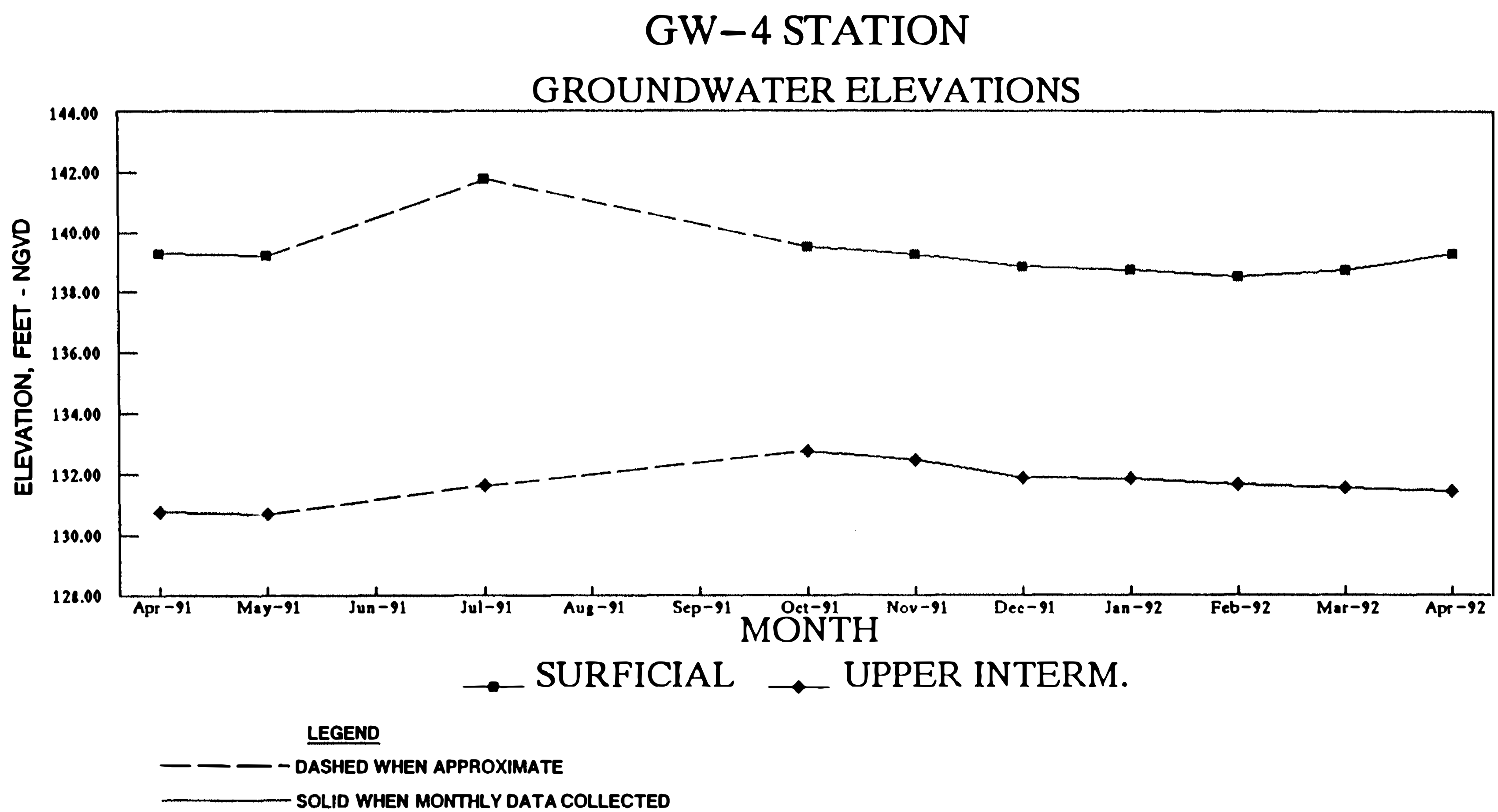

FIGURE 3.3.2-19.
Hydrograph for Groundwater Monitor Station GW-4.

SOURCES: ECT, 1992; TEC, 1992a.

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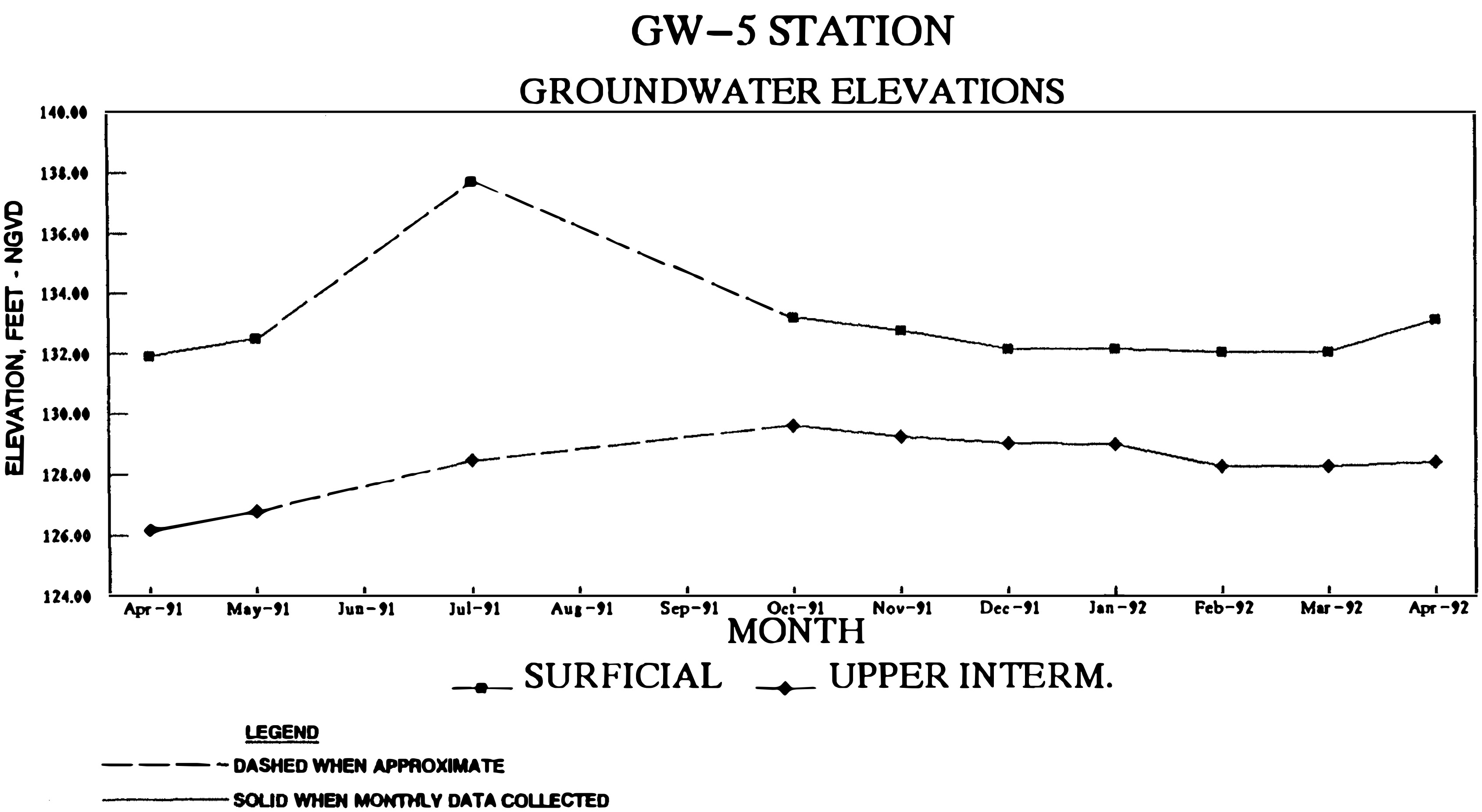

FIGURE 3.3.2-20.
Hydrograph for Groundwater Monitor Station GW-5.

SOURCES: ECT, 1992; TEC, 1992a.

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Recharge between the surficial and intermediate aquifer is classified as no recharge (0 inches per year) to moderate recharge (10 inches per year). Recharge between the intermediate and Floridan aquifers is also classified as no recharge to moderate recharge. At Station GW1, a soil sample was obtained by Tampa Electric Company (TEC, 1992a) from the Tampa Clay of the Nocatee member of the Arcadia Formation at a depth of approximately 270 ft-bls. A laboratory permeability test on this sample indicated a low permeability of 3×10^{-7} centimeters per second (cm/sec) (8.5×10^{-4} ft/day). This low permeability supports the theory that peak recharge to the Floridan aquifer will lag behind peak recharge to the surficial and upper intermediate aquifers. It also suggests that a significant amount of the water in the aquifer is replaced from distant recharge areas where conditions are more favorable for recharge of the deeper aquifers. Some local recharge to the deeper aquifers may also occur, but this would be a very minor contribution.

3.4 GEOLOGICAL AND SOIL RESOURCES

This section characterizes the existing local and regional geological and soil resources, including physiography, topography, soils, and geology in Polk County and the vicinity of the proposed Polk Power Station site. The site lies in the border between the Peace River and Alafia River drainage basins. A summary of the hydrogeologic framework for the central Florida phosphate district of west-central Florida is illustrated in Figure 3.4-1.

3.4.1 Regional Stratigraphy/Lithology

Polk County is located in the Central Highlands physiographic province which consist mainly of the Polk and Lake Uplands. The eastern part of the county lies within the Osceola Plain and Lake Wales Ridge. Elevation across the county ranges from approximately 50 to 305 ft-NGVD. The Kissimmee River Valley on the eastern edge of the county exhibits the lowest elevation. The Lake Wales Ridge is the most dominant topographic feature in peninsular Florida with elevations from 150 to 305 feet NGVD. Figure 3.4.1-1 shows the location of physiographic features in Polk County.

The proposed Polk Power Station site and surrounding region contain surficial layers of unconsolidated sand and clay underlain by a thick sequence of sedimentary rocks. The surficial layer is predominately fine sand, interbedded clay, marl, shell, and phosphorite. The primary stratigraphic units of the surficial layer include undifferentiated sands and clays. In general, the surficial sediments are thinnest in the southwestern portion of the county and thicker to the north and east and beneath the ridges. Polk County surficial deposits may range in thickness from 0 to approximately 70 ft. In the vicinity of the proposed Polk Power Station site, the surficial layer is approximately 50 ft thick.

Underlying the surficial layer is the Tamiami Formation. This formation consist mainly of clay, sand, limestone, pebbly sand, shell, and phosphatic material.

Underlying the Tamiami Formation is the Hawthorn Group. In Polk County, the Hawthorn Group consists of the Peace River Formation and the Arcadia Formation, in descending order. The Bone Valley member and an undifferentiated member make up the Peace River Formation. The primary constituents of the Peace River Formation include dolomite, sand, and clay. The Bone Valley member contains abundant phosphorite deposits that are mined extensively in Polk and neighboring counties for use in fertilizers. The Arcadia Formation consists of an undifferentiated formation, Tampa member, and Nocatee member. The Arcadia Formation contains dolomite, sand, clay, and silty, phosphatic limestone. The thickness of the Hawthorn Group ranges from very thin to approximately 300 ft.

The Tamiami Formation and Hawthorn Group together extend from approximately 50 ft-bls to approximately 275 to 300 ft-bls, in the region of the project site. Beginning with the Tampa Member of the Arcadia

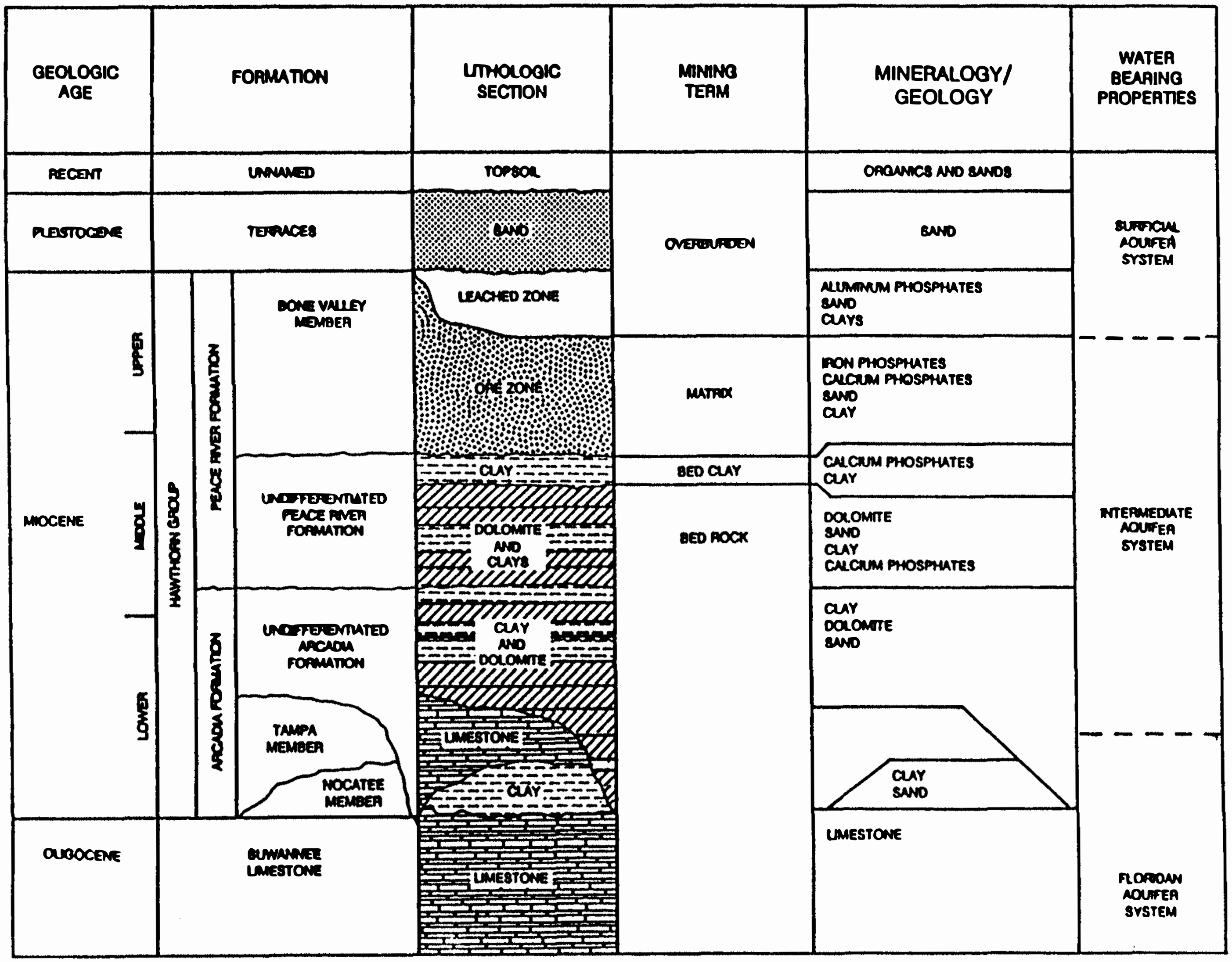

FIGURE 3.4-1.
Hydrogeologic Framework of Florida Phosphate District.

SOURCES: Campbell, 1986; TEC, 1992a.

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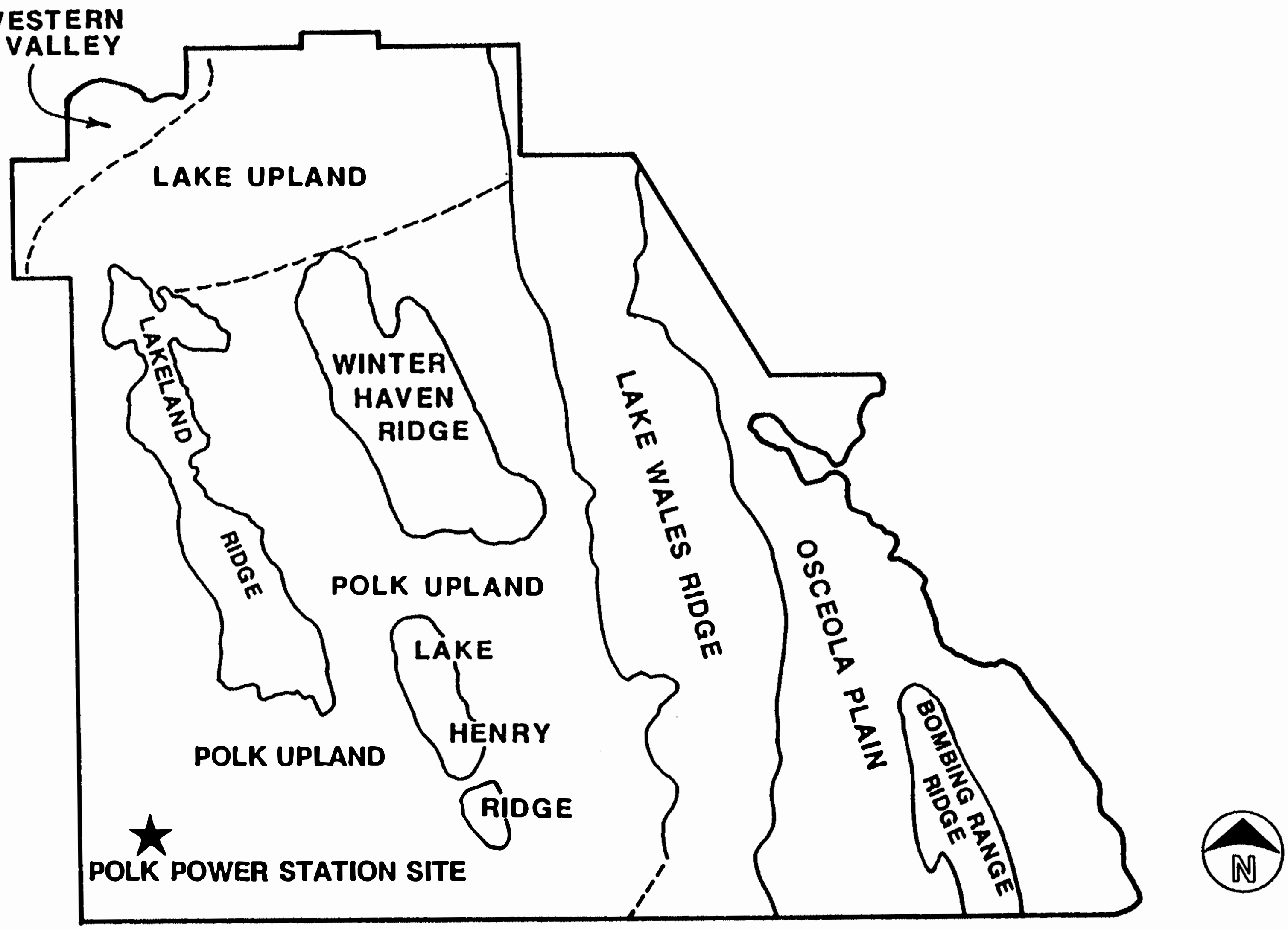

Generalized Physiographic Map of Polk County, after White (1970).

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FIGURE 3.4.1-1.
Generalized Physiographic Map of Polk County.

SOURCES: Modified Campbell, 1986; ECT, 1992; TEC, 1992a.

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Formation of the Hawthorn Group, a sequence of limestone dominated strata extends from approximately 225 ft-bls to depths in excess of 1,000 ft in the region.

Underlying the Hawthorn Group is the Suwannee Limestone of the Oligocene age. The Suwannee Limestone ranges in thickness from approximately 80 ft to over 250 ft. The Suwannee Limestone is the top of two highly productive units of the upper Floridan aquifer.

Underlying the Suwannee Limestone is the Ocala Group, Avon Park Limestone and the Oldsmar Formation of the Eocene Series. The Ocala Group crops out in the area of the Green Swamp of northern Polk County and increases in depth towards the south. The Avon Park Limestone is the lower productive formation of the upper Floridan aquifer. The deepest formation encountered in the county is the Paleocene Cedar Keys formation, which overlies strata greater than 2,000 ft.

Generalized descriptions (Campbell, 1986, Stewart, 1966, except as noted; TEC, 1992a) of the formations in the site area are summarized here in ascending order.

Oldsmar 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.

Avon Park Formation--Limestone, chalky, nodular, oolitic, fragmental, intergranular anhydrite and gypsum, very fossiliferous, cream, white, to dark brown; commonly dolomite zones in middle part, dense to finely crystalline, 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 (Wilson, 1977; TEC, 1992a).

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

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

Hawthorn Group-Arcadia Formation--Nocatee member: 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 member: 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. Undifferentiated member (Hawthorn Carbonate unit): 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 is less clastic than the underlying sand and clay unit, phosphatic throughout.

Hawthorn Group-Peace River Formation--Undifferentiated member: interbedded sands, clays, and dolomite with varying phosphate content. 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.

Undifferentiated Surficial Deposits--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.

3.4.2 Site Area Stratigraphy/Lithology

Stratigraphic data was collected from a wire-line core to prepare a general stratigraphic section and column (Figure 3.3.2-15) for the site. Data from the wire-line core and other borings conducted on site were used to evaluate the site area stratigraphy. (The wire-line core is a geotechnical sampling device that allows the collection of a continuous core of rock/sediment, 2 to 2.5 inches in diameter. The device consists of a powered hollow-stem bit, lowered by a wire or cable, that leaves a cylinder of undisturbed matrix as it descends. This undisturbed cylinder progresses up a sampling tube as the bit descends. When the sampling tube is full, it is retrieved and another tube lowered into place without having to remove the device.) The undifferentiated surficial sand deposits ranged in thickness from 15 to 28 ft. Within the Hawthorn Group, the Peace River Formation ranged in thickness from 16 to 40 ft and the Arcadia Formation was approximately 225 ft thick. The Suwannee Limestone was encountered at a depth of approximately 285 ft. This unit was not fully penetrated during this investigation. The carbonate sequence including the Suwannee Limestone, Ocala Group, Avon Park Formation, and Oldsmar Limestone extends to depths ranging from 1,500 to 1,800 ft.

Site Area Physiography

The project site falls in the geomorphic province known as the Polk Upland (White, 1970; TEC, 1992a). The majority of the proposed Polk Power Station site occurs on the Okefenokee Terrace (Sunderland Terrace) with an altitude range of +100 to +170 ft-msl, and a shoreline altitude at +170 ft-msl. The Polk Upland is bounded by the DeSoto Plain on the south and the Lake Henry or Lake Wales Ridge on the east (Campbell, 1986; TEC, 1992a). The topography of the Polk Upland is flat and underlain by a veneer of sands. Only geomorphic features associated with remnants of ancient shorelines mark the land form as it slopes gently toward the south (Campbell, 1986; TEC, 1992a).

Prior to the recent mining activities, the land surface elevations within the project site ranged from approximately 130 to 200 ft-msl. The low elevation occurs at the southeast corner. Mine tailings mounds (from the early 1900s) in the northeast portion of the site range between approximately 170 to 200 ft-NGVD adjacent to Fort Green Road. The land surface elevation along SR 37 ranges from approximately 145 to 150 ft-NGVD. West of SR 37 the site elevation ranges from approximately 150 to 110 ft-NGVD. Prior to recent mining, the land surface was relatively flat with shallow slopes. The two exceptions are the old mine tailings mounds (northeast corner) and adjacent to the South Prong Alafia River (west-northwest corner). Several circular depressions are visible on soils and topographic maps and aerial photographs.

3.4.3 Site Soils

Soil types have been mapped by the U.S. Department of Agriculture in cooperation with the Polk County Soil Conservation Service (SCS, 1990; TEC, 1992a).

The proposed Polk Power Station site is situated primarily on Smyrna-Myakka, Arents-Water, and Ona soil types. Seventeen other soil types occur across the site, but cover significantly less area. Figure 3.4.3-1 is the SCS soils map of the Polk Power Station and vicinity prior to mining activities.

The Smyrna-Myakka soil complex consists primarily of fine sands which cover broad areas of flatwoods. These soils are poorly drained with slopes that are smooth to concave at 0 to 2 percent. The water table within these soils is typically 0 to 1 ft-bls for 1 to 4 months in most years. The Smyrna soils have an organic matter content of 1 to 5 percent, and the Myakka soils have an organic matter content of 2 to 5 percent (SCS, 1990; TEC, 1992a). This soil complex has only a slight erosional risk.

The Arents-Water complex is a soil type resulting from mining activities. The Arents consists of piles (various slopes) of soil material and overburden that originally overlaid the phosphate matrix. The water part of this classification forms in depressions after the ore has been mined.

The Ona fine sands are also found in broad areas of flatwoods. The Ona soils are somewhat poorly drained with shallow slopes of 0 to 2 percent. The Ona soil has a seasonal high water table within 12 inches of the surface for 1 to 4 months in most years. The Ona sand has only a slight erosional risk.

3.4.4 Karst Hydrogeology

The entire State of Florida is underlain by an extensive thickness of carbonate strata. These sedimentary rocks are subject to dissolution by the percolation of naturally slightly acidic recharge from rainfall. Over time, this

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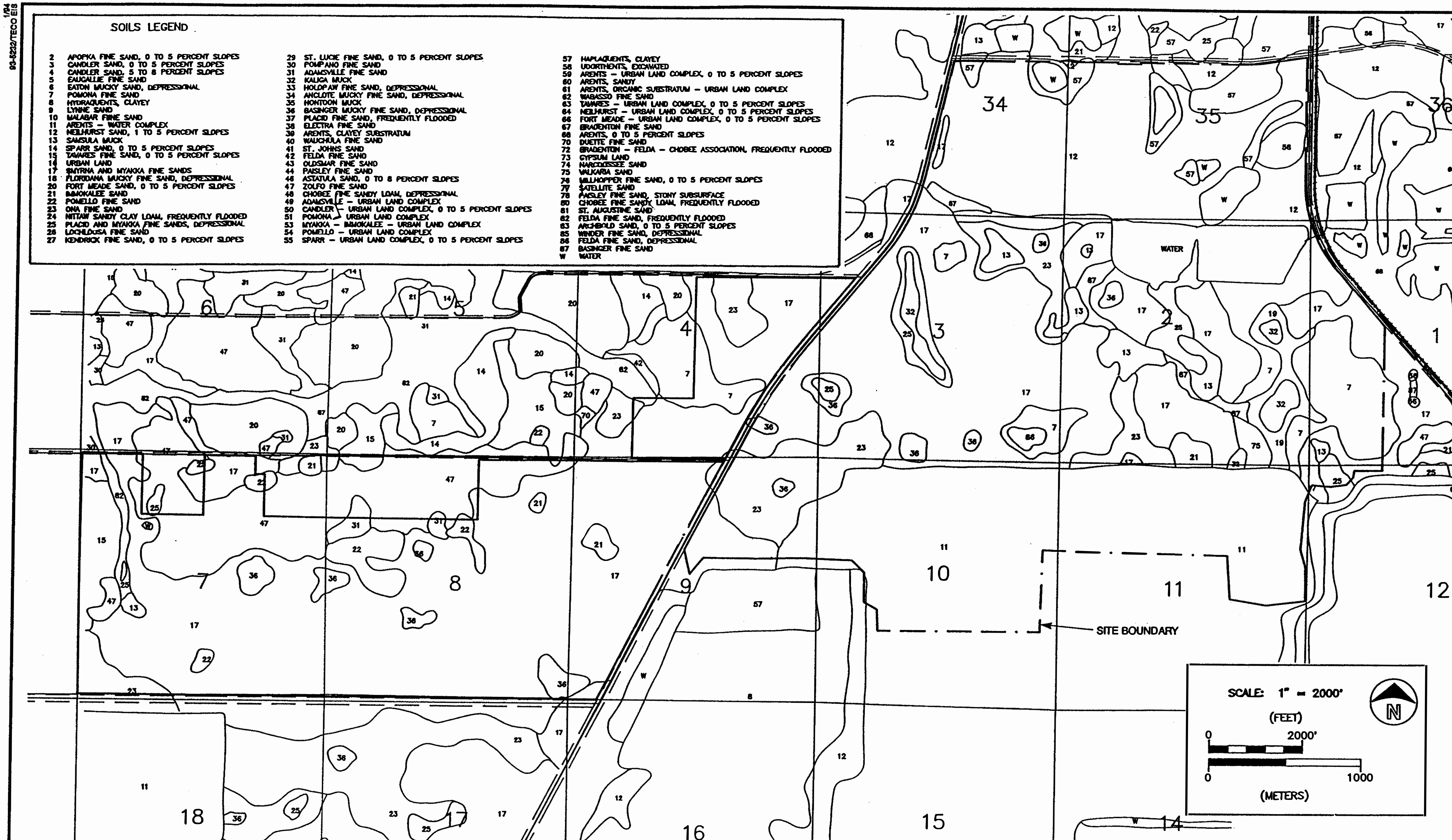

FIGURE 3.4.3-1.
SCS Soil Type Map - Premining Conditions.

SOURCES: ECT, 1992; TEC, 1992a.

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process develops solution cavities and features (secondary porosity) within the rock sequence as recharge infiltrates through the carbonate strata. In areas where surficial sediments drain into these cavities, a characteristic land surface is produced. This irregular land surface is called karst topography. Karst topography in Florida is usually recognizable on topographic maps by a high number of circular depression features, often containing water.

One of the more notable features of karst topography is sinkholes. The circular depressions caused by sinkhole formation are found throughout Florida, including Polk County. Sinkholes may provide a direct avenue for the surface water, groundwater from an overlying aquifer, and pollutants, to rapidly infiltrate into lower stratigraphic units and aquifers. Generally, karst activity occurs at a slow rate resulting in the gradual subsidence of the land surface over a large area. This slow dissolutioning process of the carbonate strata has been estimated to result in subsidence of as much as 1 ft every 5,000 to 6,000 years (Sinclair *et al.*, 1985; TEC, 1992a). The types of sinkholes that develop in Florida are controlled by the geology and hydrogeology of the region. The three major types of sinkholes common throughout Florida include solution sinkholes, cover-collapse sinkholes, and cover-subsidence sinkholes. These sinkholes are readily distinguishable by their mode of formation.

The thickness and type of cover that overlies the carbonate strata has a significant influence on the susceptibility to and the type of karst topography that develops. The presence of a thick clay sequence or other less permeable material with high artesian pressure reduces the recharge potential. Hence, this type of cover results in less susceptibility to the development of karst features and sinkholes. Figure 3.4.4-1 depicts the various zones of the different type of sinkholes for west-central Florida. The proposed Polk Power Station site is located in Zone 7, where sinkhole development is rare, but some cover-collapse sinkholes are known to occur (Sinclair *et al.*, 1985; TEC, 1992a).

The proposed Polk Power Station site is located in the southwest corner of Polk County, which appears to have undergone some karst deformation. Through review of two USGS 7.5-minute topographic quadrangles (BAIRD and DUETTE NE), several closed surface depressions were detected within the site boundaries. Review of the data obtained from the on-site drilling program conducted in support of the proposed Polk Power Station licensing efforts indicates that the surficial depressions investigated have little correlation to the underlying stratigraphy. Thus, it is unlikely that these depressions represent active karst conditions. The clay and dense carbonate sequence of the Hawthorn Group is approximately 250 ft thick beneath the site location. The presence of this thick, relatively impermeable, stratigraphic sequence limits the local recharge to the Floridan aquifer and thereby reduces the potential for sinkhole development.

A sinkhole occurrence assessment included a review of information obtained from the Florida Sinkhole Research Institute (FSRI) and other sinkhole reports. The data indicate that no sinkhole formation of

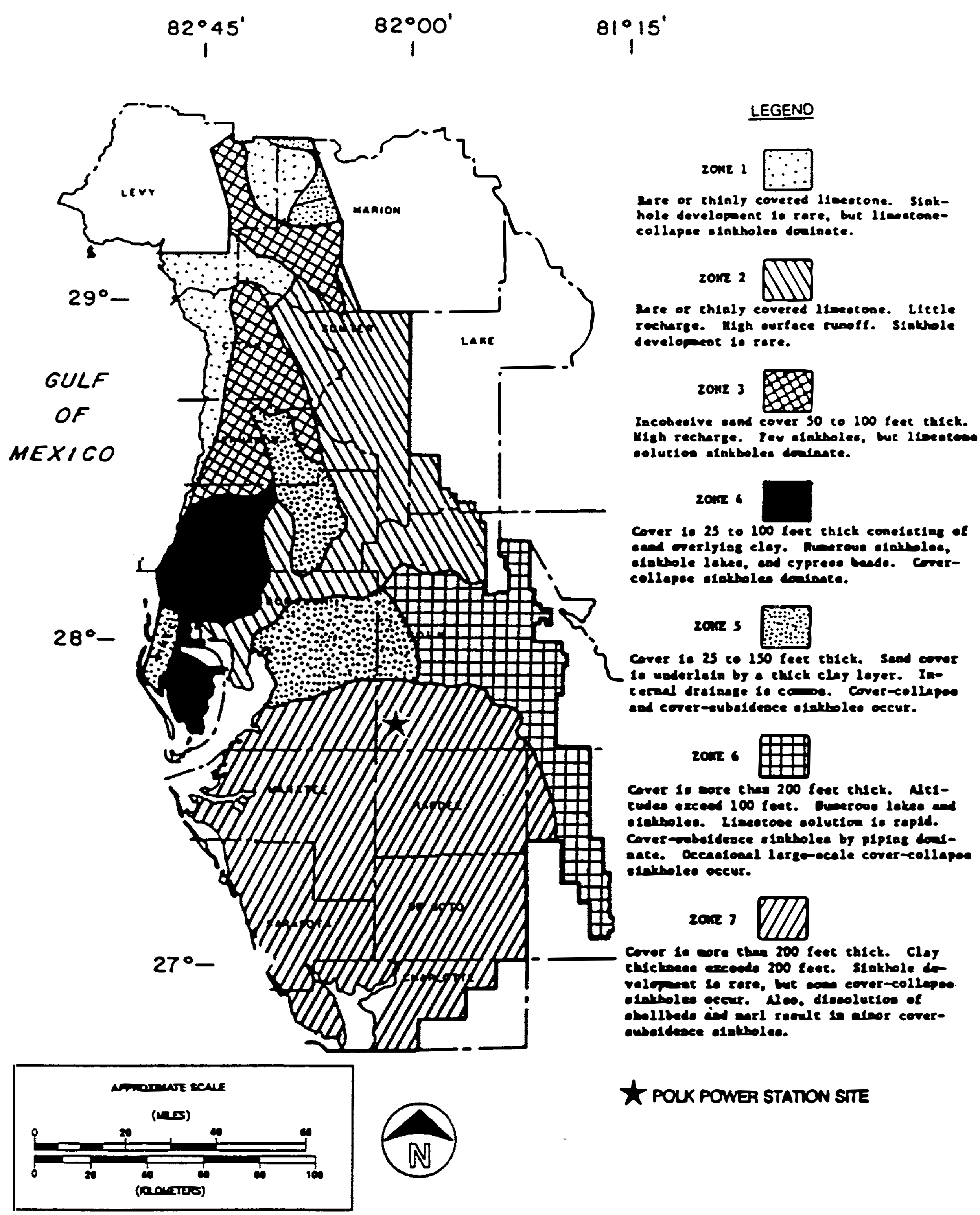

FIGURE 3.4.4-1.
Zones of Different Sinkhole Types.

SOURCES: USGS Duette ME & Baird Quads; TEC, 1992a.

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noticeable size has been observed during the site mining activities. Based on the available sinkhole data, only four sinkholes were reported in a 10-mile radius from the site within the past 35 years. Figure 3.4.4-2 shows the distribution of reported sinkholes in the vicinity of the project site. Figure 3.4.4-3 illustrates the distance from the site to the reported sinkholes. Table 3.4.4-1 summarizes available information on the four reported sinkholes.

Comparison of the topographic features, structural contours, apparent lineations, and surface-water features, reveal that geology and structural geology affect the occurrence of sinkholes in Polk County (Sinclair *et al.*, 1985; TEC, 1992a). Faults, fractures, and lineaments are commonly expressed on aerial photographs and satellite imagery as conspicuous linear features. Features and lineaments are also commonly associated with the presence of sinkholes. Data from available literature and previous studies were reviewed for the identification of linear features in southwest Polk County. A lineament map for Polk and Hillsborough Counties prepared by Ardaman & Associates, Inc. (1987) is presented in Figure 3.4.4-4. None of the major lineaments identified in this or other studies intersect or pass beneath the proposed Polk Power Station site. In Polk County, the prominent lineations appear to align with the northwest-southeast trend of the Ocala Platform and the topographic ridges with a series of less prominent lineaments at approximate right angles. The topographic ridges and the gaps between them are believed to be the surface expression of underlying structural features (Sinclair *et al.*, 1985; TEC, 1992a). Based on the available information, the potential for sinkhole development at the proposed Polk Power Station site is relatively low, compared to other areas in Polk County.

Carbonate rocks of the intermediate aquifer occur within the surficial clastic sediments at depths of 30 to 50 ft. Water, percolating through the surficial aquifer, makes contact with these carbonate rocks first. Solution cavities, particularly in the upper part of the intermediate aquifer, are probably responsible for the small land-surface depressions (TEC, 1992a).

Although solution cavities, even large ones, probably exist in the carbonate rocks of the Floridan aquifer, the aquifer is buried beneath approximately 250 ft of relatively cohesive clay and sandy clay and carbonate rock material. This material appears to have sufficient bearing strength to bridge small to moderately sized cavities. When the bearing strength is exceeded, however, a collapse would result, expressing a sinkhole at the surface. Though possible, it seems highly unlikely that collapse within the deeply-buried Floridan aquifer will have an effect at the land surface (TEC, 1992a).

Surface lineations, related to fracture zones in the bedrock, are relatively scarce in the proposed Polk Power Station area, suggesting either that groundwater circulation has not been adequate to develop large solution cavities along fractures, or that the bedrock is too deeply buried for these features to affect the land surface (TEC, 1992a).

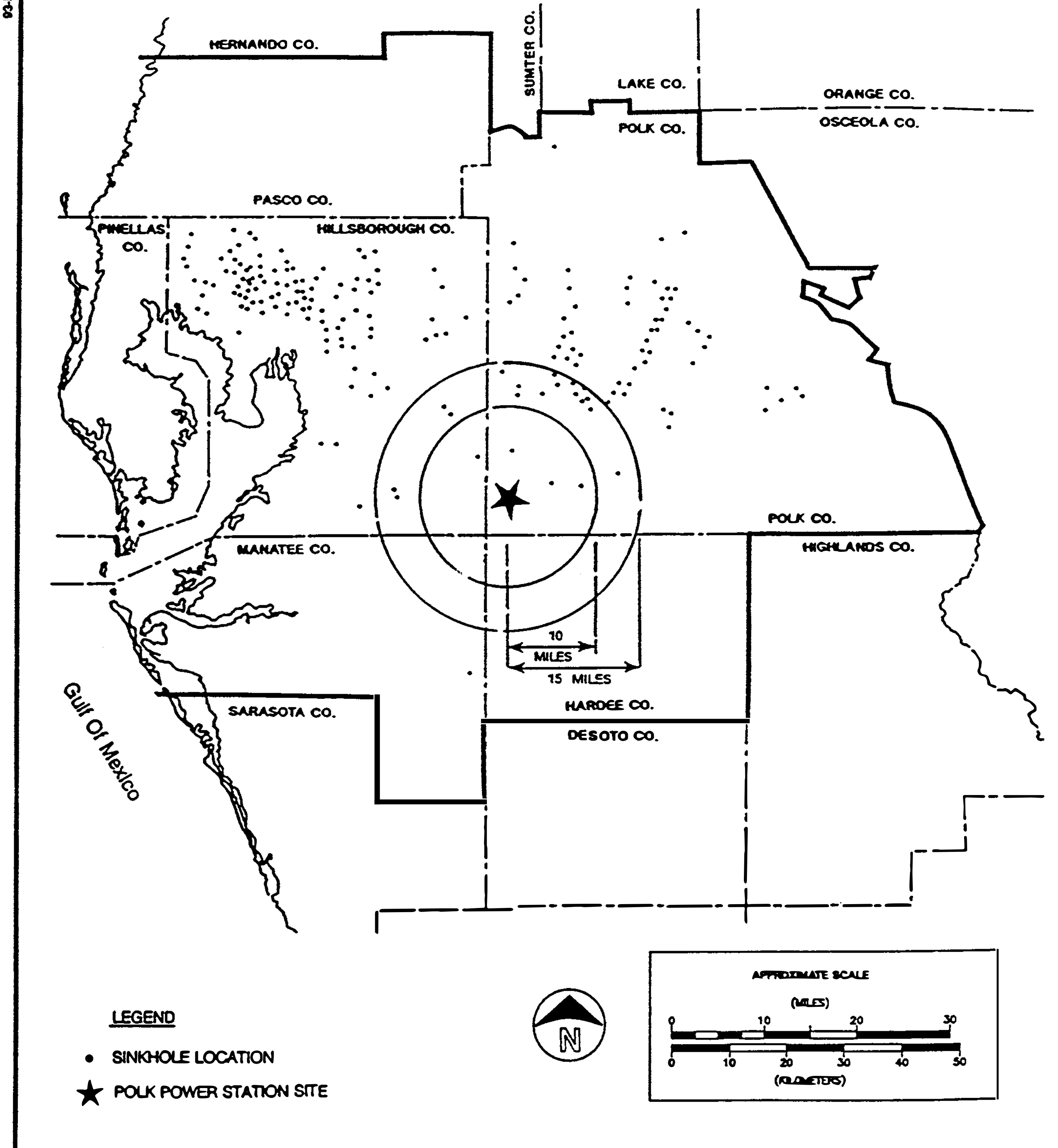

FIGURE 3.4.4-2.
Distribution of Reported Sinkholes in the Vicinity of Polk Power Station Site.

SOURCES: Ardaman & Associates. 1987; TEC. 1992a.

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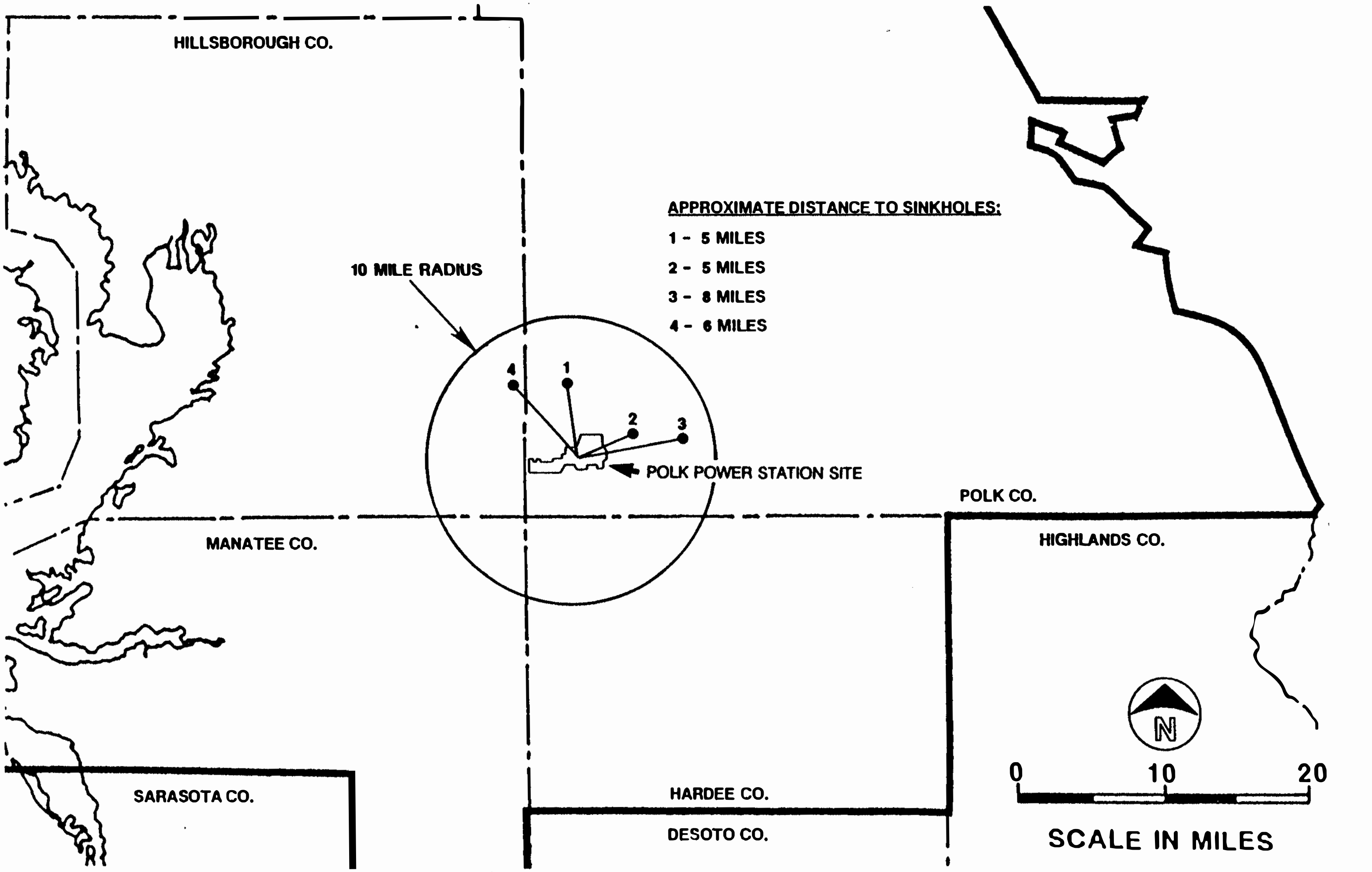

FIGURE 3.4.4-3.
Sinkhole Identification Map.

SOURCES: ECT, 1992; TEC, 1992a.

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Table 3.4.4-1. Available Information on Sinkholes within 10 Miles of the Polk Power Station Site

Sinkhole Number	FSRI Code Number	Year of Occurrence	Location				Section	County	Dimensions (ft)			Elevation (ft-msl)				Rainfall Over 90 Days Before Sinkhole Developed (inches)
			Longitude	Latitude	Range	Township			Length	Width	Depth	Land Surface	Limestone	Water Table	Potentiometric Surface	
1	16-703	NA	--	--	--	--	--	Polk	--	--	--	--	--	--	--	--
2	16-704	NA	--	--	--	--	--	Polk	--	--	--	--	--	--	--	--
3	16-017	1968	81 50 05	27 44 35	25E	31S	32	Polk	200	200	45	125	-285	NA	55	NA
4	10-648	1989	82 03 24	27 46 16	22E	31S	24	Hillsborough	100	100	15	122	-130	NA	95	8.75

NA = Specific information not available for these sinkholes from FSRI database.

Sources: FSRI, 1989; confirmed through verbal communication with Barry Beck, Ph.D., January 20, 1992; TEC, 1992a.

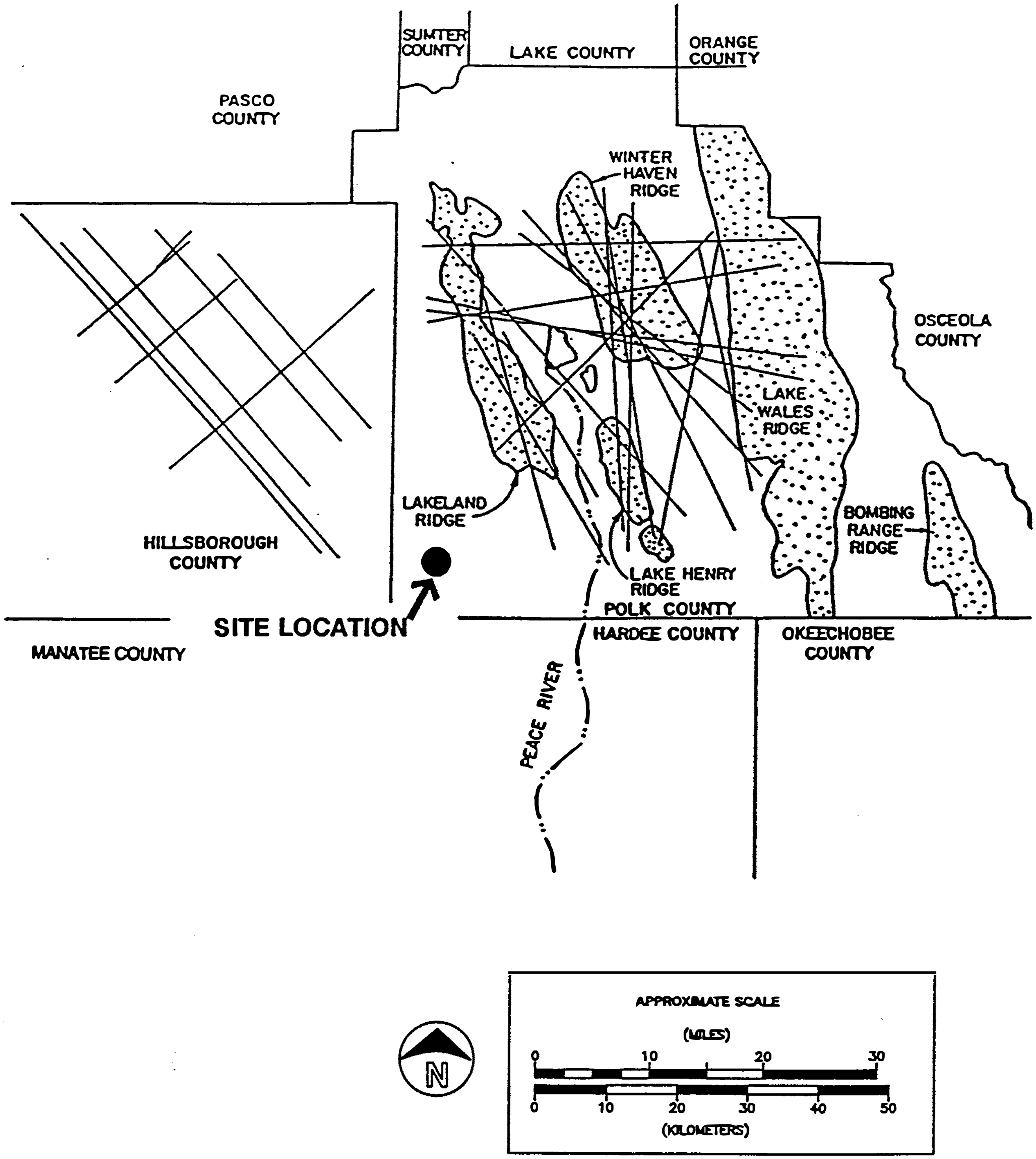


FIGURE 3.4.4-4. Prominent Lineaments in Polk and Hillsborough Counties. SOURCES: Ardaman & Associates, 1987; TEC, 1992a.	**U.S. Environmental Protection Agency, Region IV** ***Environmental Impact Statement***	**Polk Power Station** **Polk Count , Florida**

Approximately 40 additional geotechnical borings were performed at the proposed Polk Power Station site to determine the presence of karst features at the locations of all proposed power block structures under the cooling reservoir. These borings found no evidence of active karst features at these locations (TEC, 1993b personal communication with Brad Pekas, ECT Tampa).

No karst features are likely to occur (Figure 3.4.4-1), have been documented (Figure 3.4.4-3), or were detected by the on-site borings at the proposed locations of the Polk Power Station facilities. However, ancient karst features within the Polk Power Station site could exist undetected. These features could reactivate naturally, or in response to the pumping and/or surface water management activities associated with the proposed project. An open sinkhole would allow direct discharge of potentially contaminated surface waters to the deeper aquifers (Intermediate or Floridan, depending on the depth of the sinkhole) without the benefit of treatment by percolation through the sediments. In the event of the activation of a sinkhole within the Polk Power Station site, Tampa Electric Company would take reasonable measures such as diversionary berms and/or swales to restrict direct discharge of surface waters (except nonpoint-source runoff from the immediate vicinity of the sinkhole) to the sinkhole.

3.5 TERRESTRIAL ECOLOGY

The majority of the 4,348-acre proposed Polk Power Station site has been, or will be, disturbed by phosphate mining activities. By 1994, approximately 4,070 acres (94 percent) of the property will have been mined or disturbed through mining operations. Prior to July 1, 1975, approximately 523 acres of land on the site was mined or disturbed through mining. From July 1, 1975, to May 1992, an additional 2,173 acres of the site was mined, and an additional 906 acres of land was disturbed through mining activities. From May 1992 until mining ceases in 1994, an additional 446 acres will be mined and approximately 21 acres of land will be disturbed by mining activities. Only 279 acres of the site will not be mined or disturbed through mining activities. Consequently, most of the original flora on the site has been drastically altered. As a result of past and ongoing mining activities, only small portions of relatively undisturbed terrestrial, wetland, and aquatic habitats still exist on the site.

3.5.1 Biodiversity

An ecosystem is composed of two main components: the living, or biotic components, and the nonliving, or abiotic components. The living portion of an ecosystem includes the plants and animals, while the nonliving is the physical environment. The physical environment has a great influence on the community of organisms that exist in a distinct habitat. The living and the nonliving components functioning together make up an ecosystem. The greater the variety of species in an ecosystem the more diverse is the community. Therefore, biological diversity or biodiversity is a general term often defined simply as the variety and variability of life. In a community with high biodiversity, there are many components with many interconnections between the components of the community, and each is dependent to some degree on the others. This has been popularly stated as the concept that everything is connected to everything else. This interrelationship among various levels of ecological systems is fundamental to proper function. Ecological organization, and therefore biodiversity, is a ranked and ordered continuum where the reduction of diversity at any level will have effects at other levels (CEQ, 1993).

To understand biodiversity, one must recognize that the biological world is not a series of unconnected components, and that the richness of the mix of components and the connections between those components sustain the system as a whole. Regional ecosystem diversity is the pattern of local ecosystems across the landscape, sometimes referred to as landscape diversity or large ecosystem diversity. Local ecosystem diversity refers to the variety of unique assemblages of plants and animals that exist as elements of local or more succinct areas and which are linked by processes such as succession and predation (CEQ, 1993).

When natural areas are mined for phosphate ore, the overlying soil and the attendant biological community are removed so as to expose the matrix. The result is the destruction of the natural soil characteristics and the vegetative cover. The former natural habitat no longer exists. Wildlife that are mobile may find other living areas; others that are immobile, perish. Mining not only affects the local biodiversity, but it also impacts the regional ecosystem. The State of Florida, in recognition of these impacts, now requires reclamation of mined land. The Florida Institute of Phosphate Research has funded many studies on reclamation so as to return mined lands to functioning ecosystems.

It is generally accepted that more diverse ecological communities are more robust and stable than less diverse communities. More diverse communities typically have a large number of species that occupy the numerous available ecological niches. Less diverse communities have a fewer number of species (with generally a higher number of individuals per species) that occupy the fewer available ecological niches.

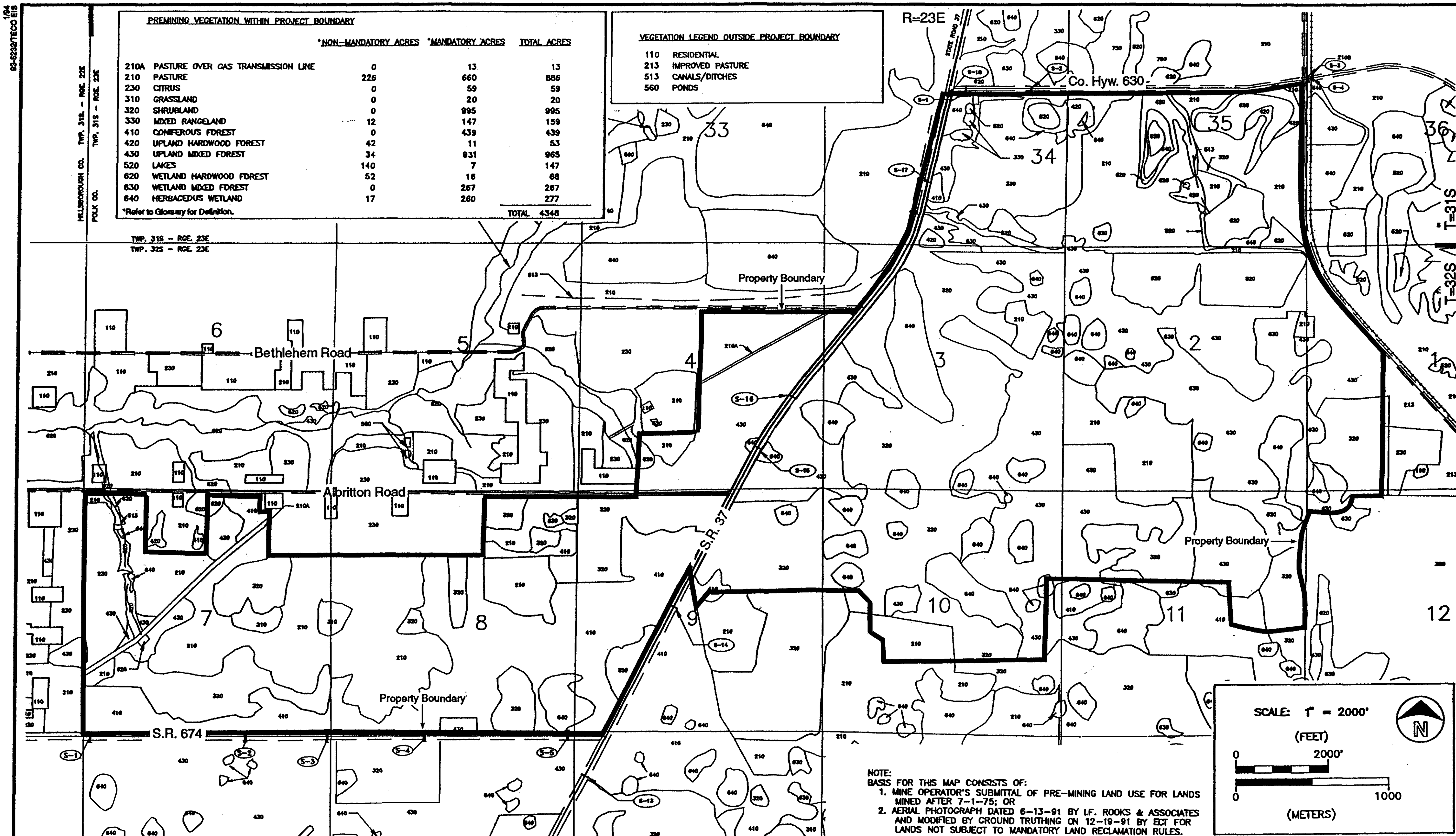
Various indices have been developed in an attempt to quantify the biodiversity of the community. These indices are often used to compare the biodiversity of an area before and after an impact, or compare an impacted area against an unimpacted (control) area to determine a level of impact. Such comparisons are often confounded by the fact that diversity can change within an area or is unevenly distributed (patchy), so that replicate sampling is important to obtaining reliable data for comparisons.

3.5.2 Vegetation

Vegetation cover/land use existing on the proposed Polk Power Station site prior to mining operations since mid-1975 is shown in Figure 3.5.2-1. These site conditions are generally referred to as premining conditions in this EIS. As indicated on the figure, the majority (65 percent) of the site was covered with primarily three upland vegetation types: pasture (20 percent), shrub and brushland (23 percent), and mixed forest (22 percent). Coniferous forest (pine flatwoods) also covered 10 percent of the site. Wetlands primarily associated with the headwater area of Little Payne Creek comprised 759 acres (17 percent) of the site.

Phosphate mining activities have significantly affected the acreage of original vegetation communities on the property. Field surveys of existing conditions were conducted by ECT during 1991-92 (TEC, 1992a). Some old-mined areas (prior to 1950) have revegetated. However, the majority of the site (more than 2,500 acres) reflect more recent mining disturbance and are essentially nonvegetated. The three upland vegetation types on the site in premining conditions now comprise less than 23 percent of the site. Wetland areas have been reduced from 17 to 8 percent in areal extent on the site. Although all other communities have generally been significantly reduced in acreage, no community types have been eliminated.

Figure 3.5.2-2 illustrates the existing land use and cover types on and adjacent to the site. Vegetation within the site has been separated into 14 major groupings based upon the FLUCCS. Table 3.5.2-1 provides the FLUCCS Level III legend, acreage, and percentages for the land use and cover map of the site. A plant species inventory of the site by plant community type was presented in the DEIS as Appendix M. Taxonomic identification of plant species follows that of Wunderlin (1982). Scientific names for identified plant species are found in the DEIS as Appendix M.



PREMINING VEGETATION WITHIN PROJECT BOUNDARY

		*NON-MANDATORY ACRES	*MANDATORY ACRES	TOTAL ACRES
210A	PASTURE OVER GAS TRANSMISSION LINE	0	13	13
210	PASTURE	226	660	886
230	CITRUS	0	59	59
310	GRASSLAND	0	20	20
320	SHRUBLAND	0	995	995
330	MIXED RANGELAND	12	147	159
410	CONIFEROUS FOREST	0	439	439
420	UPLAND HARDWOOD FOREST	42	11	53
430	UPLAND MIXED FOREST	34	931	965
520	LAKES	140	7	147
620	WETLAND HARDWOOD FOREST	52	16	68
630	WETLAND MIXED FOREST	0	267	267
640	HERBACEOUS WETLAND	17	260	277
			TOTAL	4348

*Refer to Glossary for Definition.

VEGETATION LEGEND OUTSIDE PROJECT BOUNDARY

110	RESIDENTIAL
213	IMPROVED PASTURE
513	CANALS/DITCHES
560	PONDS

FIGURE 3.5.2-1.
Premining Vegetation and Land Use Map.

SOURCES: ECT, 1992; TEC, 1992a.

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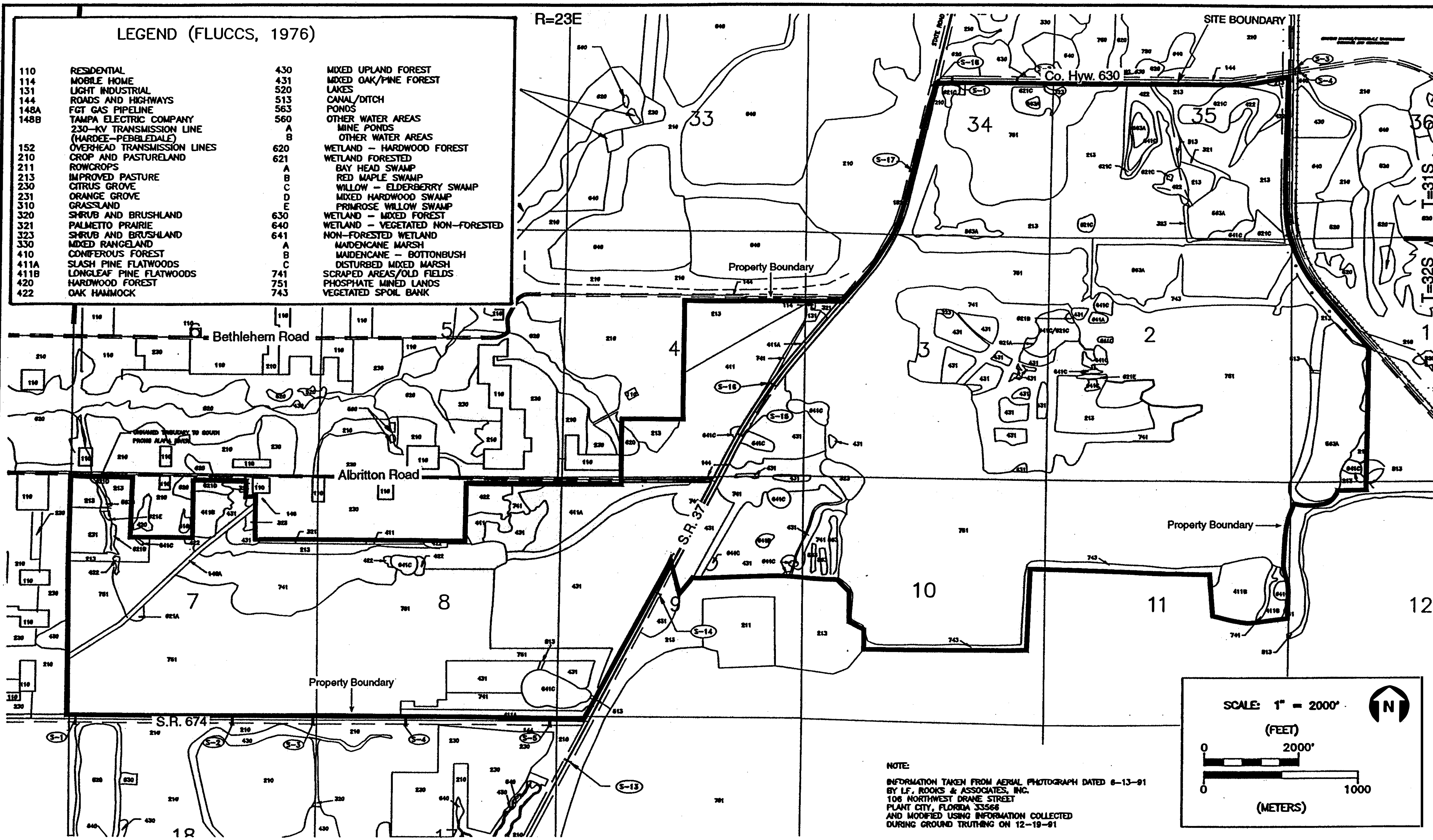

FIGURE 3.5.2-2.
Existing Land Use/Land Cover Map.

SOURCES: ECT, 1992; TEC, 1992a.

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Table 3.5.2-1. Current Acreages and Percentages of Land Use/Cover on the Tampa Electric Company Polk Power Station Site*

Land Use/ Cover Code	Type	Acres	Percentage
131	Light Industrial	3	0.1
148	Gas Transmission Pipeline	14	0.3
152	Electrical Transmission Line	27	0.6
213	Improved Pasture	452	10.4
231	Orange Grove	17	0.4
321	Palmetto Rangeland	5	0.1
323	Shrub and Brushland	18	0.4
411	Pine \Flatwoods	118	2.7
422	Oak Hammock	78	1.8
431	Mixed Oak/Pine Woods	530	12.2
513	Canals and Ditches	1	0.1
563	Ponds and Lakes	200	4.6
621	Freshwater Swamp	66	1.5
641	Freshwater Marsh	101	2.3
741	Scraped Over Areas	472	10.9
743	Spoil Banks	60	1.4
751	Phosphate Mined Land	2,186	50.2
	Total	4,348	100

* Current acreages as of December 19, 1991. It should also be noted that approximately 94 percent of the entire site has been previously or will be mined or disturbed through mining operations. Current acreages reflect unmined areas and mined areas that are still disturbed and unreclaimed, but have revegetated since mining. Therefore, for this table, Category 751 includes only those areas currently disturbed and not revegetated.

Sources: ECT, 1992; TEC, 1992a.

The eastern tract of the proposed Polk Power Station site consists primarily of recently mined areas with water-filled mine cuts between overburden spoil piles surrounding a central, unmined parcel of land. This parcel mostly contains remnant oak/pine woods, with smaller areas of shrub and brushland, old fields, pasture, scraped-over areas, disturbed marsh, and hardwood swamp. The shrub/brushland and old field associations are a result of opportunistic, pioneer species invading newly scraped-over areas. Remnant pasture is also situated on the tract. This open, grassy upland community is usually dominated by one or two species such as bahia grass and beardgrass. Marshland on the tract consists of herbaceous wetlands dominated by maidencane, rushes, sedges, and other aquatic macrophytes; most show evidence of disturbance. Forested wetlands on the tract are dominated by one or more wetland trees and/or shrubs such as red maple, swamp redbay, sweet bay, loblolly bay, dahoon holly, willow, elderberry, and primrose willow. These freshwater swamps on the site have also been altered to various degrees by prior activities or have been created by mining activities.

Two smaller, unmined areas are also located on the southeastern and southwestern corners of the eastern tract. The southwestern corner contains mostly oak/pine woods with small areas of marsh, shrub and brushland, and old fields. The marshes on the southwestern area consist mostly of disturbed assemblages of herbaceous hydrophytes and a small, relatively undisturbed maidencane-buttonbush wetland located in the center of the parcel. The majority of the approximate 33-acre southeastern corner area contains pine flatwoods together with smaller areas of old field and marsh. The pine flatwoods on this parcel is characterized by a shrub layer dominated by saw palmetto and an overstory of longleaf pines. With the absence of fire, this community may eventually succeed to a mixed oak/pine woods. In addition, the eastern tract includes a previously mined and unreclaimed parcel which contains some naturally reclaimed terrestrial habitat. This northern portion of the tract contains lakes/ponds, a drainage ditch system, marsh, shrub swamp, pasture, oak hammock, and shrub and brushland. The oak hammock in this area is dominated by live oak and laurel oak.

Most of the western tract has recently been or will be mined. Currently, portions of unmined areas are dominated by oak/pine woods and pine flatwoods. Other plant associations in the areas to be mined include pasture, palmetto prairie, old field, oak hammock, and marsh. An approximately 98-acre northwestern portion and an approximately 46-acre northeastern portion of the western tract that lies northwest of an existing FGT pipeline (i.e., Sarasota lateral) are not scheduled for mining. The northwestern parcel contains pine flatwoods, hardwood swamp, shrub and brushland, mixed oak/pine woods, oak hammock, old field, marsh, and an orange grove. A floodplain forest situated along an unnamed tributary to the South Prong Alafia River is also present. The forested wetlands in this northwestern corner of the western tract consist of: (1) mixed hardwood swamp along the floodplain reaches of the intermittent tributary and at another location east of the creek along Albritton Road, (2) a shrubby swamp area in the center of the unnamed tributary at a disturbed crossing, and (3) an isolated bayhead situated on the southern edge of the pipeline corridor. The northeastern parcel contains improved pasture.

The mined portions of the site consist of spoil piles, ditches, canals, berms, and lakes in varying degrees of vegetative recovery. The mined lands exhibit various stages of early to mid-successional species depending on time lapsed since mining and also include some areas planted as part of reclamation. Berms and spoil piles exhibit such species as wax myrtle, southern fox grape, laurel oak, water oak, Virginia creeper, and poison ivy. Along the shallow edges of mine pits, red maple, willow, primrose willow, wax myrtle, groundsel bush, and cattail occur.

Upland plant community types observed during the qualitative and quantitative vegetation field surveys conducted by ECT from March 1991 to March 1992 are summarized in the following paragraphs. Wetland and aquatic plant community types observed during the surveys are described in Section 3.5.4 (Wetlands). The developed uses (FLUCCS Codes 131, 148, and 152) on the property are not included. However, improved pasture is the dominant vegetative cover represented underneath the electrical transmission line (152) and over the gas transmission line (148) on the site. Greater detail on all of these plant community types is given in the SCA (TEC, 1992a).

Improved Pasture--213

Approximately 452 acres (10.4 percent) of the site is pasture. Improved pasture/old fields are located in scattered localities on the site, but these grasslands mostly occur along the edges of property boundaries. Improved pasture located on the site consists of mostly native pine flatwoods that was cleared in the past of all the vegetative strata and seeded with forage grasses (bahia grass) and legumes (tick trefoil, hairy indigo) for cattle production. The pastureland still remaining on the site can be characterized as remnant, old field, or reclaimed. Remnant pasture consists of pastureland that has remained in continuous use for cattle. Old field consists of abandoned pastureland that has: (1) increased in species diversity by the invasion of weedy vegetation, and (2) become overgrown with the lack of cattle grazing. Reclaimed pasture consists of recently reclaimed land that has been seeded with forage grasses and legumes for cattle. Reclaimed pasture only occurs at the northeastern corner of the property on the eastern tract.

Orange Grove--231

One citrus grove on approximately 17 acres (0.4 percent) is present on the northwestern corner of the western tract of the site. This citrus grove is planted with Valencia orange trees. Common weedy opportunistic plant species associated with the grove on the property include soda apple, Caesar's weed, smutgrass, sida, pokeweed, and painted leaf.

Palmetto Rangeland--321

Approximately 5 acres (0.1 percent) of palmetto rangeland or prairie occurs at two separate locations as narrow strips of land along property boundaries in the western tract of the site. Palmetto rangeland was pine flatwoods before the land was logged and cattle were presumably introduced. Palmetto rangeland is remnant on the site and is not currently being utilized for cattle production. Palmetto rangeland can be characterized as an open prairie dominated by a dense shrub layer of saw palmetto. Although rangeland has no true tree stratum, a few remnant pines and oaks are scattered throughout the association. Scattered woody shrub associates of the rangeland on the site include gallberry, wax myrtle, fetterbush, and dwarf huckleberry. Due to the dense growth of the shrubby layer, few herb species are present within rangeland on the property.

<u>Shrub and Brushland--323</u>

Almost 18 acres (0.4 percent) of the property contains shrub and brushland. This plant association can be characterized as highly disturbed areas dominated by weedy shrub and herb species. Typically, shrub and brushland results after opportunistic plants invade and proliferate on areas disturbed through earth moving activities. Common species associated with shrub and brushland on the property include groundsel bush, low senna, shrub verbena, wax myrtle, and shiny sumac.

<u>Pine Flatwoods--411</u>

Approximately 118 acres (2.7 percent) of the property contains pine flatwoods. Pine flatwoods are distributed along the northern property boundary, as a large area between Bethlehem Road and Albritton Road on the western tract, and as a small isolated area at the southeastern corner of the eastern tract. Pine flatwoods are open to dense woods dominated by an overstory of pines. Longleaf pine occurs on the drier sites; slash pine is frequently found along wetter areas. Portions of the flatwoods located on the western tract also contain planted slash pines. Shrub layers are dominated by saw palmetto and other associated woody vegetation (e.g., gallberry, wax myrtle, dwarf huckleberry, and fetterbush). Pine flatwoods is a sub-climax community that is maintained in an open woodland state through the periodic occurrence of ground fires. In the absence of fire, woody taxa form a sub-canopy layer. The two stands of longleaf pine-dominated woods located on the northwestern corner of the western tract and the southeastern corner of the eastern tract are good examples of flatwoods with established hardwoods in the understory due to fire suppression.

<u>Oak Hammock--422</u>

Less than 2 percent (78 acres) of the site supports stands of upland hardwoods or oak hammock. The hammocks on the property are dominated by a canopy of live oaks. Other arboreal associates of the oak hammock include laurel oak, water oak, cabbage palm, persimmon, and black cherry. Due to the closed canopy, the oak hammocks on the property have a cool, moist interior that supports mesic species. Hammocks on the site contained occasional saw palmetto, beautyberry, wax myrtle, and oak seedlings in the open shrub stratum; the sparsely-vegetated ground layer supports such shade tolerant herb taxa as dichanthelium grass, chickweed, elephant's foot, Florida parietaria, and broomweed.

Mixed Oak/Pine Woods--431

Mixed oak/pine woods occupies the greatest area (530 acres [12.2 percent]) of plant community types remaining on the proposed Polk Power Station site. Mixed oak/pine forest results when oaks become codominant with pines either through the absence of fire or logging operations followed by fire suppression. Except for the mixture of pines and oaks in the canopy, the species composition and structure of understory layers are similar to pine flatwoods and palmetto rangeland. The majority of the relatively disturbed but unmined habitat located within the proposed area of power plant facility development consists of mixed oak/pine forest.

Scraped Over Areas/Spoil Banks--741/743

Approximately 532 acres (12.2 percent) of the site contains scraped areas and spoil banks. Weedy, pioneer species of grasses, forbs, and herbs quickly invade newly exposed soil created by clearing and earthmoving operations. These open, grassy areas resemble old fields in character and are dominated by a diverse assemblage of upland and in some portions, wetland transitional plant species. Old field species such as common ragweed, bushy beardgrass, beardgrass, purple thistle, tick trefoil, and rabbit's tobacco are characteristic of scraped areas. Spoil piles and banks that were created by the dumping of over-burden from mining operations either support similar species to the old fields or are dominated by woody taxa such as shrub verbena, shiny sumac, and black cherry.

Old fields occur throughout the southwestern and northeastern parcels located in the eastern tract. Little bluestem dominated both of these areas in the spring and fall seasons. However, overall species composition changed dramatically between sampling events due to changes associated with the season and rainfall.

Phosphate Mined Land--751

The majority of the proposed Polk Power Station site has been or will be mined or disturbed through phosphate mining operations (approximately 4,070 acres or 94 percent). Based on December 19, 1991, site conditions, 2,186 acres (50.2 percent) of the site, exhibits land forms consistent with FLUCCS category 751. These lands consist of cleared land, spoil piles of material that have been scraped from the surface, and excavated areas which are filled with water. Generally, these areas are either devoid of vegetation, are dominated by the ruderal species as described for old fields, or support opportunistic wetland plants (especially cattails) along the littoral/shallow water reaches of mine ponds and cuts.

3.5.3 Wildlife

The diversity and relative abundance of on-site wildlife species were determined by habitat analyses, literature reviews, agency contacts, and aerial and ground surveys (TEC, 1992a). Semi-annual (dry and wet season) surveys were conducted to determine variations in abundance, distribution of resident species, and utilization of the site by migrant species. Methodologies used in collecting wildlife data during the field surveys are described in detail in the SCA (TEC, 1992a).

A list of mammal, bird, amphibian, and reptile species with a confirmed presence or likelihood of occurrence on the proposed Polk Power Station site is presented in the DEIS as Appendix N. Presence or likelihood of occurrence of endangered, threatened, or species of special concern can be found in Section 3.5.5.

Mammals

The relatively undisturbed habitats on site (mixed oak/pine woods, pine flatwoods, and various wetlands), coupled with the mined and reclaimed areas provide sufficient requirements for most mammals found in this region of Florida. Species using edge communities were commonly observed and included white-tailed deer, eastern cottontail, armadillo, and southeastern pocket gopher. Forest dwelling animals included bobcat, raccoon, opossum, and the eastern gray squirrel. The aquatic systems provide habitat for marsh rabbits and river otters. Although not observed on site, it would be expected that the gray fox, feral hog, and both the striped and spotted skunk would also occur there.

Small mammal live-trapping, conducted in the dry and wet seasons, was performed in wetlands, old field, and mixed oak/pine habitats. The two most common species captured were the eastern harvest mouse and hispid cotton rat. Species trapped in old field habitats included these two species plus the cotton mouse. Oak/pine forests produced hispid cotton rat, eastern harvest mouse, cotton mouse, golden mouse, and eastern wood rat. Trapping in wetland communities produced hispid cotton rat, eastern harvest mouse, short-tailed shrew, and rice rat.

Birds

The 4,348-acre Polk Power Station property supports a variety of upland, wetland, and aquatic bird habitats. The avifauna present generally consists of species common to central Florida. The population of summer residents (i.e., nesting species) is seasonally augmented by the influx of migrant species and winter residents. Migrant species commonly observed or expected to occur on the property include yellow-rumped warbler, palm warbler, pine warbler, black and white warbler, blue-gray gnatcatcher, ruby-crowned kinglet, brown creeper, cedar waxwing, northern parula warbler, Canada warbler, American redstart, yellow warbler, brown-headed cowbird, and a variety of sparrows (Family Fringillidae). None of these species is expected to nest on the property or in central Florida.

A number of resident species such as black and turkey vultures, common crow, blue jay, mourning dove, several species of swallows, eastern cardinal, common grackle, and rufous-sided towhee occur throughout all upland habitats. However, the on-site bird species diversity and distribution are primarily dependent on the presence of specific vegetation communities and suitable habitat conditions. The highest diversity of species and the greatest abundance of birds were regularly observed along the dike road separating old mine ponds and lakes on the east-central portion of the site. This area supports several interspersed vegetation communities. This mix of habitats, along with the adjoining densely-vegetated shorelines, provides excellent forage and nesting areas for upland and wetland species. Resident upland species commonly recorded in this area of the property include northern cardinal, rufous-sided towhee, common crow, white-eyed vireo, tufted titmouse, blue jay, eastern mockingbird, mourning dove, gray catbird, common grackle, Carolina wren, and brown thrasher. Common yellowthroat, boat-tailed grackle, red-winged blackbird, and short-billed marsh wren were the common wetland songbirds in this area.

The bird species diversity and abundance on the central and western portions of the property are lower. Improved pasture, mixed oak/pine forest, and to a lesser degree, oak hammock are the principal habitats on the central portion of the site. Eastern meadowlark, killdeer, American kestrel (including the southeastern and eastern subspecies), red-tailed hawk, great horned owl, loggerhead shrike, tree swallow, and cattle egret are the most commonly recorded species in the improved pasture habitat. The associated mixed oak/pine forest stands and interspersed shrub-brushland communities support eastern cardinal, rufous-sided towhee, ground dove, blue jay, tufted titmouse, Carolina wren, yellow-breasted sapsucker, downy woodpecker, red-bellied woodpecker, common nighthawk, ruby-throated hummingbird, white-eyed vireo, Cooper's hawk, sharp-shinned hawk, bobwhite, eastern bluebird, eastern phoebe, brown thrasher, Carolina chickadee, common grackle, yellow-breasted chat, and gray catbird.

Birds characteristic of the oak hammocks include barred owl, pileated woodpecker, black-billed cuckoo, red-headed woodpecker, red-shouldered hawk, red-eyed vireo, summer tanager, wild turkey, blue jay, screech owl, chuck-wills-widow, and great-crested flycatcher. Many of the species listed under the mixed oak/pine community, however, are opportunistic feeders and frequently range into the oak hammocks of the site as well.

The western portion of the proposed Polk Power Station property, located west of SR 37, supports primarily phosphate-mined land and active mining operations. As a result, birds occur in scattered tracts of mixed oak/pine forest and improved pasture, as well as in the pine flatwoods community along the northern section of this tract. Birds commonly observed or expected in this pine flatwoods habitat include great horned owl, Bachman's sparrow, great-crested flycatcher, eastern bluebird, common flicker, blue jay, bobwhite, mourning dove, pileated woodpecker, brown-headed nuthatch, blue-gray gnatcatcher, summer tanager, and pine warbler. The citrus grove, located on the northwestern corner of the western tract, supports primarily eastern mockingbirds, loggerhead shrikes, southeastern American kestrels, ground doves, and common grackles.

No red-cockaded woodpeckers were recorded in on-site pine flatwoods during seasonal surveys of this habitat. The red-cockaded woodpecker is usually restricted for nesting to pine flatwoods containing over-mature longleaf pine stands affected by red-heart disease (Wood, 1983). Although this habitat extends throughout the southeastern United States, early harvesting of southern pines has reduced the number of preferable trees for these birds. Due to the limited acreage (118 acres - 2.7 percent), condition, and relatively young age of pine flatwoods found on site (Figure 3.5.2-2), there is low probability of finding red-cockaded woodpeckers. A review of FGFWFC records revealed no on-site or nearby (within one mile) locations for these birds. The nearest colony recorded by FGFWFC is 48 miles southeast of the Polk Power Station site. Searches of the Polk Power Station site were made by a Tampa Electric Company's consultant for the birds by full pedestrian searches of small, scattered habitats achieving greater than 80 percent visual coverage. Searches were conducted on the dates listed below:

Bird Surveys	Mammal Surveys*	Plant Surveys*
5 February 1990	19-29 March 1991	18-23 March 1991
24-29 March 1991	5-9 April 1991	24-29 March 1991
1-5 April 1991	20-24 August 1991	1-5 April 1991
30 August 1991		20-24 August 1991
30 January 1992		30 January 1992
9-10 March 1992		

* Surveys also included bird observations

Surveys for red-cockaded woodpeckers were particularly focused in the northwest corner of the property which contains the oldest pine stand on the site. There were no sightings of the birds or their distinctive nesting cavities in the trees. The conclusion is that the site is not used for nesting and is probably not home to the species, while on-site foraging is possible. On-site pines are relatively young stands and no individuals were sighted during the field studies. Subsequently, FWS, in a letter to EPA dated December 2, 1993, concurred with this finding. In a letter to EPA dated January 26, 1994, FWS also concluded that red-cockaded woodpeckers would not likely occur in the transmission corridor in the vicinity of the Mulberry-Bradley Junction or the area designated for construction of the rail spur (see Appendix B).

Florida scrub jays occur in xeric scrub habitats in scattered locations along the central Florida ridge and along coastal ridges. Florida scrub jays have specific habitat requirements for nesting and foraging typified by oak scrub along with palmetto, scattered sand pine, and rosemary (Cox, 1987). They tend to avoid wetlands and forested communities. The decline of Florida scrub jays is apparently caused by the loss of scrub habitat which has been converted to residential developments, citrus groves, and pastureland. During one of many botanical field efforts along transects on the proposed site, two Florida scrub jays (sex unknown - indistinguishable by field observations) were briefly observed in a nonpreferred habitat (red maple grove) in the proposed power block area on September 20, 1991, by a Tampa Electric Company consultant ecologist. A review of FGFWFC records (personal communication 1991a), found documentation of the closest group of

Florida scrub jays about 13 miles from the subject property. During six wildlife efforts (listed previously) conducted by Tampa Electric Company consultant biologists, each of which included bird surveys, no Florida scrub jays were found. The methods used were similar to those outlined in FGFWFC Nongame Wildlife Program Technical Report No. 8 (1991b) except that the habitats that are associated with the species are small and fragmented. As a result, each area was walked and at least 80 percent visual coverage was achieved. Attractant sounds were utilized to call individuals during the walk over. In addition, observation of scrub habitats from elevated tops of spoil piles, including the use of spotting scopes and binoculars, was also conducted. As documented previously, these bird surveys were conducted over a two-year period. In addition, botanical surveys were being conducted on a different schedule with no additional sightings of Florida scrub jays. The conclusion reached as a result of these field efforts was that two specimens were observed on-site; however, Florida scrub jays were not sighted again during various subsequent surveys. Therefore, while the Florida scrub jay has visited or passed through the site and is known to exist in the area from FGFWFC records, it may not typically inhabit the subject property or exists in small numbers since it was observed only once. A field visit by FWS biologists on December 23, 1993, resulted in the FWS opinion that scrub jays or their habitat were not likely to be impacted by the proposed project, including the adjoining rail spur (see letter dated December 28, 1993, from FWS to EPA in Appendix B). A letter from FWS to EPA dated January 26, 1994, also noted that the area designated by Tampa Electric Company for the transmission line in the vicinity of Mulberry-Bradley Junction would not adversely affect this species (see Appendix B).

Reptiles and Amphibians

Common reptile species encountered in the oak/pine woods or brushy fields during field surveys included the corn snake, eastern coachwhip snake, black racer, pygmy rattlesnake, eastern box turtle, and green anole. The Florida cooter and alligator were common inhabitants of the open water habitats.

Commonly encountered amphibians included the oak toad in the oak/pine communities and the green treefrog and southern leopard frog in the hardwood swamp habitats. Given the abundance of aquatic habitats on site, several other species of frogs and toads would be expected to occur commonly and are listed in the DEIS as Appendix N.

3.5.4 Wetlands

Virtually all wetlands on site have either been created by or impacted by phosphate mining activities. Alterations to the surface water and groundwater have resulted in changes to the hydroperiods of remnant wetlands on site. Most of the wetlands on site have been invaded by weedy plants such as dog fennel. This composite usually becomes established in open wetlands that are experiencing prolonged dry conditions. During a long period of drought, dog fennel may temporarily invade undisturbed marshes, but die back once normal water levels return. In a hydrologically-altered wetland system either due to surface water drainage or groundwater interruptions, dog fennel may become established for longer durations. Most of the marshes on the property reflect this latter circumstance.

Wetlands in the eastern tract include marshland and forested wetlands. Marshland on the tract consists of herbaceous wetlands dominated by maidencane, rushes, sedges, and other aquatic macrophytes; most show evidence of disturbance. Forested wetlands on the tract are dominated by one or more wetland trees and/or shrubs such as red maple, swamp redbay, sweet bay, loblolly bay, dahoon holly, willow, elderberry, and primrose willow.

Most of the western tract has recently been or will be mined. Many of the mine cuts or excavations have filled with water. Along some of the shallow portions of these cuts and ponds, opportunistic wetland plants (e.g., cattails) have invaded creating marginal wetland habitats.

An approximately 98-acre northwestern portion of the western tract which lies west of an existing FGT pipeline is not scheduled for mining. In addition to the upland habitats described in Section 3.5.2, this parcel contains a hardwood swamp and marsh.

Plant community types observed in wetland areas during the qualitative and quantitative vegetation field surveys conducted by ECT from March 1991 to March 1992 are summarized (including size and percent cover of the entire site) in the following paragraphs. Plant communities are described in further detail in the SCA (TEC, 1992a).

Freshwater Swamp--621

The swamp community is present on 66 acres (1.5 percent) of the proposed Polk Power Station site. Arboreal overstory and understory water-tolerant hardwood components of the swamps on the site include either single species dominant or mixed assemblages of red maple, black gum, swamp redbay, loblolly bay, willow, and sweet bay. Included in the swamp category are shrub swamps. Shrub swamps are several stages leading in transition to mature tree swamps. Willow, elderberry and primrose willow form monotypic or codominant stands of shrub swamp on the property.

Three remnant, disturbed hardwood swamps were sampled within the northeastern, unmined parcel of the eastern tract where the power block is proposed. The three hardwood swamp types include maple swamp, mixed hardwood swamp, and mixed shrub swamp (see Tables 5, 6, and 7, respectively, in the DEIS, Appendix L). The maple swamp is a small association located on the edge of a larger, open marshy area. The canopy of the swamp is composed of red maple, willow and dahoon holly. The shrub layer is open and contains red maple saplings. Dog fennel was also recorded as a shrub associate, due to its woody nature and stature at this sampling site. In the open marsh, frog's-bit was the most important taxon within the herb stratum. Other herbaceous components included goldenrod, smartweed, clubrush, soft rush, torpedo grass, dog fennel, marsh pennywort, panic grass, water hoarhound, beardgrass, galingale, and big carpetgrass, in decreasing order of importance.

The mixed hardwood swamp located west of the maple swamp exhibited a greater species diversity within the canopy, although red maple was still the most important tree species overall. Other canopy associates included laurel oak, water oak, dahoon holly, black gum, slash pine, swamp redbay, and wax myrtle. The shrub layer was open with red maple saplings, saw palmetto, groundsel bush and wax myrtle, in descending order of importance. The herb stratum was mostly unvegetated, but contained species generally indicative of a fluctuating hydrological regime such as Virginia chain fern, redroot, goldenrod, soft rush, dog fennel, chalky bluestem, clubrush, smartweed, bushy goldenrod, and torpedo grass.

The mixed shrub swamp is located within the center of the remnant disturbed-area which was historically the headwaters of Little Payne Creek. The area has been altered due to mining operations. However, the depressions located between berms and spoil piles collect water and support the growth of hydrophytes. The area is mostly open with the occasional occurrence of shrubs throughout. Groundsel bush, primrose willow, willow, and red maple saplings comprise the shrub layer. Large specimens of Caesar's weed and pokeweed were also conspicuous components within the shrub stratum. The open herbaceous layer contained 26 species of plants that are typically associated with transitional or disturbed wetlands. Maidencane dominated the deeper water areas of the system. The most common herbs included maidencane, beardgrass, goldenrod, pickerelweed, smartweed, soft rush, frog's-bit, wild balsam apple, and bushy beardgrass.

Freshwater Marsh--641

Total acreage of freshwater marsh on the site is approximately 101 acres (2.3 percent). Freshwater marshes are circular to irregularly-shaped, herb-dominated wetlands that may be ponded for 6 months out of the year. These open, nonforested wetlands are represented by remnant, natural areas that have been hydrologically altered due to drawdowns of the surficial aquifer associated with mining and artificially-created wetlands established during past earth-moving operations. Maidencane, pickerelweed, arrowhead, and fire flag are some of the typical emergents associated with the deeper water areas of the marshes. The shallow fringes to the deeper water areas are dominated by sand cordgrass, little bluestem, chalky bluestem, soft rush, and fireweed. Most of the marshes on the property have been invaded by weedy species, such as dog fennel, due to alterations in hydrological regimes or other disturbances.

Since the majority of marshes have not experienced fires over a long period of time, wetland tree and shrub species have become established in some areas. One marsh located in the center of the southwestern corner of the eastern tract is relatively undisturbed (see Tables 8 and 9 in the DEIS, Appendix L). This marsh is dominated by maidencane in the herbaceous layer. Buttonbush also occurred sporadically throughout this marsh. Other emergents included sand cordgrass, redroot, chalky bluestem, creeping rush, big carpetgrass, beak rush, dichanthelium grass, and pedicelled milkweed, in descending order of importance. However, this system was not invaded by weedy, opportunistic species at any time during 1991. Due to the rather isolated location of this wetland, past perturbations have not apparently had an adverse effect on overall species composition or diversity (i.e., all of the species present are indicative of a healthy, stable wetland system). However, this wetland is the exception to the rule on the property.

Wildlife observed in wetland areas included marsh rabbits, river otters, and numerous birds. In comparison with the forested, shrub and brushland, and aquatic habitats, the bird diversity and abundance in the isolated marshes of the property were low. This was directly attributable to the recent drought conditions and the concomitant lowering of the surficial water table, which left most of the on-site marshes dry. As a result, wetland species such as Florida sandhill crane, American wood stork, king rail, Virginia rail, eastern snipe, American woodcock, belted kingfisher, and redwing were not recorded in these habitats during the 1991-1992 bird surveys.

Consultations with FDEP, SWFWMD, and USACOE were conducted to establish each agency's respective jurisdictional authority over the wetlands and surface waters on the site. Based on the disturbed nature of the site under FDEP jurisdiction and existing permits with mitigation requirements, FDEP has determined that a formal FDEP Jurisdictional Declaratory Statement determination will not be required (see Appendix C, correspondence with FDER, April 20, 1992). FDEP jurisdiction will be confirmed on a case by case basis if development or reclamation activities encroach on Waters of the State as defined by current rules and methodology.

The Jacksonville District of the USACOE performed a jurisdictional determination for the site proposed by Tampa Electric Company as the project site (Site PLK-A). The jurisdictional determination indicated that the USACOE claims jurisdiction over approximately 253.11 acres of wetlands (approximately 211.78 acres of phosphate mine cuts and approximately 41.33 acres of highly stressed wetlands) located on the proposed project site. The USACOE issued a Public Notice to this effect on October 7, 1992 (see Appendix C). A map showing the limits of the USACOE jurisdictional determination is provided as part of the Tampa Electric Company permit application (see Appendix C). Official USACOE notification of Tampa Electric Company of the jurisdictional determination was on November 4, 1992. The jurisdictional determination has a 3-year expiration date after notification.

The existing policy of USACOE defines Waters of the United States as any wetland system, man-made or otherwise, which contains water and vegetation to the extent that it exhibits, in form and function, the characteristics of wetlands. The active mining areas nominally less than 2 years old would be exempted from

USACOE jurisdiction. This would include all areas west of SR 37 and approximately 100 acres of the last area to be mined east of SR 37.

SWFWMD has also confirmed in a site visit on June 29, 1992, that wetlands located on old phosphate-mined land proposed to be developed for this project are under SWFWMD's jurisdiction. A letter and map confirming their jurisdiction is also provided in Appendix C.

3.5.5 Threatened and Endangered Species

Listed species identified as occurring or potentially occurring on or near the proposed Polk Power Station site and the probability of their occurrence are provided in Table 3.5.5-1. This list was derived from a review of the FNAI matrix and the current records of the Florida Committee on Rare and Endangered Plants and Animals (FCREPA), Florida Department of Agriculture and Consumer Services (FDACS) (plant species only), FGFWFC (animal species only), and the FWS. A thorough investigation of the site and the immediate vicinity (up to 1 mile outside of project boundaries), was also conducted by monitoring for endangered and threatened species and species of special concern at quarterly intervals during 1991.

Flora

Due to the highly disturbed condition of the site, few important plant species would be expected to occur. Federally listed plant species do not have a high or moderate potential to occur on the site. Twenty-eight species of plants either listed by FDACS as either threatened or commercially exploited or by FCREPA as rare have the potential for occurrence on the property. Out of the 28 species, 10 species were found on the site. However, two epiphytic species (shoestring fern and red-needle leaf), a terrestrial aroid (spoon-flower), and three terrestrial orchids (Habenaria orchids) also have a high potential for occurrence within appropriate habitat in unmined areas of the site. Results of the field surveys for important species on the site are described in the following paragraphs.

Carter's Mustard (*Warea carteri*)

This species is found in sand pine scrub, and sandhill openings in the north and central counties of Florida and is considered occasional within its range (Wunderlin, 1982). No Carter's mustard was found on site. Due to unsuitable habitat conditions, the presence of this species on the site is highly unlikely.

Clasping Warea (*Warea amplexifolia*)

This species is found in dry pinelands, in sandy openings, and sandhills. Clasping Warea is considered rare within its range (Wunderlin, 1982). No clasping warea were found on site. Due to unsuitable habitat conditions, the presence of this species on the site is highly unlikely.

Table 3.5.5-1. Threatened and Endangered Species that Occur or Could Potentially Occur on or Near the Tampa Electric Company Polk Power Station Site (Page 1 of 4)

Common Name	Scientific Name	Designated Status* FWS[1]	FGFWFC[2]	FDACS[3]	FCREPA[4]	CITES[5]	Potential for Occurrence†
Plants							
Aspidium fern	*Thelypteris kunthii*	--	--	T	--	--	P
Bluestem	*Sabal minor*	--	--	T	--	--	P
Carter's mustard	*Warea carteri*	E	--	E	--	--	U
Cinnamon fern	*Osmunda cinnamomea*	--	--	CE	--	--	P
Clasping warea	*Warea amplexifolia*	E	--	E	--	--	U
Coontie	*Zamia pumila*‡	--	--	CE	T	II	M
Dahoon holly	*Ilex cassine*	--	--	CE	--	--	P
Florida bonamia	*Bonamia grandiflora*	T	--	E	E	--	U
Golden polypody	*Phlebodium aureum*	--	--	T	--	--	P
Hairy wireweed	*Polygonella ciliata* var. *basiramia*	E	--	E	--	--	U
Hartwrightia	*Hartwrightia floridana*	C2	--	T	R	--	L
Highlands scrub St. John's-wort	*Hypericum cumulicola*	E	--	E	E	--	U
Long-horned orchid	*Habenaria quinqueseta*	--	--	T	--	II	H
Netted chain fern	*Woodwardia areolata*	--	--	T	--	--	P
Paper-like nailwort	*Paronychia chartacea*	T	--	E	--	--	U
Pigmy fringetree	*Chionanthus pygmaeus*	E	--	E	E	--	U
Prickly pear	*Opuntia compressa*§	--	--	T	--	II	P
Red-needle leaf	*Tillandsia setacea*	--	--	T	--	--	H
Rein orchid	*Habenaria odontopetala*	--	--	T	--	II	H
Royal fern	*Osmunda regalis*	--	--	CE	--	--	P
Scrub blazing star	*Liatris ohlingerae*	E	--	E	--	--	U
Scrub lupine	*Lupinus aridorum*	E	--	E	--	--	U
Scrub plum	*Prunus geniculata*	E	--	E	--	--	U
Shoestring fern	*Vittaria lineata*	--	--	T	--	--	H
Spoon-flower	*Peltandra sagittifolia*	--	--	--	R	--	H
Water spider orchid	*Habenaria repens*	--	--	T	--	II	H
Wild azalea	*Rhododendrum viscosum*	--	--	T	--	--	P
Wild coco	*Pteroglossapsis ecristata*	C2	--	T	--	II	P

Table 3.5.5-1. Threatened and Endangered Species that Occur or Could Potentially Occur on or Near the Tampa Electric Company Polk Power Station Site (Page 2 of 4)

Common Name	Scientific Name	Designated Status*					Potential for Occurrence†
		FWS[1]	FGFWFC[2]	FDACS[3]	FCREPA[4]	CITES[5]	
Amphibians and Reptiles							
American alligator	*Alligator mississippiensis*	T(S/A)	SSC	--	SSC	II	P
Bluetail mole skink	*Eumeces egregius lividus*	T	T	--	E	--	U
Eastern indigo snake	*Drymarchon corais couperi*	T	T	--	SSC	--	P
Florida pine snake	*Pituophis melanoleucus mugitus*	C2	SSC	--	SU	--	H
Florida scrub lizard	*Sceloporus woodi*	C2	--	--	T	--	L
Gopher frog	*Rana aereolata aesopus*	C2	SSC	--	T	--	H
Gopher tortoise	*Gopherus polyphemus*	C2	SSC	--	T	--	P
Gulf hammock dwarf siren	*Pseudobranchus striatus lustricolus*	C2	--	--	SU	--	U
Island glass lizard	*Ophisaurus compressus*	C2	--	--	--	--	U
Sand skink	*Neoceps reynoldsi*	T	T	--	T	--	L
Short-tailed snake	*Stilosoma extenuatum*	C2	T	T	T	--	M
Southern hognose snake	*Heterodon simus*	C2	--	--	--	--	H
Birds							
Arctic peregrine falcon	*Falco peregrinus tundrius*	T	E	--	E	I	M
Audubon's crested caracara	*Polyborus plancus audubonii*	T	T	--	T	--	H
Black-crowned night heron	*Nycticorax nycticorax*	--	--	--	SSC	--	P
Cooper's hawk	*Accipiter cooperii*	--	--	--	SSC	--	P
Eastern least bittern	*Ixobrychus exilis*	--	--	--	SSC	--	H
Florida sandhill crane	*Grus canadensis pratensis*	--	T	--	T	II	P
Florida scrub jay	*Aphelocoma coerulescens coerulescens*	T	T	--	T	--	P
Florida grasshopper sparrow	*Ammodramus savannarum floridanus*	E	E	--	E	--	M
Glossy ibis	*Plegadis falcinellus*	--	--	--	SSC	--	P
Great egret	*Casmerodius albus*	--	--	--	SSC	--	P
Limpkin	*Aramus guarauna*	--	SSC	--	SSC	--	H
Little blue heron	*Egretta caerula*	--	SSC	--	SSC	--	P
Migrant loggerhead shrike	*Lanius ludovicianus migrans*	C2	--	--	--	--	H
Osprey ‖	*Pandion haliaetus*	--	--	--	T	II	P
Red-cockaded woodpecker	*Picoides borealis*	E	T	--	--	--	L

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Table 3.5.5-1. Threatened and Endangered Species that Occur or Could Potentially Occur on or Near the Tampa Electric Company Polk Power Station Site (Page 3 of 4)

Common Name	Scientific Name	Designated Status* FWS[1]	FGFWFC[2]	FDACS[3]	FCREPA[4]	CITES[5]	Potential for Occurrence†
Birds (continued)							
Short-tailed hawk	*Buteo brachyurus*	--	--	--	R	--	L
Snowy egret	*Egretta thula*	--	SSC	--	SSC	--	P
Southeastern American kestrel	*Falco sparverius paulus*	C2	T	--	T	II	P
Southern hairy woodpecker	*Picoides villosus auduboni*	--	--	--	SSC	--	L
Southern bald eagle	*Haliaeetus leucocephalus leucocephalus*	E	T	--	T	I	P
Tricolored heron	*Egretta tricolor*	--	SSC	--	SSC	--	P
White ibis	*Eudocimus albus*	--	SSC	--	SSC	--	P
Wood stork	*Mycteria americana*	E	E	--	E	--	P
Yellow-crowned night heron	*Nycticorax violacea*	--	--	--	SSC	--	L
Mammals							
Florida black bear	*Ursus americanus floridanus*	C2	T	--	T	III	U
Florida mouse	*Podomys floridanus*	C2	SSC	--	T	--	L
Florida panther	*Felis concolor coryi*	E	E	--	E	I	U
Round-tailed muskrat	*Neofiber alleni*	C2	--	--	SSC	--	L
Sherman's short-tailed shrew	*Blarina carolinensis (=brevicauda) shermani*	C2	SSC	--	SU	--	U
Sherman's fox squirrel	*Sciurus niger shermani*	C2	SSC	--	T	--	P
Southeastern big-eared bat	*Plecotus rafinesquii macrotis*	C2	--	--	R	--	U

* R = rare.
T = threatened.
T(S/A) = threatened due to similarity of appearance.
E = endangered.
SSC = species of special concern.
SU = status undetermined

CE = commercially exploited.
C2 = a candidate for listing, with some evidence of vulnerability, but for which not enough data exists to support listing.
I = included in Appendix I (of CITES).
II = included in Appendix II (of CITES).

Table 3.5.5-1. Threatened and Endangered Species that Occur or Could Potentially Occur on or Near the Tampa Electric Company Polk Power Station Site (Page 4 of 4)

† U = unlikely; site is not within the species' range and contains unsuitable habitat.
L = low; occurrence of an important species within or near property boundaries is highly unlikely because of species range or unsuitable habitat or both.
M = moderate; important species may occur onsite since range and suitable habitat exists within property boundaries.
H = high; there is a very good possibility that an important species exists within property boundaries since range and suitable to optimal habitat for the species are found onsite.
P = present; the species listed has been observed on the subject property either visually or by signs thereof.

‡ *Zamia floridana*, *Z. integrifolia*, and *Z. umbrosa* = *Zamia pumila* fide Wunderlin, 1982.
§ *Opuntia compressa* = *O. humifusa* fide Wunderlin, 1982.
‖ Applicable in Monroe County only.

Sources: [1]FWS, [2]FGFWFC, [3]FDACS, [4]FCREPA, [5]CITES in: FGFWFC, 1991c.

Coontie (*Zamia floridana*, *Z. integrifolia*, *Z. umbrosa* = *Zamia pumila* fide Wunderlin, 1982)
This palmlike plant occasionally occurs within scrub, hammocks, pine flatwoods, and sometimes in converted palmetto rangeland and pasture within interior counties in west-central Florida. No coontie was found within the well-drained rangeland, pasture, flatwoods, or hammock on the property during repeated searches. Therefore, there is only a moderate potential for occurrence of coontie on the site.

Dahoon Holly (*Ilex cassine*), Prickly Pear (*Opuntia compressa* = *O. humifusa* fide Wunderlin, 1982), Cinnamon Fern (*Osmunda cinnamomea*), and Royal Fern (*Osmunda regalis*)
Dahoon holly, cinnamon fern, and royal fern are mostly common swamp inhabitants, while prickly pear occurs within flatwoods and scrubby areas. All of these species were observed on the site. Dahoon holly, cinnamon fern, and royal fern mostly occur within the woods contiguous to the unnamed tributary to the South Prong Alafia River on the western tract. This area will not be impacted by mining or site development. Prickly pear occurs sporadically throughout the flatwoods and mixed oak/pine woods on the site.

Florida Bonamia (*Bonamia grandiflora*)
This species inhabits scrub and may be seen trailing over bare sand. No Florida bonamia were found on site. Due to unsuitable habitat conditions, the presence of this species on the site is highly unlikely.

Golden Polypody (*Phlebodium aureum*)
This epiphytic species, which mostly inhabits the old frond bases of cabbage palms, occurs within the floodplain reaches of the unnamed tributary to the South Prong Alafia River located on the extreme northwestern area of the western tract and within the unmined, southeastern area of the eastern tract.

Habenaria Orchids (*Habenaria odontopetala*, *H. quinqueseta* and *H. repens*)
Habenaria orchids grow within cypress swamps, hardwood swamps, hammocks, marshes, bogs, and ditches. These orchids are actually quite common throughout central and south Florida, but have received a *threatened* status by FDACS presumably to restrict collection by orchid enthusiasts. Although not seen on the property, Habenaria orchids could occur within the floodplain forest of the unmined tributary to the South Prong Alafia River in the northwestern corner of the site.

Hairy Wireweed (*Polygonella ciliata* var. *basiramia*)
This is a species found in sand pine scrub in Highlands and Polk Counties. It is considered rare within its range (Wunderlin, 1982). No hairy wireweed was found on site. Due to unsuitable habitat conditions, the presence of this species on the site is highly unlikely.

Hartwrightia (*Hartwrightia floridana*)

Hartwrightia occasionally inhabits open, acidic seepage areas such as the edges of marshes in central and northern Florida. None of the potential habitat areas investigated during 1991 contained Hartwrightia.

Highlands Scrub St. John's-wort (*Hypericum cumulicola*)

This species is endemic to the white wind-deposited sands that of the central Florida ridge from southern Highlands County north to the vicinity of Frostproof in Polk County (Ward, 1979). No highlands scrub St. John's-wort were found on site. Due to unsuitable habitat conditions, the presence of this species on the site is highly unlikely.

Paper-like Nailwort (*Paronychia chartacea*)

This species is found in sand pine scrub in central Florida counties and is considered occasional within its range (Wunderlin, 1982). No paper-like nailwort was found on site. Due to unsuitable habitat conditions, the presence of this species on the site is highly unlikely.

Pigmy Fringetree (*Chionanthus pygmaeus*)

The pigmy fringe tree is on of the species largely restricted to the white, coarse, excessively leached, wind-deposited sands that form the central Florida scrub. This shrub species is endemic from an area near Sebring in Highland County north to Haines City, Polk County (Ward, 1979). No pigmy fringetree were found on site. Due to unsuitable habitat conditions, the presence of this species on the site is highly unlikely.

Netted Chain Fern (*Woodwardia areolata*)

This terrestrial fern species is common within swamps and marshes in Florida. Netted chain fern was observed in the floodplain area adjacent to the unnamed tributary to the South Prong Alafia River.

Red-Needle Leaf (*Tillandsia setacea*)

Red-needle leaf occurs on tree trunks and branches within hammocks and swamps throughout central Florida. This air plant is the third most common species of indigenous bromeliad in the State of Florida. The *threatened* species status by FDACS is probably attributable to its potential over-collection because of its showy needle-like leaves that turn a reddish color in the fall. No red-needle leaf was found on the site. However, due to suitable habitat, this epiphyte may occur within the unnamed tributary to South Prong Alafia River floodplain forest.

Scrub Blazing Star (*Liatris ohlingerae*)

This species can be found in sand pine scrub in Polk and Highlands Counties and is considered rare within its range (Wunderlin, 1982). No scrub blazing star were found on site. Due to unsuitable habitat conditions, the presence of this species on the site is highly unlikely.

Scrub Lupine (*Lupinus aridorum*)

This species is found in sand pine scrub in Polk and Orange Counties and is considered rare within its range (Wunderlin, 1982). No scrub lupine were found on site. Due to unsuitable habitat conditions, the presence of this species on the site is highly unlikely.

Scrub Plum (*Prunus geniculata*)

This is a species found in sand pine scrub in the central Florida counties. Within its range it is considered occasional (Wunderlin, 1982). No scrub plum was found on site. Due to unsuitable habitat conditions, the presence of this species on the site is highly unlikely.

Shoestring Fern (*Vittaria lineata*)

Typically, shoestring fern can be found growing in the axils of old cabbage palm leaf bases within hammocks or the woodland edges of hardwood swamps. This fern is frequent throughout central and south Florida and probably occurs within the floodplain of the unnamed tributary to the South Prong Alafia River. However, no specimens of shoestring fern were observed during searches on the site.

Spoon-Flower (*Peltandra sagittifolia*)

Only one flowering specimen of Peltandra (*P. virginica*) was found on the site within the floodplain of the unnamed tributary to South Prong Alafia River. However, in its vegetative stage, spoon-flower is virtually indistinguishable from *P. virginica*. Therefore, there is a high probability of occurrence for spoon-flower within the floodplain of the unnamed tributary to the South Prong Alafia River on the site.

Wild Azalea (*Rhododendron viscosum*), Bluestem (*Sabal minor*), and Aspidium Fern (*Thelpteris kunthii*)

All of the above-referenced species are common mostly within hydric hammocks and hardwood swamps in the State of Florida. All of these species were observed in the floodplain swamp along the unnamed tributary to the South Prong Alafia River on the property.

Wild Coco (*Pteroglossapsis ecristata*)

Wild coco is a terrestrial orchid frequently occurring within sand pine scrub, sandhills, and pinelands in central and south Florida. Approximately 500 or more individuals of wild coco were observed within the grassy fields of the power block area within the eastern tract. Smaller numbers of this orchid were also observed in the southwestern, unmined area within the eastern tract.

Fauna

A total of 46 (with Osprey) wildlife species either endangered, threatened, rare, species undetermined, or species of special concern were identified as occurring or having potential to occur on the proposed Polk Power Station site. These species are discussed in the following paragraphs.

American Alligator (*Alligator mississippiensis*)
This species ranges throughout the southeastern United States in the lower coastal plain and inhabits most wetland communities where sufficient open water is present. Since alligator populations have recovered sufficiently within their historic range, the species' FWS-protected status has been downgraded to threatened due to similarity of appearance, which will maintain protective measures for other crocodile species. Currently, the State of Florida permits regulated harvests of alligators to control population growth, especially where alligators are incompatible with current land uses. Alligators were commonly observed in the reclaimed and unreclaimed lakes on site as well as ditches, canals, and streams in the vicinity of the site.

Bluetail Mole Skink (*Eumeces egregius lividus*)
This species is found only in the Lake Wales Ridge in Polk, Highlands and Osceola Counties. The typical habitat is sand pine scrub, rosemary scrub, oak scrub turkey oak barrens, high pine and xeric hammock. They are less commonly found in high pine and the turkey oak barrens that remain after high pine communities have been lumbered. They are also known to inhabit disturbed habitats like citrus groves and similar habitats. However, the known range of this species does not include the project site (Christman, 1992). Therefore this species is unlikely to occur. No bluetail mole skink were found on site.

Eastern Indigo Snake (*Drymarchon corais couperi*)
Indigo snakes occur in xeric scrub and sandhill communities (frequently in association with gopher tortoises), and moister communities such as pine flatwoods and hardwood hammocks. One individual was observed in the old field portion in the southeastern corner of the eastern tract.

Florida Scrub Lizard (*Sceloporus woodi*)
This lizard prefers open sandy areas bordering sand pine scrub and sandhill associations. Both of these associations occur in well drained sandy soils. The distribution of the scrub lizard is highly disjunct, probably due to the patchy distribution of suitable habitat (Moler, 1992). No Florida scrub lizards were found on site.

Florida Pine Snake (*Pituophis melanoleucus mugitus*)
The Florida pine snake has similar habitat requirements as the gopher tortoise and is found in xeric upland habitats including sandhill, scrub oak, and longleaf pine/turkey oak habitats where the pocket gopher is found. This upland species is known to inhabit gopher tortoise burrows. Since its range includes the site, and its preferred habitat and prey species occur on site, it is highly likely this snake occurs on site.

Gopher Frog (*Rana aereolata aesopus*)
Suitable habitat for gopher frogs includes xeric uplands such as sandhill and sand pine scrub communities. Occasionally found in mouse burrows, crayfish holes, and stump holes, the gopher frog is most often associated with gopher tortoise burrows. The probable occurrence of this species on site is listed as high due

to its range and habitat requirements being met. However, as previously stated, gopher tortoise burrows which may be inhabited by gopher frogs were only located in areas not scheduled for power plant development.

Gopher Tortoise (*Gopherus polyphemus*)

Gopher tortoises prefer xeric habitats such as sand pine scrub, oak scrub, turkey oak associations, relatively well-drained pine flatwoods, and old-field associations. This species is present with nine active, four inactive, and six abandoned burrows present. In the northeastern corner of the eastern tract, one active burrow was found. In the southeastern corner of the eastern tract, four active burrows were found, and in the southwestern corner of that same tract, two active burrows were discovered. Two active burrows were also discovered on the northwestern corner of the western tract.

Gulf Hammock Dwarf Siren (*Pseudobranchus striatus lustricolus*)

This species occurs in stagnant bogs associated with cypress and flatwoods ponds, drainage ditches and smaller floodplain lakes. It may be more or less restricted to wetlands within narrow strips of hydric hardwood hammock situated near the Gulf Coast. The gulf hammock dwarf siren has been reliably reported for only three localities in Levy and Citrus counties. Thus, the range for this species does not include Polk County (Moler, 1992). This species is unlikely to occur in Polk County.

Sand Skink (*Neoseps reynoldsi*)

This species is found in Polk /county on the Lake Wales and the Winter Haven ridges. The primary habitat is rosemary scrub but it also occurs in sand pine scrub, oak scrub, scrubby flatwoods and turkey oak barrens. The sand skink is restricted to microhabitats with loose sand, sunny exposures and the absence of grasses. This species cannot live in area with an abundance of plant roots and agricultural practices destroy its habitat (Moler, 1992). No sand skinks were found on site. Its likelihood of occurrence on the site is low.

Short-Tailed Snake (*Stilosoma extenuatum*)

This species prefers extremely well-drained soils usually in longleaf pine-turkey oak and oak hammock habitats. Not much is known of its life history, but it does spend much of its time underground. Since its range and some habitat occur on site, there is a moderate likelihood this species could be found on site.

Southern Hognose Snake (*Heterodon simus*)

The southern hognose snake inhabits sandy soil habitats, however it has an affinity for the more xeric communities such as sand pine, or longleaf pine-turkey oak habitats. This snake feeds on frogs and toads (Ashton and Ashton, 1981). No southern hognose snakes were found on site, although this species could be found in the longleaf pine flatwoods as well as the upland shrub habitat.

Arctic Peregrine Falcon (*Falco peregrinus tundrius*)

This bird of prey breeds throughout most of the United States, but is only migratory in Florida. It is unique in that it nests on cliffs, tall trees, or buildings, and captures its prey (birds) on the wing. None were observed on site although it does like areas where birds congregate. If it were to occur, it would be considered an uncommon migrant.

Audubon's Caracara (*Polyborus plancus audubonii*)

This species is a bird of the open country. Savannah and wetter areas constitute the typical habitat, although this species can be found in improved pasture lands and in wooded areas with more limited stretches of open grassland (Kale, 1978). The caracara could use both the reclaimed lands and the open lands of the power station site. No Audubon's caracara were found on site. This species could be found in the palmetto prairie, pastureland, or cropland found on the site.

Black-Crowned Night Heron (*Nycticorax nycticorax*)

This species is common throughout most of the United States and breeds and winters throughout Florida. They utilize virtually all shallow aquatic habitats and tend to forage at night. Population levels within the state are unknown. Several individuals were repeatedly observed roosting and feeding along the willows bordering the unreclaimed lake on the northeast corner of the site. No nests were discovered, however.

Cooper's Hawk (*Accipiter cooperi*)

The Cooper's hawk inhabits edge areas between lowland hardwoods or hammocks and open areas primarily preying on small birds, mammals, or herpetofauna. Population declines have been attributed to illegal shooting, pesticide contamination, and habitat destruction. Its breeding and wintering range includes all of the study area. Suitable habitat is also present throughout the site. One individual was observed on site during field investigations.

Eastern Least Bittern (*Ixobrychus exilis*)

This secretive, small heron inhabits both fresh and saltwater marshes and prefers dense stands of grassy vegetation. Although not observed on site, there is a high likelihood of occurrence due to suitable habitat on site.

Florida Sandhill Crane (*Grus canadensis pratensis*)

The Florida sandhill crane is a nonmigratory resident. Florida sandhill cranes nest and feed in shallow freshwater marshes and wet prairies throughout central and south Florida. Feeding also occurs in low-lying pastures, shallow marshes, and prairies. The primary reasons for their population decline are habitat loss and human encroachment of nesting and feeding areas. The range of the Florida sandhill crane includes the proposed plant site and it can be expected to be found occasionally in suitable nonforested wetland habitats on site. No known nesting areas for the sandhill were identified in the site vicinity, however.

Florida Scrub Jay (*Aphelocoma c. coerulescens*)
Florida scrub jays occur in xeric scrub habitats in scattered locations along the central Florida ridge and along coastal ridges. Florida scrub jays have specific habitat requirements and require oak scrub along with saw palmetto, scattered sand pine, and rosemary. They tend to avoid wetlands and forested communities. Two individuals were observed on site in the proposed power block area. However, repeated efforts (including surveys in nearby shrub-brushland habitats) failed to locate any scrub jay nesting colonies or individuals on subsequent field inspections. A field inspection by FWS biologists on December 23, 1993, also failed to locate evidence of this species or its habitat on the site (see letter to EPA from FWS dated December 28, 1993, in Appendix B). A subsequent letter from FWS to EPA on January 26, 1994 (also included in Appendix B), concluded that the transmission line for the Polk Power Station in the vicinity of the Mulberry-Bradley Junction would not adversely affect the scrub jay.

Florida Grasshopper Sparrow (*Ammodramus savannarum floridanus*)
This race of grasshopper sparrow inhabits areas after burns, including saw palmetto and dwarf live oak a foot or two high preferring this habitat to open grassy areas. Howell and Nicholson, who wrote about this bird in the 1930s, indicated that the population existed only in widely separated colonies. Records since the 1960s indicate population declines (Kale, 1978). This species could be found in the palmetto prairie or possibly the shrub and brushland; however, none were found on site.

Glossy Ibis (*Plegadis f. falcinellus*)
This species utilizes many wetland types in the state and feeds in marshy or wet prairie areas. Principal food items include crayfish and insects. As with other wading birds, it was observed feeding in some of the lakes on site.

Great Egret (*Casmerodius albus*)
This large, white bird is found throughout Florida in virtually all wetland habitats from fresh to salt water. Great egrets were the most common wading bird observed on site. It was seen in all lakes, ponds, and ditches around the site.

Limpkin (*Aramus guarauna*)
The limpkin inhabits slow-moving freshwater habitats such as rivers, streams, marshes, and lake shores of Florida. The limpkin feeds on freshwater snails and mussels. No individuals were observed on site although suitable habitat is available. Its likelihood of occurrence is considered high.

Little Blue Heron (*Egretta caerulea*)

This medium-sized wading bird, like the great egret, inhabits all wetland systems in Florida including fresh and salt water. Prey consists of small fish, crustaceans, and insects. Found with other waders, it was observed occasionally on the site.

Migrant Loggerhead Shrike (*Lanius ludovicianus migrans*)

This is a predatory songbird that inhabits agricultural lands and other open areas. During the winter, the northern migrants inflate the Florida population. Rodents, lizards, small birds, grasshoppers, caterpillars, and other insects make up its animal diet (Kale, 1990). The open land available on the project site makes it possible for the migrant loggerhead shrike to occur although no migrant loggerhead shrikes were found on site.

Osprey (*Pandion haliaetus*)

The osprey is designated as a species of special concern (Monroe County only) by FGFWFC. It inhabits wooded edges of water bodies such as lakes, rivers, and bays. It utilizes tall trees, utility poles, and navigation channel markers for nesting. Birds were observed feeding on site, and one active nest was found on-site at the southern edge of the proposed power block area. Another osprey nest was located just off site along the edge of a large clay settling area south of the southern property boundary of the eastern tract.

Red-Cockaded Woodpecker (*Picoides borealis*)

The red-cockaded woodpecker is usually restricted to pine flatwoods containing over-mature longleaf pine stands affected by red-heart disease. Although this habitat extends throughout the southeastern United States, early harvesting of southern pines has reduced the number of preferable trees for these birds. Due to the limited acreage and age of pine flatwoods found on site, there is a low probability of finding red-cockaded woodpeckers. The FWS has concurred with this assessment in a letter to EPA dated December 2, 1993 (see Appendix B).

Short-Tailed Hawk (*Buteo brachyurus*)

Their preferred habitat is mature cypress, mangroves, or riverine hardwood swamps bordering open areas where they hunt. Its main prey is small birds. Due to the lack of suitable habitats, the likelihood of occurrence for this bird on the site is low.

Snowy Egret (*Egretta thula*)

Snowy egrets nest throughout Florida in both salt and fresh water wetlands. They frequently nest in mixed colonies with great egrets and tricolored herons; they feed on small fish and insects. This bird was also commonly observed using the aquatic habitats on site.

Southeastern American Kestrel (*Falco sparverius paulus*)

This small falcon is an open-land bird often seen perching on utility poles and wires, preying on insects and small rodents. It is found throughout Florida and typically nests in cavities drilled by woodpeckers or in nest boxes and birdhouses. Several individuals were observed on the site, although no nesting areas were found during bird surveys specifically conducted in March and April of 1991 to observe nesting activity.

Southern Hairy Woodpecker (*Picoides villosus audubonі*)

Although little is known about this bird, it is believed to prefer heavily forested areas including pines, cypress stands, or hardwood swamps. Since large tracts of forested lands do not exist on site, the likelihood of occurrence for this species is expected to be low.

Southern Bald Eagle (*Haliaeetus l. leucocephalus*)

Eagles occurring in peninsular Florida include permanent residents and seasonally occurring migrants. Based on aerial and ground surveys of the study area and a review of known nest locations and agency data, three bald eagle nests are known to occur in the study area. Two of the nests were found on site, one (abandoned) in the southeast corner of the eastern tract and one (inactive) in the northwest corner of the western tract. Neither of these potential nesting areas will be disturbed by the proposed project development. Repeated visits during potential nesting periods yielded no sighting of eagles. The nest in the western tract is in relatively poor shape structurally. The nest has not been observed for the past 5 consecutive years to officially list it as abandoned according to FWS rules (FWS, 1987b). This nest was previously unknown prior to this study but there is no evidence underneath it to indicate any eagle use. Great horned owls were recorded using the eastern nest in early 1991, but it has since fallen down.

The third nest is active but occurs off site to the east along Fort Green Road. This nest is identified by FGFWFC as PO-40-A and has been active since 1989. The nest is located in a slash pine tree situated on a farmstead, with a residence located near the tree. The nest was active when observed in January 1992. This nest lies approximately 1.5 miles from the power block area, while the closest construction activities (the cooling reservoir) will occur approximately 2,500 ft away.

Tricolored Heron (*Egretta tricolor*)

This species occurs throughout Florida but tends to nest more in coastal areas than freshwater areas. They are commonly found either nesting or feeding with other waders and eat primarily small fish. They were occasionally observed on site feeding with other waders. However, no nest sites were found during site surveys.

White Ibis (*Eudocimus albus*)

The white ibis also inhabits both fresh and salt water wetlands. They typically nest in large colonies and feed in shallow water. Principal food items are crayfish and insects. This species is one of the most abundant wading birds in the state but is declining due to habitat loss. This bird was also observed feeding on site, although in small numbers.

Wood Stork (*Mycteria americana*)

The population status, colony locations, and reproductive success of wood storks throughout the state are closely monitored by FGFWFC and National Audubon Society (NAS) through annual counts and ground and aerial colony surveys. Wood storks nest in cypress swamps and feed in freshwater marshes and flooded pastures and ditches.

A review of FGFWFC colony data compiled during annual aerial surveys indicates that no known colonies are located in the vicinity of the site. Individual storks or small flocks may feed or occur as transients throughout the study area that is suitable feeding habitat. Such areas include wet prairie and freshwater marshes, and flooded portions of fields and pastures. A few individuals were observed feeding on the site.

Yellow-Crowned Night Heron (*Nyctanassa violacea*)

Similar to the black-crowned night heron, this species utilizes a wide range of wetland habitats in Florida. However, it appears that coastal areas (mangroves and mud flats) are favored. The species is listed as a species of special concern by FCREPA. None were observed on site and due to its habitat preference, there is a low likelihood of occurrence on site.

Florida Black Bear (*Ursus americanus floridanus*)

The Florida black bear inhabits thickets and vine-choked bay swamps. The thick vegetation is apparently essential for the species. Population maps locate one Florida black bear population in the north portion of Polk county and the south part of Lake county (Humphrey, 1992). The disturbed nature of the project site makes the presence of the Florida black bear unlikely.

Florida Mouse (*Podomys floridanus*)

This burrowing species is confined to xeric upland habitats of peninsular Florida, and the principal habitat of this Florida endemic is sand pine scrub in an early successional stage. It also occurs in xeric longleaf pine-turkey oak and scrubby flatwood associations. It is often found as a commensal with gopher tortoises. Although some suitable habitat is found on site, the range of this species is marginal in southern Polk County, so its likelihood of occurrence is listed as low.

Florida Panther (*Felis concolor coryi*)

Currently, panthers in Florida occur primarily in large tracts of undisturbed lands south of the site. The majority of panther sightings are from Big Cypress Swamp in Collier County. In Charlotte County, Telegraph Swamp provides suitable habitat.

Numerous cat tracks (primarily bobcat) were observed on site. Although a larger cat was actually observed by field personnel, no tracks were observed on the property large enough for an adult panther. Discussions with FGFWFC's biologists indicate that due to the range and habitat requirements of the panther, it is highly unlikely one would be found on site.

Round-Tailed Muskrat (*Neofiber alleni*)

This rodent, also called the Florida water rat, lives in and around freshwater marshes composed of dense maidencane stands and pickerelweed. This species is found throughout much of Florida and southeastern Georgia. Because the muskrat is nocturnal and its presence is sporadic even in suitable habitat, accurate population estimates are difficult to obtain. Since the preferred habitat of this species is extremely limited on site, its likelihood of occurrence is considered low.

Sherman's Fox Squirrel (*Sciurus niger shermani*)

Sherman's fox squirrel inhabits northern and central peninsular Florida where suitable habitat such as sandhill and scrub oak communities exist. A few individuals were observed in the oak/pine woods in the northwestern corner of the western tract in an area not scheduled for power plant development. Even more individuals were observed off site along areas of Albritton Road to the west of the site.

Sherman's Short-tailed Shrew (*Blairina carolinensis (=brevicauda) shermani*)

On the basis of present knowledge, this species has the most restricted range of any mammal in Florida. Although it has been suggested that it might have a general distribution on the west coast of peninsular Florida, it has not been reported in suitable habitats at other localities in the general region (Humphrey, 1992). Although habitat for this species could exist on the project site, the range of this species appears to make its existence on site unlikely.

Southeastern Big-eared Bat (*Plecotus rafinesquii*)

The heavy forested regions of Florida are preferred by the Southeastern big-eared bat. They often roost singly or in small colonies in dilapidated buildings, shacks and old cabins located in pine or hardwood forests. This species is one of the few bats to readily roost in semi-lighted situations. It appears to not be abundant in any known Florida location (Humphrey, 1992). The Southeastern big-eared bat range does not extend into Polk County, thus this species is unlikely to occur on site.

3.5.6 Transmission Line Corridor Ecology

The proposed eastern corridor connecting the Polk Power Station site to the existing Hardee-Pebbledale 230-kV transmission line will be 400 ft wide, approximately 1 mile long, and completely contained within the proposed Polk Power Station site boundaries. This corridor proceeds in a general northeastern direction from the on-site substation across old mined, unreclaimed lands to the existing transmission line.

The proposed northern transmission corridor connecting Polk Power Station to the existing Mines-Pebbledale 230-kV transmission line will run west from the on-site substation to SR 37. The following transmission line corridor has been selected by Tampa Electric Company, however, a specific right-of-way alignment within the corridor has not been finalized. The proposed centerline of the corridor will turn north at SR 37 at a point approximately 1,500 ft north of Bethlehem Road. The proposed corridor will traverse north along SR 37, and then turn northwest at a point south of Bradley Junction in order to connect to the existing circuit while avoiding this community. The total length of this transmission line corridor is approximately 5.2 miles, including approximately 0.75 mile on the proposed Polk Power Station site. Once the final right-of-way is selected, coordination for wetlands and cultural resources would need to be accomplished by Tampa Electric Company as it would be finalized after the EIS process.

Descriptions of the existing environment and potential effects of the proposed transmission line corridors in this section will primarily focus on the portion of the northern corridor, which is located outside of the proposed Polk Power Station site boundaries. In addition to evaluating socio-political and bio-physical characteristics for the proposed corridor, FDEP application guidelines (FDER Form 17-1.211(1), FAC) also require analysis of an area extending 0.5 mile from the edge of the corridor. This additional area will be referred to as the adjacent 0.5-mile wide study area.

Corridor selection was dictated on the basis of selecting corridors that could connect the proposed Polk Power Station to the existing transmission grid while minimizing land use and environmental impacts. The existing land use (FLUCCS Category II) and vegetation cover (FLUCCS Category III) for the off-site portions of the northern corridor and within 0.5 mile of the edges of the corridor were identified and mapped using information from USGS 1:24,000 topographic quadrangle maps, 1992 Land-Use and Land-Cover Maps prepared by SWFWMD, and 1-inch = 400-ft prints of aerial photographs taken in March 1992. Information gathered from these sources was substantiated through field studies and helicopter flyovers. Land use and vegetation are shown in Figure 3.5.6-1. Recent aerial photographs (March 1992) of the northern corridor area at a scale of 1:24,000 are shown in Figure 3.5.6-2.

Vegetation

Vegetation communities within the off-site portion of the northern corridor and in the area extending 0.5 mile from either edge of the corridor is primarily previously mined areas. The area of the corridor is approximately 1,870 acres. Small areas of remnant, relatively natural communities also exist and include pine flatwoods (411) [12 acres or 0.6 percent], mixed forest (430/431) [60 acres or 3.2 percent], hardwood forest (420) [6 acres or 0.3 percent], shrub and brushland (320), and mixed rangeland (330). Cropland and pastureland/improved pasture (210/213) [15 acres or 0.8 percent], and citrus groves (230) [32 acres or 1.7 percent] are also present.

The lands mined for phosphate within the northern corridor are classified as "extractive." Approximately 1,668 acres (or about 90 percent) of the land in the corridor is in this category. The extractive land is cleared land, with spoil piles of materials which have been scraped from the surface. Between the spoil piles are low areas that are filled with water. The open water area was estimated to be 15 percent of the area extractive without land-use classification. These open water areas were not included as part of the wetland area.

Wetlands and aquatic habitats within this corridor include freshwater marsh (641) [1 acre or 0.1 percent], freshwater swamp (621) [58 acres or 3.1 percent], lakes (520) [9 acres or 0.5 percent], and other water areas (563) such as mine pit lakes, cattle ponds, and other manmade water bodies. The only natural water crossing in this corridor is a crossing of the South Prong Alafia River.

The freshwater marshes within and adjacent to the corridor are located in basically circular depressions within upland habitats. Zonation is often apparent, and distinct vegetation zones form in response to elevation, degree of inundation, and organic content of the soil. In some areas, shrubs have become established possibly due to drainage alterations or lack of fire. Typical marsh species present include St. John's wort, sand cordgrass, maidencane, beak rushes, beardgrasses, galingales, rushes, yellow-eyed grasses, milkworts, meadow-beauties, bog-buttons, pickerelweed, and arrowhead.

Freshwater swamps, dominated by a mixture of hardwood trees, occur along the South Prong Alafia River intersecting the corridor north of the power plant site. In addition, shrub swamp associations occur at edges of mine pit lakes, within clay settling areas, and within marsh areas which have been altered or which have not experienced periodic fires.

Typically within the mixed hardwood swamp, the canopy is dense and dominated by water-tolerant hardwoods with some cypress. The following tree species are representative of the floodplain swamps traversed by the corridor: red maple, laurel oak, pop ash, blackgum, sweetgum, and bald cypress. When the canopy is dominated by either bald or pond cypress, the wetland can be characterized as a cypress strand or dome depending upon the forest profile, canopy dominance, hydroperiod, and other factors. Often a sub-canopy composed of dahoon holly, swamp redbay, pop ash, loblolly bay, and sweet bay is discernible. Common shrubs include buttonbush, highbush blueberry, wax myrtle, elderberry, and primrose willow. Common herbs observed are beak rushes, galingales, dichanthelium grasses, cinnamon fern, royal fern, thelypteris, Virginia

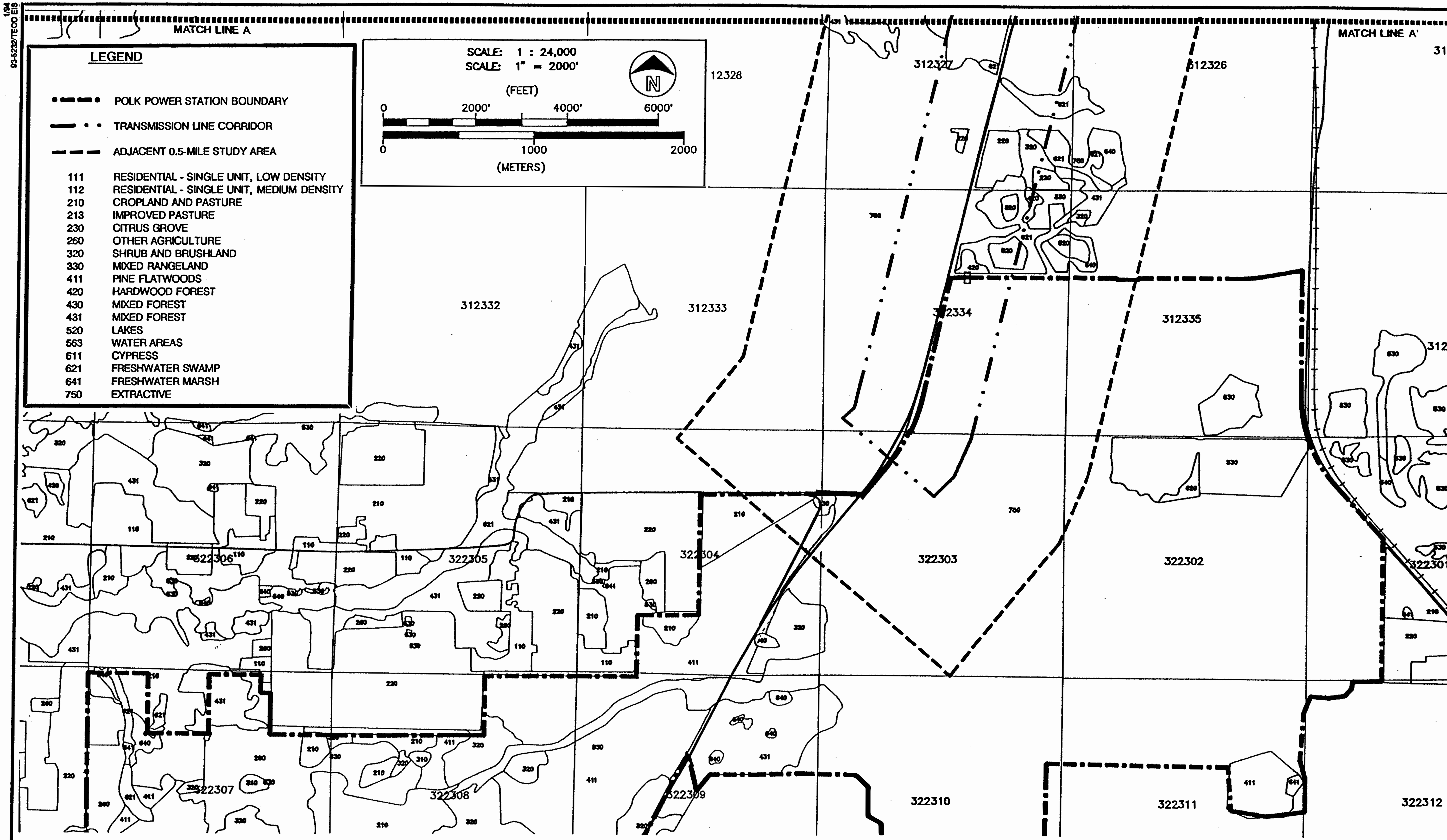

FIGURE 3.5.6-1. (1 of 2)
Land Use and Land Cover within a 0.5-Mile Radius of the Proposed Transmission Line Corridor.

SOURCES: SWFWMD, 1991; ECT, 1992; TEC, 1992a.

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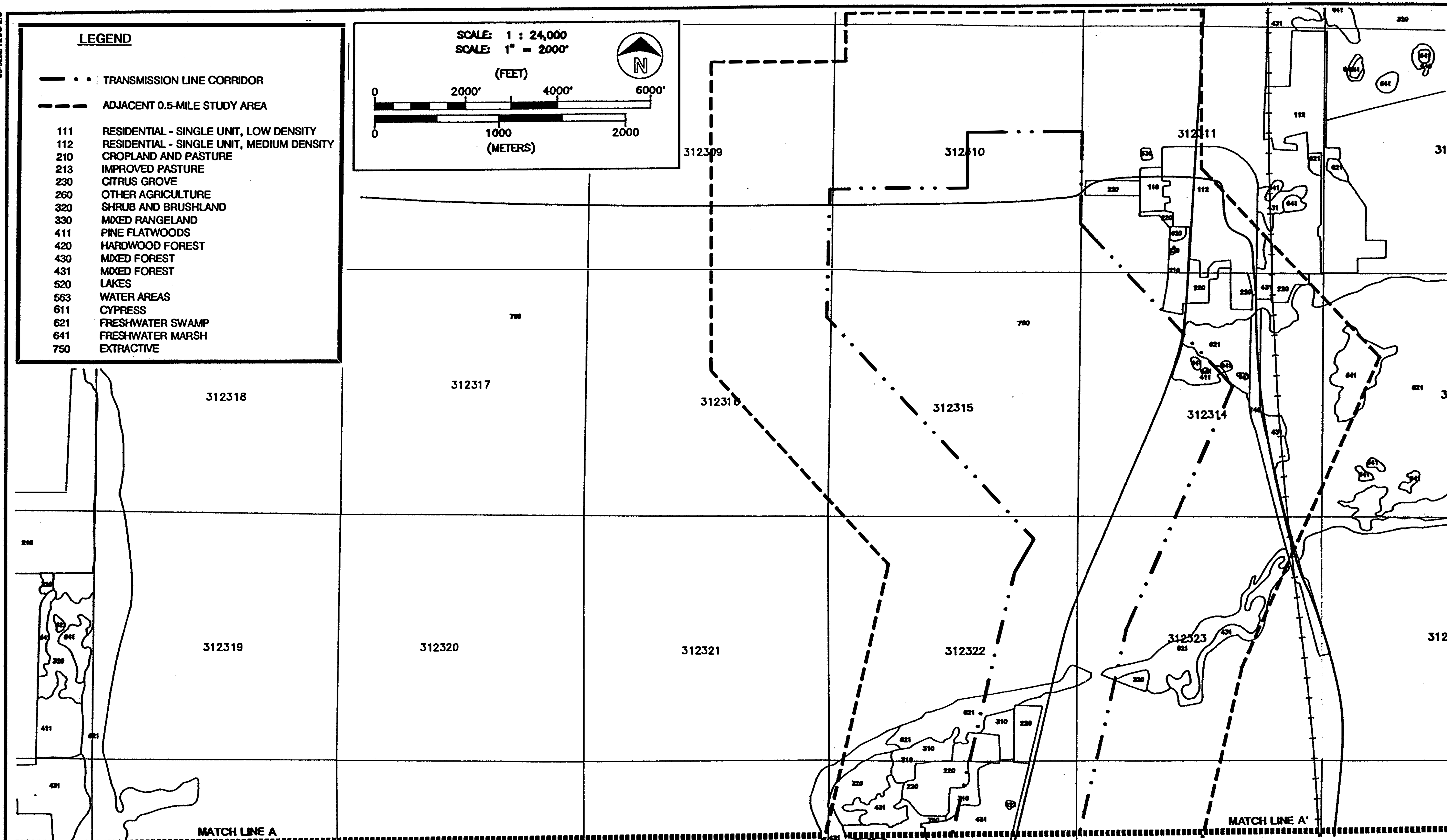

FIGURE 3.5.6-1. (2 of 2)
Land Use and Land Cover within a 0.5-Mile Radius of the Proposed Transmission Line Corridor.

SOURCES: SWFWMD, 1991; ECT, 1992; TEC, 1992a.

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FIGURE 3.5.6-2. (1 of 2)
Northern Transmission Line Corridor and Adjacent Study Area.

SOURCES: SRMC, 1992; ECT, 1992; TEC, 1992a.

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FIGURE 3.5.6-2. (2 of 2)
Northern Transmission Line Corridor and Adjacent Study Area.

SOURCES: SRMC, 1992; ECT, 1992; TEC, 1992a.

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chain fern, coinwort, water hoarhound, panic grasses, maidencane, and pickerelweed. Vines are a conspicuous element of the flora. Southern fox grape, catbriers, peppervine, Virginia creeper, and poison ivy are common vines.

Shrub swamps are usually typified by the predominance of willow and/or red maple in the canopy. Shrubs, herbs, and vines are similar to those described for the floodplain of the South Prong Alafia River.

The "lakes and other water areas" category encompasses all open water bodies created through activities associated with phosphate mining or agriculture (cattle ponds). The littoral vegetation zone is comprised of emergent freshwater marsh or swamp species as listed previously. In addition, floating-leaved or submerged aquatic plants are typical. These include water hyacinth, water lettuce, hydrilla, fragrant white water lily, spatterdock, and *Scirpus cubensis*.

Threatened and Endangered Species

Of the 28 species of plants listed in Table 3.5.5-1, ten are known to occur on the plant site which encompasses the on-site eastern corridor and a segment of the northern corridor. Several of the plant species listed in Table 3.5.5-1 potentially occur within or 0.5 mile on either side of the off-site portions of the northern corridor, especially within the floodplain of the South Prong Alafia River north of the plant site. These plants are dahoon holly, cinnamon fern, royal fern, golden polypody, wild azalea, bluestem, Aspidium fern, red-needle leaf, shoestring fern, and netted chain fern. Two other species, prickly pear and wild coco, are often common on reclaimed mined lands or improved pasture, both of which are abundant vegetation types within the northern corridor study area.

In addition to the plants listed on Table 3.5.5-1, one additional species was evaluated as having the potential to occur within or adjacent to the northern corridor. This species is the needle palm (*Rhapidophyllum hystrix*). This unique palm is spottily distributed in central and northern Florida and is currently listed as commercially exploited by FDACS. Although rare in the State of Florida, this palm is locally abundant within suitable habitat areas. Though known to occur in certain areas along the South Prong Alafia River in Polk County, it has not been recorded or found within the northern corridor study area.

Within the northern corridor, only five percent of the total area can be considered habitat for flora and faunal species closely associated with upland natural habitats such as pine flatwoods, hardwood forests and mixed forests. Species that are associated with wetlands such as lakes, swamp or marsh wetlands would be able to utilize less than 4 percent of the northern corridor. Those species that can use the extractive land use have 1,668 acres, or 90 percent, of potential habitat available. The extractive lands include mined land (with open water in the mine cuts) and reclaimed land.

Any of the wildlife species listed in Table 3.5.5-1 have the same potential for occurrence in the corridors. No individual nesting or unique habitats for any of these species were observed in the northern corridor. It is unlikely that the northern corridor contains any habitat solely depended upon by one of these species.

3.6 AQUATIC ECOLOGY

Little Payne Creek, Payne Creek, and the unnamed tributary to the South Prong Alafia River are the aquatic systems located on, or in the vicinity of, the proposed Polk Power Station site. Wetlands associated with the on-site drainage basins of Little Payne Creek and Payne Creek have been altered due to past and current mining activity on the property. An old, unreclaimed mine-cut lake and a reclaimed lake are situated in the east-central area of the eastern tract within the former headwater area of Little Payne Creek.

In the site vicinity, the Little Payne Creek system consists primarily of a man-made ditch which connects to the reclaimed lake on the site and runs along the western side of Fort Green Road. This ditch crosses Fort Green Road in an easterly direction at a point approximately 1.5 miles south of the proposed Polk Power Station site and eventually discharges into a remnant portion of Little Payne Creek. The headwaters and only remaining relatively undisturbed portion of Payne Creek are located 1 mile south of the property boundary on the western side of SR 37. Culverts direct the water under SR 37 into a canal which proceeds south and then east.

The unnamed tributary is an intermittent stream that is located on the northwestern corner of the western tract. This tributary is relatively undisturbed and consists of a small, incised creekbed within a narrow, floodplain forest. This surface water feature was not mapped as a stream because it is obscured by floodplain forest. It was, however, included within the FLUCCS designation of freshwater swamp (621).

Plant community types observed in aquatic habitats on the proposed Polk Power Station site primarily fall under FLUCCS Codes 513/563--Canals and Ditches/Ponds and Lakes. Characteristics (including size and percent of the total site area) of these community types are described in the following paragraphs.

About 1 acre (0.02 percent) of ditches/canals were of a sufficient size on the property to map. The ditches and canals on the site can be characterized as sparsely vegetated, deeply incised permanent to semi-permanent water channels.

Approximately 200 acres (4.6 percent) of old ponds/lakes resulting from either drainage or mine-related activities occur at scattered locations on the site. The smaller man-made ponds are seasonally inundated and typically support a proliferation of aquatic emergent macrophytes. Two prominent, large lakes located at the east side of the eastern tract are permanent surface water features that were created as a result of phosphate mining. The northern lake in this area is a 30-year-old mine cut with unstable, eroding steep banks and was never reclaimed. The southern lake has been recently reclaimed and supports shallow slopes partially planted with native hydrophytes such as pickerelweed, arrowhead, and bulrush.

The aquatic habitats of the site, particularly the old mine cuts and reclaimed lake on the eastern portion of the property, provide feeding habitat to large numbers of water birds. Large numbers of double-crested cormorants, ring-billed gulls, laughing gulls, Caspian terns, black terns, American coots, common gallinules, American anhinga, and pairs of mottled ducks, wood ducks, pied-billed grebes, purple gallinules, king rails, and white pelicans were observed during the field surveys. Wading birds were particularly abundant along the eastern ponds and lakes. One early-morning bird survey of these areas, conducted in March 1992, identified 240 great egrets, 50 great blue herons, 57 black-crowned night herons, 20 glossy ibis, 78 snowy egrets, 5 tricolored herons, 50 cattle egrets, and several green-backed herons feeding along shorelines on the eastern portion of the property. Although many of these waders, particularly black-crowned night herons, roost in the maples, willows, and cattails surrounding these lakes, no wading bird nesting colony was located within the boundaries of the Polk Power Station site. Several American wood storks, which were also recorded roosting and feeding along the eastern lakes, are not expected to nest on or in the vicinity of the property due to the absence of suitable nesting habitat. Ospreys and an occasional individual bald eagle were also recorded in the aquatic habitats of the eastern portions of the site.

Migratory water birds present on the site include ducks, mergansers, pelicans, coots, gallinules, gulls, terns, and shorebirds. Although a number of these species (e.g., pied-billed grebe, mottled duck, American coot, common gallinule, laughing gull, Caspian tern, and killdeer) also occur as summer residents, their relative abundance sharply decreases each spring.

During 1991, ECT conducted an aquatic ecology monitoring program as part of the documentation for the SCA (TEC, 1992a). Figure 3.6-1 illustrates the locations of the seven aquatic sampling stations where water quality, fish, and macroinvertebrate sampling was conducted.

3.6.1 Fish

Table 3.6.1-1 provides the results of the wet and dry season sampling for fish. Mosquitofish was the most common species collected. Bluegill and largemouth bass were the most common recreational species collected.

The results indicate that Station AE-1 had the lowest number of individuals and species diversity. This is not surprising since Station AE-1 is an intermittent stream with very reduced accessibility to fish. Mosquitofish comprised the sole species captured at AE-1 during April 1991. Mosquitofish are a highly invasive and adaptive species which give birth to their young live thereby reducing mortality associated with limited oxygen and water availability to eggs.

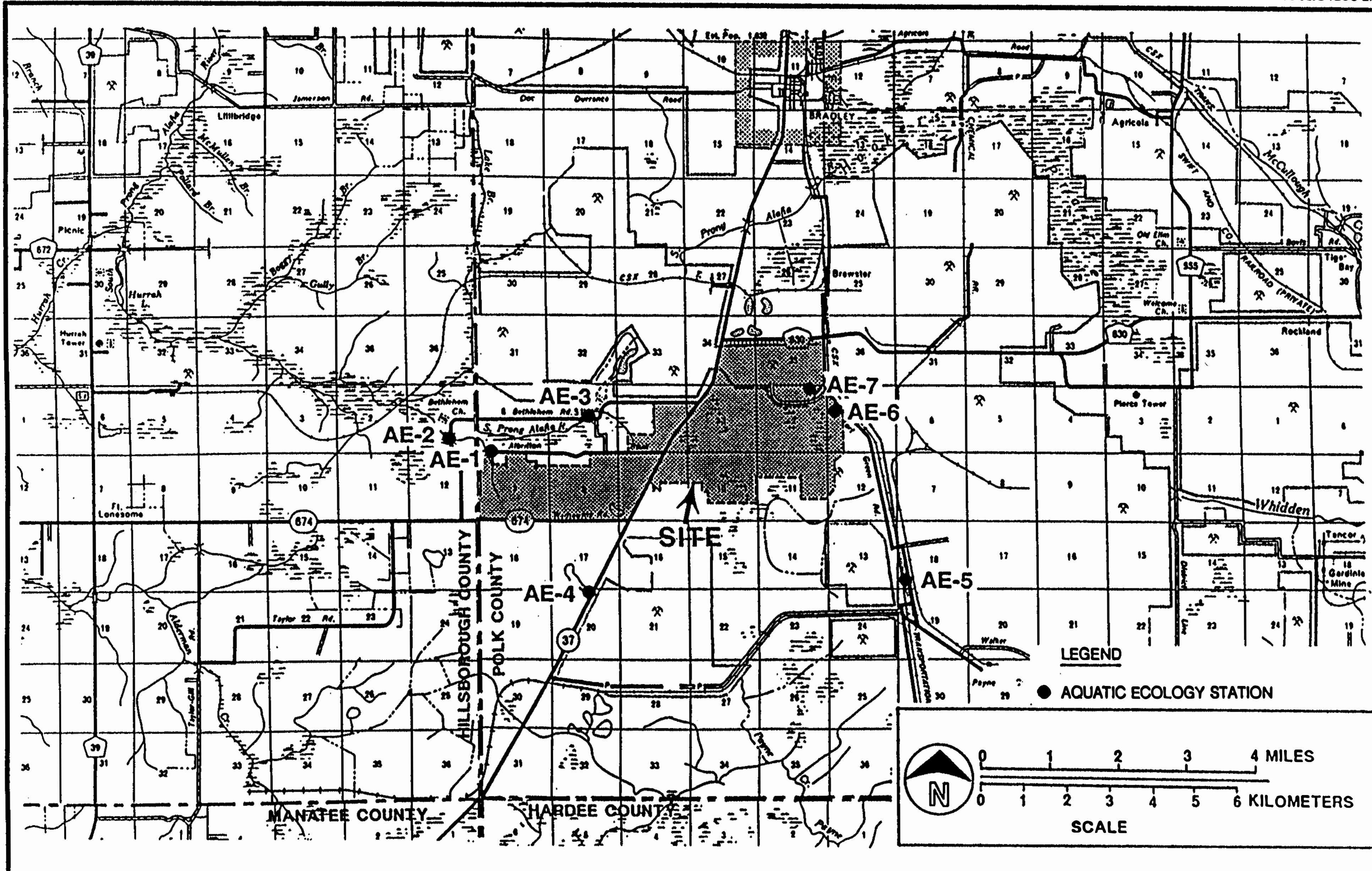

FIGURE 3.6-1.
Aquatic Ecology Monitoring Stations.

SOURCES: FDOT Map, FL.; ECT, 1992; TEC, 1992a.

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Table 3.6.1-1. Number of Taxa of Fish Collected from the Tampa Electric Company Polk Power Station Site, April and August 1991

Family	Common Name	Scientific Name	Sampling Stations						
			AE-1	AE-2	AE-3	AE-4	AE-5	AE-6	AE-7
<u>April 1991</u>									
Cyprinidae	Golden Shiner	*Notemigonus crysoleucasi*	1						
Cyprinodontidae	Seminole killifish	*Fundulus seminolis*		3	6	18			17
	Bluefin killifish	*Lucania goodei*			4			1	
	Least killifish	*Heterandria formosa*						2	
Poeciliidae	Mosquitofish	*Gambusia affinis*		6		58	5	107	49
	Sailfin molly	*Poecilia latipinna*							12
Atherinidae	Brook silverside	*Labidesthes sicculus*		6	5			17	
Centrarchidae	Bluegill	*Lepomis macrochirus*		3		3	5	37	1
	Banded pygmy sunfish	*Elassoma zonatum*				18			
	Largemouth bass	*Micropterus salmoides*						40	
	Redear sunfish	*Lepomis microlophus*						1	
<u>August 1991</u>									
Lepisosteidae	Florida spotted gar	*Lepisosteus platyrhincus*		1		*			
Clupeidae	Threadfin shad	*Dorsoma petenense*							7
Cyprinidae	Taillight shiner	*Notropis maculatus*			8				
Cyprinodontidae	Seminole killifish	*Fundulus seminolis*		1					
Poeciliidae	Mosquitofish	*Gambusia affinis*	4			5		11	12
Centrarchidae	Bluegill	*Lepomis macrochirus*			2		3	1	1
	Largemouth bass	*Micropterus salmoides*					1	4	

* Numerous individuals observed, none actually caught.

Sources: ECT, 1992; TEC, 1992a.

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The results from Stations AE-2 and AE-3 were similar to one another; both stations yielded five different species and the number of individuals were similar. Although more opportunistic species (i.e., mosquitofish) were more evident at Station AE-2, differences between the two stations were insignificant.

Station AE-4 is a popular fishing spot, by both humans and small alligators. The presence of both sometimes interfered with sampling. Station AE-4 yielded five different species. Although species diversity did not appear very high, the representation by different families was high relative to other stations sampled.

Station AE-5 is essentially a ditch, with rock forming the substrate under a railroad crossing. Water flow at Station AE-5 was normally brisk. High flow and the abundance of floating/submerged vegetation tended to allow the easy escape of Nile perch during sampling.

Basin morphology and fish assemblages at Stations AE-6 and AE-7 were rather dissimilar. The reclaimed lake (Station AE-6) has a gradually sloping shoreline and native aquatic vegetation. Station AE-6 had the largest population density of all the stations sampled and the highest species diversity. The old mine-cut (Station AE-7) has sheer limerock walls which rapidly drop to an unknown depth. Vegetation at Station AE-7 was dominated by both nuisance and exotic species. Fish obtained in sampling probably represented only those species occupying the narrowly, vegetated edge of the lake. These fish were dominated by opportunistic species and bait fish (i.e., threadfin shad). The larger fish and the predatory species were difficult to capture, as they could quickly dive and seek refuge in the numerous limestone crevices.

Overall, fish sampling during the dry season event (April 1991) yielded greater numbers of individuals and greater species diversity. The stagnant station (AE-1) sampled during the dry season was the exception. In the deeper stream stations (AE-2 and AE-3), fish probably moved further upstream in the wet season. At the reclaimed lake station (AE-6), the numerous largemouth bass caught in the spring were quite young. It is likely that many of these fish were occupying deeper habitats offshore as they matured (i.e., they were less common in the lake-edge habitat sampled in August 1991).

3.6.2 Benthic Macroinvertebrates

Macroinvertebrate sampling included sediment grab sampling of the infaunal (organisms living within the substrate) benthic community and artificial substrate sampling of the epifaunal (organisms living on vegetation, wood, and other substrates) communities in March and August 1991. Benthic infaunal communities were sampled with a petite Ponar dredge. The epifaunal communities were sampled by allowing them to colonize Hester-Dendy artificial substrate samplers.

During the Polk Power Station study, 198 taxa were identified. A total of 132 taxa was identified from artificial substrate samples and 137 taxa were identified from the Ponar samples. Individual species collected in each sample and their enumerations are provided in the DEIS as Appendix O.

Different species groups dominated the two sample types (Table 3.6.2-1). The artificial substrate samples collected primarily insects (81 percent composition), while the Ponar dredge sampler collected primarily (53 percent) annelids (segmented worms). However, insects were still abundant (39 percent) within the sediment samples. Insects were overwhelmingly dominated by larvae of the family Chironomidae, the nonbiting midge flies. The annelids were primarily tubificid worms, although leeches were abundant at one station (AE-5).

Diptera (true flies) comprised 72 percent of the organisms collected on artificial substrates. Dominant species fluctuated by station and sampling period and included the following taxa: *Tanytarsus* spp., *Polypedilum* spp., *Glyptotendipes lobiferous*, *Cladotanytarsus* spp., *Goeldichironomus* spp., *Corynoneura* sp., *Thienemanniella* spp., *Rheotanytarsus exiguus*, *Paratanytarsus* sp., and *Rheocricotopus robacki*.

Annelids were the dominant benthic organisms (53 percent) collected by the Ponar grab. Most of these annelids were tubificid worms; only five taxa were collected. The dominant taxon was immature tubificids without capiliform setae. These were most likely all *Limnodrilus hoffmeisteri*.

The taxonomic composition, density, and diversity of macroinvertebrate populations in the present study area were similar to those from Payne Creek reported in the SCA for the Hardee Power Station (Tampa Electric Company, Seminole Electric Cooperative, Inc., 1990; TEC, 1992a). Densities and diversities of macroinvertebrates in the reclaimed streams of the South Prong Alafia River from the Brewster Phosphate monitoring study were much lower than those collected in the present study at stations in the South Prong Alafia River and tributary stream (Aurora, Inc., 1988 and 1989; TEC, 1992a).

Densities

Densities of macroinvertebrates collected by station, sample type, and sampling episode are shown in Figure 3.6.2-1. Densities of epifaunal invertebrates ranged from a low of 59 organisms per square meter (organisms/m^2) at Station AE-4 in March 1991 to a high of 85,482 organisms/m^2 at Station AE-5 in August 1991.

Average densities collected over the course of the study are shown in Table 3.6.2-2 by station and sample type. Greatest invertebrate densities during the study were found on artificial substrate samplers at Station AE-5 and averaged 56,506 organisms/m^2. The invertebrate densities at this station are indicative of an enriched water body. Epifaunal densities were also high at Stations AE-6 and AE-7, averaging 20,412 and

Table 3.6.2-1. Percent Composition of the Macroinvertebrate Populations Collected from the Tampa Electric Company Polk Power Station Site, March and August 1991

	Annelida		Crustacea		Chironomid		Other Insects		Mollusca	
Stations	M	A	M	A	M	A	M	A	M	A
Artificial Substrates										
AE-1	0	1	22	15	51	65	8	10	19	8
AE-2	2	0	1	<1	90	81	7	17	<1	2
AE-3	<1	2	<1	2	91	77	8	19	<1	<1
AE-4*	0	19	13	9	66	63	31	9	0	0
AE-5	17	<1	48	<1	26	96	9	3	0	0
AE-6	5	82	9	<1	87	13	5	2	2	17
AE-7	1	<1	4	0	95	100	<1	0	0	0
Mean†	9		9		72		9		3	
Ponar Samples										
AE-1	14	27	4	1	72	94	7	3	2	28
AE-2	3	84	1	16	94	9	1	0	1	9
AE-3	40	32	1	2	48	19	3	7	8	38
AE-4	57	89	10	0	33	11	0	0	0	0
AE-5	44	47	14	1	32	50	<1	<1	2	7
AE-6	86	81	5	1	5	11	3	2	0	4
AE-7	31	90	15	<1	54	10	0	<1	0	0
Mean†	53		5		39		2		7	

Note: M = March 1991.
A = August 1991.

* Data from the artificial substrates at Station AE-4 were obtained from Hester-Dendy samplers collected in October 1991 rather than in August 1991 due to vandalism.

† Mean of all stations from both sampling episodes.

Sources: ECT, 1992; TEC, 1992a.

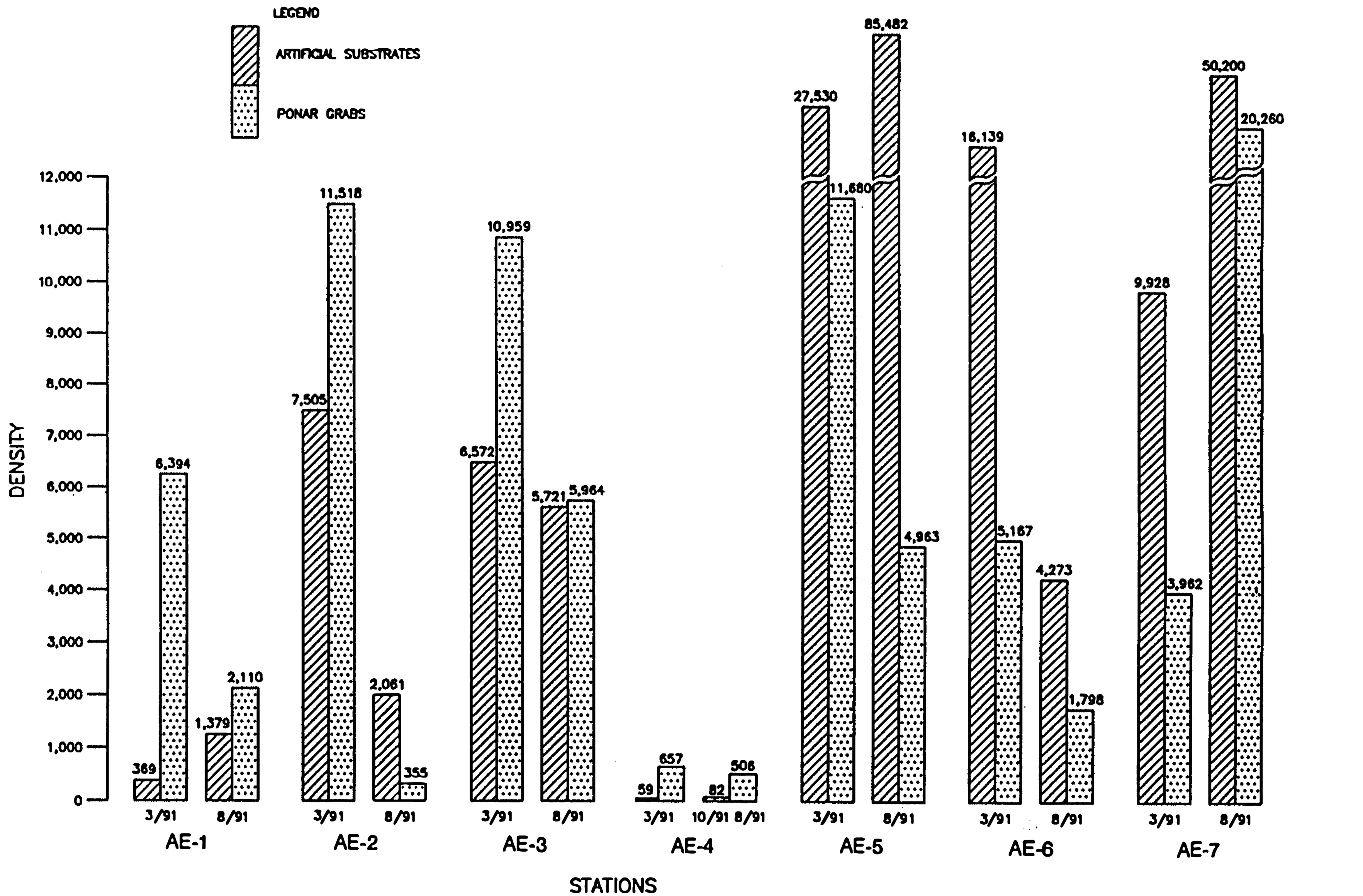

FIGURE 3.6.2-1.
Macroinvertebrate Density (No./m²) from Artificial Substrate and Ponar Grab Samples, Collected from the Seven Aquatic Sampling Stations - March, August 1991.

SOURCES: ECT, 1992; TEC, 1992a.

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Table 3.6.2-2. Mean Density, Diversity, and Number of Macroinvertebrate Taxa Collected from the Tampa Electric Company Polk Power Station Site, March and August 1991

Station	Artificial Substrates			Ponar Grab		
	Mean Density*	Number of Taxa	Diversity (d)	Mean Density*	Number of Taxa	Diversity (d)
AE-1	874	34	3.74	4,252	40	4.12
AE-2	4,783	40	3.48	5,936	22	2.47
AE-3	3,189	44	3.65	8,462	34	3.29
AE-4	70	10	2.63	582	10	2.69
AE-5	56,506	19	1.94	8,322	24	3.14
AE-6	20,412	24	1.77	3,482	18	2.09
AE-7	30,064	12	0.92	12,111	18	2.48

Note: (d) = Shannon diversity index.

* Mean number of organisms per square meter.

Sources: ECT, 1992; TEC, 1992a.

30,064 organisms/m^2, respectively. These stations are located in old mine cuts, and the high densities reflect the enriched conditions in these lakes.

Lowest densities of epifauna occurred at Station AE-4, where an average of 70 organisms/m^2 was collected during the year of study. This station, located on SR 37, is in the remnant headwaters of Payne Creek. This station is an extremely popular fishing spot, and the samplers were frequently disturbed during their incubation period. Samplers were vandalized in August, redeployed, and vandalized again in September. Another group of samplers redeployed in September were finally collected in an undisturbed condition in late October. Repeated disturbance of this location by fishermen, etc., may partially account for the low densities. Other reasons for the low densities at this site are related to stream order, low DO, and low flow.

Macroinvertebrate densities were lower in Ponar samples than in artificial substrate samples. Similar to artificial substrate samples, lowest infaunal densities were collected at Station AE-4 and averaged 582 organisms/m^2. Highest densities were collected at Station AE-7 and averaged 12,111 organisms/m^2.

Diversity

The Shannon diversity index (d) and number of taxa are illustrated by station, sample type, and sample episode in Figure 3.6.2-2. Diversity ranged from a low of 0.04 in samples collected by artificial substrates at Station AE-7 in August to a high of 4.51 in samples collected by the Ponar grab at Station AE-1 in August.

Table 3.6.2-2 lists the average of all diversity values and number of taxa by station and sample type. During the study, the lowest mean diversities were found on artificial substrate samples at Stations AE-5, AE-6, and AE-7 and averaged 1.94, 1.77, and 0.92, respectively. Fewest taxa were collected at Station AE-4, where an average of 10 taxa per sample was found.

Wilhm and Dorris (1968; TEC, 1992a) proposed a relationship between diversity and the pollutional status of the sampling stations. They rate stations with diversity values above 3 as having clean water, values from 1 to 3 as moderately polluted, and values less than 1 as heavily polluted. These guidelines were based on data from a variety of clean-water and polluted streams. Based on these guidelines, Stations AE-1, AE-2, and AE-3 would be considered to generally have better water quality than Stations AE-4 through AE-7. This is further supported by Tampa Electric Company's water quality data in Section 3.2.3.

3.6.3 Important Species and Systems

No listed threatened or endangered aquatic species were identified on or adjacent to the proposed Polk Power Station site. No outstanding Florida waters exist on or near the proposed project site.

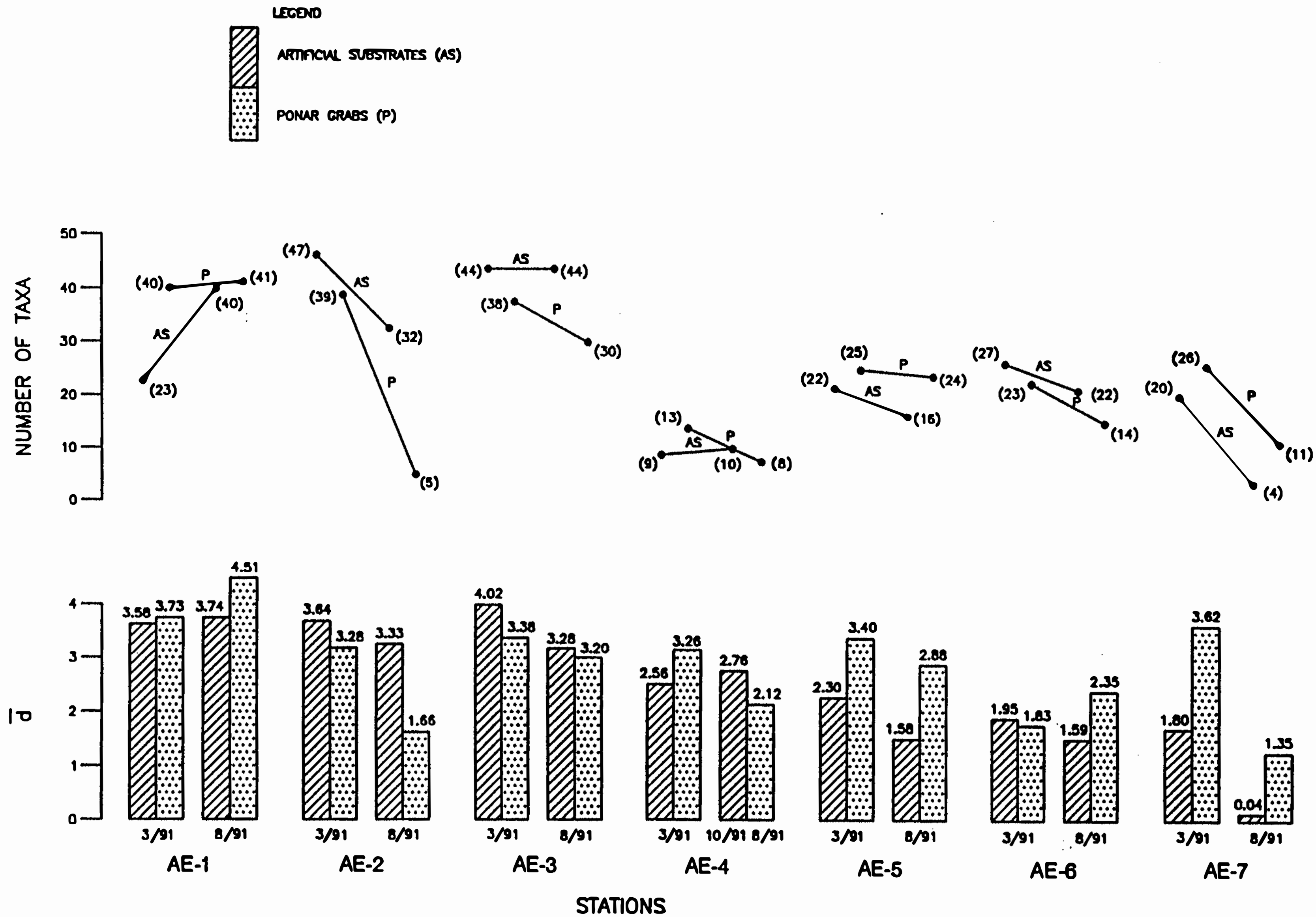

FIGURE 3.6.2-2.
Macroinvertebrate Diversity (d̄) and Total Number of Taxa from Artificial Substrate and Ponar Grab Samples, Collected from the Seven Aquatic Sampling Stations - Mar, Aug. 91.

SOURCES: ECT, 1992; TEC, 1992a.

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Freshwater game fish are those species that are considered desirable for recreational fishing in Florida. Largemouth bass, bluegill, and redear sunfish were the common recreational fishing species collected during fish sampling on the site (Section 3.6.1). Only one species of fish was collected that would be considered endemic to Florida: the Seminole killifish. It was collected at four out of seven sampling stations. No species were collected that would be indicators of good ecological conditions.

No fish species were collected which would be considered especially significant to local ecological systems. However, the mosquitofish was a common species caught at six out of seven sampling locations. This species is highly invasive, adaptive, and can tolerate poor water quality conditions.

3.7 SOCIOECONOMIC CONDITIONS

As shown on Figure 3.7-1, the primary study area is formed by a 5-mile radius around the project site, and is located predominantly within Polk County, except for a small area located in southeastern Hillsborough County. The 5-mile boundary was selected because it addresses adjacent land uses within a reasonable degree of influence of the proposed project. This dimension is also consistent with criteria established by FDEP regulation in the Instruction Guide for Certification Application: Electrical Power Plant Site, Associated Facilities, and Associated Transmission Lines, FDEP Form 17-1.211(1).

A regional study area was also identified based on the proposed Polk Power Station site's location, and anticipated sources of employment and commuting patterns. As shown in Figure 3.7-2, the regional study area includes Polk, Hillsborough, Manatee, and Hardee Counties. Certain socioeconomic characteristics (e.g., population) are described for all counties in the regional study area while other characteristics (e.g., police protection) are discussed for only Polk and Hillsborough Counties due to the limited impact in Manatee and Hardee Counties.

Existing land uses both within the site and in the adjacent 5-mile primary study area are mostly associated with phosphate mining. These uses include lands currently used for mining, reclaimed areas, and unreclaimed areas. Scattered residential areas are found in some areas around the site. The nearest community to the proposed Polk Power Station site is unincorporated Bradley Junction, which lies approximately 4.4 miles to the north of the proposed power block and fuel storage area.

Each of the four counties in the regional study area has different development patterns which range from primarily urban in Hillsborough County, to primarily agricultural in Hardee County. Much of Polk County contains agricultural uses; however, the Lakeland/Winter Haven Standard Metropolitan Statistical Area (SMSA) is becoming increasingly urbanized as a result of its proximity to Tampa and Orlando.

As shown in Figure 3.7-1, the proposed Polk Power Station site is completely within the borders of Polk County, although the western edge borders Hillsborough County. The nearest incorporated municipality to the site is the City of Bowling Green, located approximately 10 miles to the southeast in Hardee County. The nearest incorporated areas in Polk County to the proposed site are the Cities of Fort Meade and Mulberry, which lie approximately 11 miles to the east and north of the site, respectively. Larger incorporated communities lying within a 45-minute commuting distance include: Bartow, approximately 13 miles northeast; Lakeland, approximately 17 miles north; Winter Haven, approximately 26 miles to the northeast; Plant City, approximately 19 miles to the northwest; Bradenton, approximately 35 miles to the southwest; and the Tampa urban area including Brandon, whose outer fringe is located approximately 23 miles west-northwest of the proposed Polk Power Station site.

3.7.1 Demography

3.7.1.1 Existing Population Levels

Population counts for the regional study area, based on 1980 and 1990 U.S. Census data and population projections to the year 2010, are shown in Table 3.7.1-1. Hillsborough, Polk, and Manatee Counties are ranked fifth, eighth, and sixteenth, respectively, in the State of Florida in terms of 1990 county population. Between 1980 and 1990, Manatee's population increased 42.6 percent, making it one of the fastest growing counties in Florida. Hillsborough County's population increased 29 percent, while Polk County's population increased 26 percent during the same decade. Net in-migration accounted for the majority of population increase in all three counties. Hardee County ranked fiftieth in population among Florida counties and experienced a decrease in population between 1980 and 1990. Although births exceeded deaths by almost a two-to-one ratio in Hardee County for the decade, out-migration resulted in a net loss of population (BEBR, 1991).

Another indicator of population growth and level of urbanization is the ratio of persons per square mile (persons/mi^2). For 1990, the statewide average was 239 persons/mi^2. In 1990, Hillsborough County ranked sixth highest in the state in population density at 792 persons/mi^2. Manatee County and Polk County ranked sixteenth highest and eighteenth highest with densities of 283 persons/mi^2 and 222 persons/mi^2, respectively. Hardee County ranked fiftieth highest at 31 persons/mi^2 (BEBR, 1992a).

The population in the census tract containing the Polk Power Station, its surrounding 5-mile radius study area, and the northern transmission line corridor and its adjacent 0.5-mile study area lost approximately 337 persons (17.1 percent) between 1980 and 1990. Total population in 1990 was 1,638, compared to a population 1,975 in 1980.

3.7.1.2 Projected Population

As shown in Table 3.7.1-1, population within the counties of the regional study area is projected to increase to 1.96 million by the year 2010 or approximately 0.5 million person increase over the 1990 population. Polk County's population is anticipated to increase 33.2 percent to 0.54 million persons, while Hillsborough County's population is projected to increase 31.2 percent to 1.09 million persons. Manatee's population is expected to increase by 44.3 percent to over 0.3 million persons. Hardee County has the lowest projected population increase of 1,700 persons and a percentage increase in population of 8.7 percent over the 20-year period (BEBR 1992a).

3.7.2 Economic Conditions in the Regional Study Area

3.7.2.1 Labor Force and Employment

Table 3.7.2-1 presents the labor force and unemployment data for Polk, Hillsborough, Manatee, and Hardee Counties and the state. Hillsborough and Manatee Counties have unemployment rates below state levels, while Hardee and Polk Counties have unemployment rates at higher levels than those of the State of Florida.

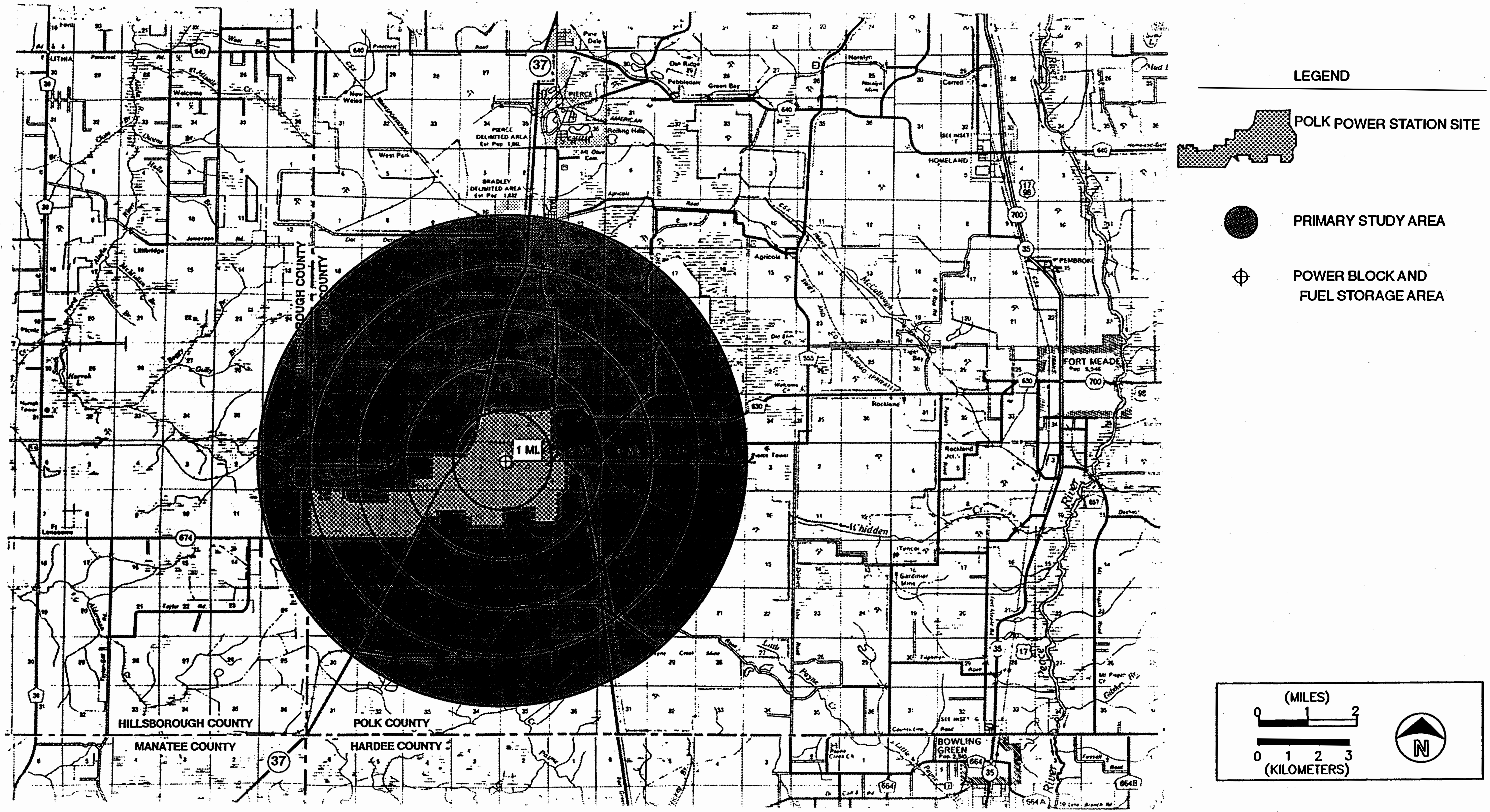

FIGURE 3.7-1.
Polk Power Station Site Primary Study Area.

SOURCES: ECT, 1992; Modified from TEC, 1992a.

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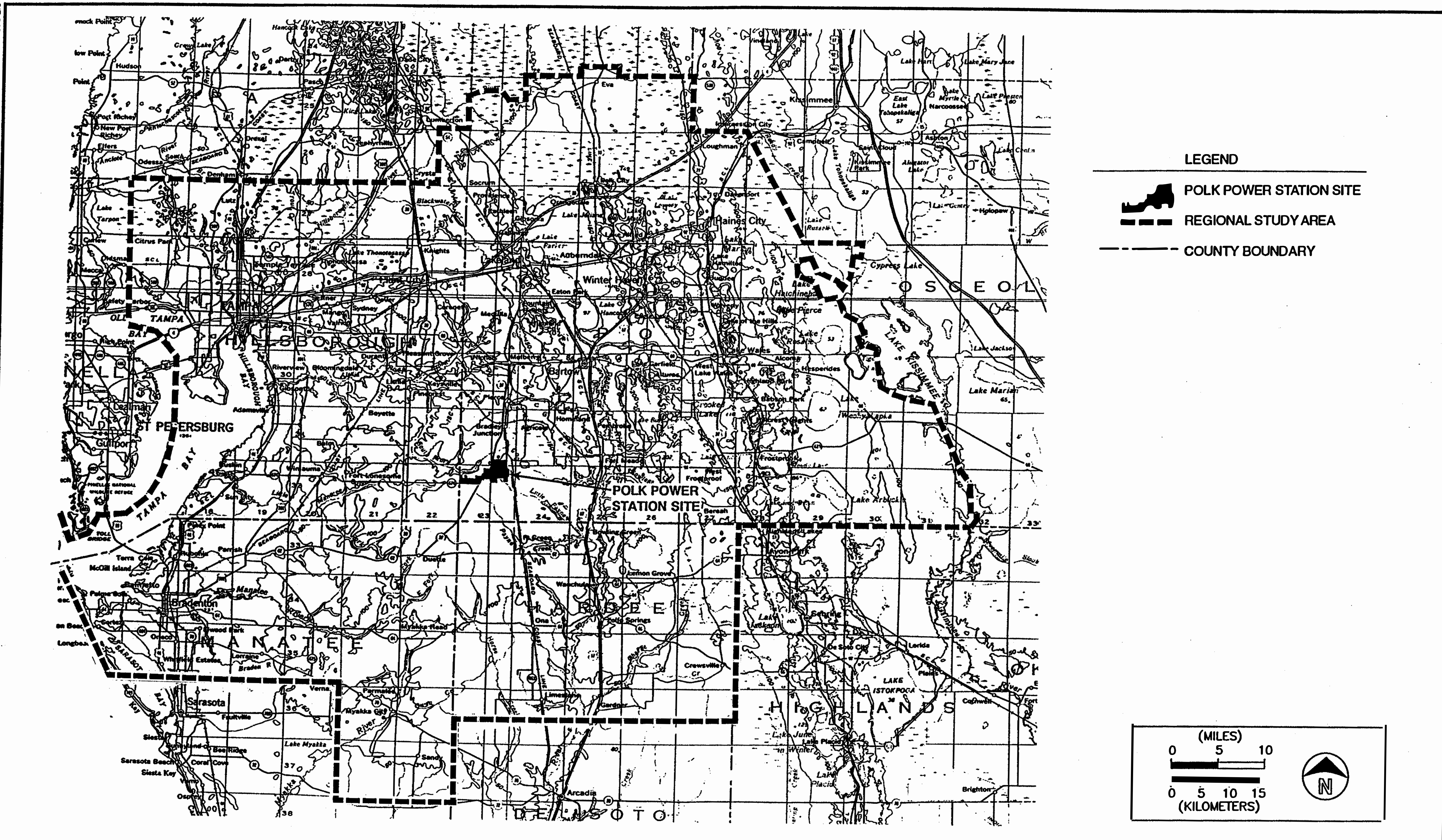

FIGURE 3.7-2.
Regional Socioeconomic Study Area.

SOURCES: ECT, 1992; TEC, 1992a.

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Table 3.7.1-1. Population Estimates and Projections for Polk, Hillsborough, Manatee, and Hardee Counties, Florida

Location	Population (in thousands, rounded to hundreds)			
	1980	1990	2000	2010
Polk County	321.7	405.4	477.9	540.0
Hillsborough County	646.7	834.1	970.4	1,094.0
Manatee County	148.4	211.7	260.3	305.4
Hardee County	20.4	19.5	20.5	21.2
Total Population	1,137.2	1,470.7	1,729.1	1,960.6

Location	Percent Change			
	1980-1990	1990-2000	2000-2010	1990-2010
Polk County	26.0	17.9	13.0	33.2
Hillsborough County	29.0	16.3	12.7	31.2
Manatee County	42.6	23.0	17.3	44.3
Hardee County	-4.4	5.0	3.5	8.7
Total Percent Change	29.3	17.6	13.4	33.3

Sources: BEBR, 1992a.
BEBR, 1984.
TEC, 1992a.

Table 3.7.2-1. Labor Force and Unemployment in Polk, Hillsborough, Manatee, and Hardee Counties in 1991

Location	1991 Population	Labor Force	Labor Force as Percent of Population	Average Annual Percent Unemployment
Florida	13,195,592	6,431,205	48.7	6.6
Polk County	414,700	180,659	43.6	10.1
Hillsborough County	843,203	467,011	55.4	6.0
Manatee County	215,130	97,469	45.3	5.8
Hardee County	19,812	9,368	47.3	10.5

Sources: BEBR, 1992a.
TEC, 1992a.

Hardee and Polk Counties had average annual unemployment rates in 1991 of 10.5 percent and 10.1 percent, respectively (BEBR, 1992a), compared to the state average of 6.6 percent.

Employment Projections

Baseline year (1989) and projected (2000) employment figures by SIC code as prepared by Florida Department of Labor and Employment Security (FDLES), Bureau of Labor Market Information for Polk and Hillsborough Counties are shown in Table 3.7.2-2. For Polk County, an industry-wide increase of 45,674 employment positions at a 24.38-percent change is estimated to occur between 1989 and 2000, while employment increases in Hillsborough County are estimated at 155,107 positions for a 31.85-percent change. In Polk County, the two highest projected increases, both in terms of total positions and percent change, are services and wholesale and retail trade. The third highest projected increase in Polk County employment positions is in the manufacturing sector, while the third highest projected increase, according to percentage change, is expected in the transportation and public utilities sector. In Hillsborough County, the three sectors with the highest projected increases, both in terms of total positions and percentage change are: services, wholesale and retail trade, and finance, insurance, and real estate (BEBR, 1991).

Average annual construction employment in Polk County and Hillsborough Counties in 1990 totalled 31,168. Average annual construction wage in Polk County was $20,300, slightly lower than Hillsborough County's average annual construction wage of $22,631. Average annual employment in 1990 for general contractors excluding building contractors (SIC 301600) totalled 1,885 and 3,938 in Polk and Hillsborough Counties, respectively. Special trade contractors (SIC 301700) totalled 4,905 for Polk County and 13,975 for Hillsborough County. Construction employment in Polk County is projected to increase to 9,537 (13.63 percent) by the year 2005. Hillsborough County's construction employment is projected to increase to 27,414 for a 17.41 percent increase over 1990 levels.

Average Wage by Sector

Annual average employment and wage data for Hillsborough and Polk Counties in 1990 is shown in Table 3.7.2-3, illustrating higher annual average employment and average annual wages for Hillsborough County compared to Polk County. For Polk County in 1990, the highest average annual wage according to general service sector was recorded for federal government employees, followed by state government, local government, and the private sector. The highest average annual wages according to specific sector were: (1) services, and (2) transportation, communication, and public utilities employees of the federal government. The third highest average annual wage reported in Polk County for 1990 was the mining sector of private industry (FDLES, 1991; TEC, 1992a).

In Hillsborough County, the 1990 highest reported wage by general service sector was for federal government employees, followed by local government, state government, and private industry. Accordingly, the three

Table 3.7.2-2. Baseline and Projected Employment by SIC Code, Polk and Hillsborough Counties

SIC Code	Occupation	Polk County 1989 Annual Average Employment	Polk County 2000 Projected Employment	Polk County Change in Employment	Polk County Percent Change	Hillsborough County 1989 Annual Average Employment	Hillsborough County 2000 Projected Employment	Hillsborough County Change in Employment	Hillsborough County Percent Change
000000	Total, all industries	187,378	233,052	45,674	24.38	487,023	642,130	155,107	31.85
100000	Agriculture, forestry, and fishing, total	15,904	19,959	4,055	25.50	15,472	17,735	2,263	14.63
200000	Mining, total	4,067	4,221	154	3.79	94	100	6	6.38
300000	Construction, total	8,989	10,602	1,613	17.94	25,762	30,613	4,851	18.83
400000	Manufacturing, total	23,004	27,909	4,905	21.32	40,483	48,065	7,582	18.73
500000	Transportation and public utilities	7,998	10,077	2,079	25.99	29,537	36,706	7,169	24.27
600000	Wholesale and retail trade, total	43,143	55,481	12,338	28.60	115,851	153,407	37,556	32.42
700000	Finance, insurance, and real estate, total	8,841	10,440	1,599	18.09	34,140	44,766	10,626	31.12
800000	Services, total	47,044	60,514	13,470	28.63	153,669	221,908	68,239	44.41
900000	Government, total	10,445	12,733	2,288	21.91	26,253	33,030	6,777	25.81
808800	Self-employed and unpaid family	17,943	21,116	3,173	17.68	45,762	55,800	10,038	21.94

Sources: FDLES, Division of Labor, Employment, and Training, Bureau of Labor Market Information, OES Matrix Industry Employment Estimates, 1991; ECT, 1992; TEC, 1992a.

TECO[WP]Chap3\T372-2.tab 052794

Table 3.7.2-3. 1990 Average Annual Employment and Wages, Polk and Hillsborough Counties

Industry	Polk County Average Annual Employment	Polk County Average* Annual Wage ($)	Hillsborough County Average Annual Employment	Hillsborough County Average* Annual Wage ($)
Total, all industries	157,062	19,399	440,584	21,120
Subtotal, private industry	134,074	19,106	378,681	20,587
Agriculture, forestry, and fishing	8,700	13,987	11,363	10,302
Mining	4,095	29,961	51	20,977
Construction	8,287	20,300	22,881	22,631
Manufacturing	22,352	23,740	40,059	23,148
Transportation, communication, and public utilities	7,032	23,128	25,412	28,789
Wholesale trade	7,935	23,120	33,794	29,742
Retail trade	34,337	13,467	80,683	12,694
Finance, insurance, and real estate	7,861	21,493	34,928	25,228
Services	33,420	19,159	139,424	20,005
Subtotal, federal government	1,482	28,124	10,892	30,578
Transportation, communication, and public utilities	1,019	30,674	4,194	32,193
Retail trade	0	0	448	10,550
Finance, insurance, and real estate	8	18,350	267	38,867
Services	1	35,162	3,013	30,032
Public administration	455	22,508	2,970	31,129
Subtotal, state government	3,904	22,360	13,611	21,582
Agriculture, forestry, and fishing	44	17,334	11	18,857
Construction	551	25,286	513	25,023
Services	242	24,401	8,059	21,201
Public administration	3,068	21,738	5,029	21,842
Subtotal, local government	17,602	20,238	37,346	23,581
Transportation, communication, and public utilities	0	0	656	26,619
Retail trade	9	10,304	74	12,075
Finance, insurance, and real estate	61	15,175	229	18,969
Services	10,859	19,310	22,585	23,050
Public administration	6,673	21,808	13,802	24,443

Note: Subtotals may not equal totals due to ES-202 Program disclosure editing and/or rounding.

* Total annual wages divided by annual average employment, rounded to nearest whole dollar.

Sources: ECT, 1992.
TEC, 1992a.

highest annual average wages by specific sector were recorded within the federal government, and include in descending order: finance, insurance, and real estate; transportation, communications, and public utilities; and public administration. The highest private sector average annual wage reported in Hillsborough County for 1990 was in the wholesale trade sector (FDLES, 1991; TEC, 1992a).

3.7.2.2 General Income Characteristics

Although the average for the state was slightly higher than the national average, the 1988 and 1989 total per capita incomes in all four counties in the study region were below both state and national figures. For 1989, the state average per capita income was $17,739 compared to $17,555 nationally, while the averages were $16,640 in Manatee County, $16,292 for Hillsborough County, $14,455 for Polk County, and $13,542 for Hardee County (BEBR, 1991).

The generalized 1989 source of income (labor versus proprietorship) for the four-county region is shown on Table 3.7.2-4. In Polk County, approximately 85.5 percent of total 1989 earnings were attributable to labor income (wage and salary disbursements combined with other labor income), with the remaining 14.5 percent derived from proprietorship. In Hillsborough County, the 1989 proportion was approximately 91.3 percent labor to 8.7 percent proprietorship, with the Hardee proportion approximately 66.6 percent labor to 33.4 percent proprietorship, and the Manatee proportion was approximately 83.1 percent labor to 16.9 percent proprietorship (BEBR, 1991). The higher percentage of proprietor's income in Hardee County is largely attributable to farm income which accounted for 20.2 percent of personal income in 1990 compared to 4.3 percent, 3.6 percent, and 1.1 percent for Manatee, Polk, and Hillsborough Counties, respectively.

3.7.3 Community Services

3.7.3.1 Water, Wastewater, and Solid Waste Treatment Facilities

Potable water and sanitary sewerage service are provided in various areas of Polk and Hillsborough County by both public and private entities. Large portions of Polk County, however, have no central services. In those areas, individual wells and septic tanks are used.

The proposed Polk Power Station is located in rural Polk County, an area not provided with public potable water supply or sanitary sewerage service. The nearest potable water service area is located in Bradley Junction, servicing the general boundaries of the community of Bradley Junction. No sewer service is available in Bradley Junction.

The Polk County concurrency/growth management requirements include the issuance of a Certificate of Concurrency in accordance with the Concurrency Management Ordinance of Polk County, adopted June 1992 (concurrency means that the necessary public facilities and service standards are available when the impacts of

Table 3.7.2-4. 1989 Source of Personal Income: Total Earnings on a Place-of-Employment by Industrial Sector (1991) Work Basis by Major Type of Income

County	Total Earnings ($)	Wage and Salary Disbursements ($)	Other Labor Income ($)	Proprietor's Income		
				Total ($)	Farm ($)	Nonfarm* ($)
Hardee	152,899	93,898	8,000	51,001	33,931	17,070
Hillsborough	11,161,518	9,358,268	833,259	969,991	145,172	824,819
Manatee	1,675,766	1,271,945	120,087	283,734	89,760	193,974
Polk	3,907,791	3,053,983	287,426	566,382	161,910	404,472

County	Total Earnings (%)	Wage and Salary Disbursements (%)	Other Labor Income (%)	Proprietor's Income		
				Total (%)	Farm (%)	Nonfarm* (%)
Hardee	100.0	61.4	5.2	33.4	22.2	11.2
Hillsborough	100.0	83.8	7.5	8.7	1.3	7.4
Manatee	100.0	75.9	7.2	16.9	5.4	11.6
Polk	100.0	78.2	7.4	14.5	4.1	10.4

* Excludes limited partnerships

Sources: BEBR, 1991.
ECT, 1992.
TEC, 1992a.

development occur). Since the proposed Polk Power Station would provide its own potable water and sanitary sewerage services, a Certificate of Concurrency will not be required or issued for these services (TEC, 1992a).

Three landfills are currently operating in Polk County with a total available capacity of 1,350 tpd. The useful life of these landfills is projected to the year 2010; however, Polk County has proposed a solid waste processing plant, which, if constructed, could extend the useful life of these landfills to the year 2030. The North Central Landfill is located nearest the proposed Polk Power Station site and has a capacity of 1,000 tpd. Based on adequate existing and future capacity of Polk County landfills, the station will fulfill the requirements of the Concurrency Management Ordinance of Polk County.

3.7.3.2 Public Safety

Fire-Fighting Facilities

Fire protection services in Polk County are divided into four regional quadrants. The Polk Power Station falls within the southwest quadrant, and fire fighting efforts would be coordinated through the Southwestern Battalion Officer. There are a total of 28 county fire stations, of which 10 stations are staffed 24 hours, 10 are staffed by career fire fighters during the daytime, with the remainder using volunteer fire fighters. There are approximately 10 additional city-operated fire stations in Polk County (Polk County Fire Department, 1992; TEC, 1992a).

The nearest fire station to the proposed Polk Power Station within Polk County is the Bradley Station, located approximately 4.4 miles to the north, in Bradley Junction. This station is staffed by two full-time fire fighters on duty from 8 a.m. to 5 p.m., 5 days per week, and 8 to 12 volunteer fire fighters. This facility is a primary response unit and is equipped with a pumper truck (approximately 750 gpm), tanker truck, and rescue truck. Estimated response times range from 8 to 12 minutes for responses by full-time fire fighters and 12 to 20 minutes when using volunteer fire fighters. The next nearest facility is the Fort Meade Station, which is a city rather than county facility staffed by 15 to 20 volunteers, with an estimated response time of 20 to 25 minutes. This station is equipped with three full-size pumper trucks (greater than 1,000-gpm capacity) and a tanker truck. Hazardous Materials Response Team capabilities or an aerial truck would respond from the Bartow Air Base Station, with an estimated response time of 25 minutes (TEC, 1992a; Polk County Fire Department, 1993).

For most responses, Polk County would exhaust their fire fighting resources before requiring assistance from another county, such as Hillsborough. If assistance were necessary from Hillsborough County, it likely would include hazardous materials or aerial truck assistance from Hillsborough County's Brandon Station (Polk County Fire Marshal, 1992; TEC, 1992a). In the event that additional fire fighting capabilities would be necessary, the nearest Hillsborough County station is the Southeastern Station located on Lithia Pinecrest Road west of CR 39 on Browning Road. This facility is staffed 24 hours by three full-time volunteers, with an estimated response time of 20 to 25 minutes. The next nearest fire station is the Wimauma Station, located on 7th Avenue in Wimauma. This facility is staffed by three permanent fire fighters over 24-hour periods. The Hillsborough County Fire Department has 32 facilities with 330 career fire fighters and 220 volunteers (Hillsborough County Fire Department, 1992; TEC, 1992a).

Police Protection

Police service in unincorporated Polk County is provided by the Polk County Sheriff's Department. A total of six sheriff's stations are contained in Polk County, with a total of 383 sworn officers, 590 automobiles, and 242 patrol units (Polk County Sheriff's Department, 1991; TEC, 1992a). Deputies patrolling the proposed Polk Power Station area are based out of the West Regional Substation located at 2105 East Lakewood Drive in south Lakeland. A total of approximately 109 sworn officers are located at the West Regional Substation. Responses are prioritized according to urgency, with an average estimated response time of 10 to 15 minutes for a routine response, with considerably shorter time expected for high-priority emergencies. Because the proposed Polk Power Station site lies in unincorporated Polk County and is more than 10 miles from the nearest municipality, responses by city police departments under most circumstances are not expected (Polk County Sheriff's Department, 1992; TEC, 1992a).

Hillsborough County has a total of seven sheriff's stations and 838 sworn officers. The nearest Hillsborough County station to the proposed Polk Power Station site is located in Brandon (Hillsborough County Sheriff's Department, 1991; TEC, 1992a).

3.7.3.3 Education

Public school information for Hillsborough and Polk Counties is shown in Table 3.7.3-1, which indicates that Hillsborough County has almost twice as many prekindergarten to 12th grade students enrolled for the 1989-90 school year, and correspondingly more prekindergarten to 12th grade schools. In Hillsborough County, 62.1 percent of high school graduates and 50.5 percent of Polk County high school graduates enrolled in some higher form of education (vocational school, junior college, or state college). Though Hillsborough County collected more total revenues per full-time equivalent (FTE) student than Polk County, both counties had comparable expenditures per FTE student, school tax millage rates, and percentage of total staff that are teachers. Hillsborough County built five new schools for the 1991-92 school year and two additional schools are programmed in 1992-93 (Hillsborough County Board of Education, 1991; TEC, 1992a).

Table 3.7.3-2 consists of a listing of the Hillsborough and Polk County schools located nearest to the proposed Polk Power Station site for the 1991-92 school year. The nearest Polk County schools are in Mulberry and Fort Meade, which are 12.5 and 10.5 miles away, respectively, while the nearest public schools in Hillsborough County are in Lithia and Plant City, which are 14 and 21 miles away, respectively. No public

Table 3.7.3-1. Public Education Information

	Polk County	Hillsborough County
1989-1990 School Year Data		
Total PK-12 public school enrollment[1]	64,256	120,364
High school graduates continuing education[2]	1,641 (50.5%)	3,885 (62.1%)
FTE teacher-to-FTE student ratio[3]		
Elementary	1:20.37	1:20.85
Secondary	1:17.61	1:19.41
Percentage of total staff that are full-time teachers[3]	51.47%	48.78%
Total all revenues ($1,000)[3]	$265,226	$583,706
Revenue/FTE student	$3,999	$4,534
Total expenditures, all funds ($1,000)[3]	$268,233	$561,030
Expenditure/FTE student	$3,761	$3,828
Debt service ($1,000)	$3,187	$19,932
Operating tax millage	6.217	6.347
1991-1992 School Year Data[4]		
Total public schools		
Elementary	61	102
Middle junior	17	26
Other secondary	12	14
Total pre-kindergarten through 12th grade	90	142
Adult	3	17
Vocational	3	3
Other	37	21

Sources: [1] State of Florida, Department of Education, MIS Statistical Brief, Series 90-10B, 1990.
[2] State of Florida, Department of Education, MIS Statistical Brief, Series 90-09B, 1990.
[3] BEBR, 1991, Florida Statistical Abstract, 1991.
[4] State of Florida, Department of Education, 1991-1992 Florida Public Schools MIS Data Sheet, 1991.
TEC, 1992a.

Table 3.7.3-2. Nearest Polk and Hillsborough County Public Schools to the Polk Power Station, 1991-1992 School Year

POLK COUNTY

Mulberry (approximately 11 miles north)

Grades K-3
Kingford Elementary School
1400 Dean Street
Mulberry
Total Capacity: 700
1993/94 Enrollment: 694

Grades 4-6
Purcell Elementary School
305 Northeast 1st Avenue
Mulberry
Total Capacity: 500
1993/94 Enrollment: 484

Grades 7-8
Mulberry Middle School
500 Southeast 9th Avenue
Mulberry
Total Capacity: 625
1993/94 Enrollment: 606

Grades 9-12
Mulberry Senior High School
Northeast 4th Circle
Mulberry
Total Capacity: 800
1993/94 Enrollment: 758

Fort Meade (approximately 11 miles east)

Grades Pre K-3
Lewis Elementary School
115 South Oak Avenue
Fort Meade
Total Capacity: 525
1993/94 Enrollment: 506

Grades 4-5
Riverside Elementary School
1002 Northeast 6th Street
Fort Meade
Total Capacity: 250
1993/94 Enrollment: 199

Grades 6-7
Fort Meade Middle School
610 South Charleston Avenue
Fort Meade
Total Capacity: 250
1993/94 Enrollment: 216

Grades 8-12
Fort Meade Junior-Senior High School
700 Edgewood Drive
Fort Meade
Total Capacity: 500
1993/94 Enrollment: 460

HILLSBOROUGH COUNTY

Lithia (approximately 13 miles northwest)

Grades K-6
Pinecrest Elementary School
7950 Lithia Pinecrest Road
Lithia
Total Capacity: 889
1993/94 Enrollment: 838

Plant City (approximately 19 miles northwest)

Grades 7-9
Turkey Creek Middle School
5005 South Turkey Creek Road
Plant City
Total Capacity: 1,249
1993/94 Enrollment: 1,417

Grades 10-12
Plant City High School
One Raider Place
Plant City
Total Capacity: 2,273
1993/94 Enrollment: 2,147

Sources: Hillsborough County Board of Education, 1991.
Polk County School Board, 1992.
ECT, 1992.
TEC, 1992a.

schools are located in unincorporated Bradley Junction; school-age children in Bradley Junction attend Mulberry schools (Polk County Board of Education, 1992; TEC, 1992a).

3.7.3.4 Health Care Facilities

The nearest hospitals to the proposed Polk Power Station site are Bartow Memorial and Polk General, both located in Bartow approximately 13 miles to the northeast. Bartow Memorial is a private facility, while Polk General is a public hospital established primarily for indigent care. Both hospitals are equipped with emergency rooms, but neither are equipped with a trauma center. The nearest trauma centers to the proposed Polk Power Station site are Lakeland Regional Hospital located approximately 17 miles to the north, and Tampa General Hospital, which is approximately 20-minutes by helicopter from the Polk Power Station (Polk County Division of Public Safety, 1992; TEC, 1992a).

Polk County has eight hospitals totaling 1,785 general hospital beds at a ratio of 434 general hospital beds per 100,000 population. Hillsborough County has 19 hospitals totaling 3,366 general hospital beds, averaging 400 general hospital beds per 100,000 population. The State of Florida ratio of adequate hospital services is 406 general hospital beds per 100,000 population (BEBR, 1991; TEC, 1992a).

The emergency medical services (EMS) facilities that would respond to the proposed Polk Power Station site are located at the Fort Meade Fire Station. These facilities include advanced life support. The Fort Meade Fire Station EMS response time is estimated to be 20 to 25 minutes (Polk County Division of Public Safety, 1992; TEC, 1992a).

3.7.3.5 Existing Housing Stock

Information describing 1990 housing stock as based on census data for the four-county area is shown on Table 3.7.3-3, which identifies 677,151 total housing units, 98,859 total vacant units, and 34,651 vacant seasonal or recreational units within the four-county region.

Hillsborough County had the largest number of total 1990 housing units, at 367,740, or approximately 54 percent of the four-county total. Polk County had approximately half as many as Hillsborough County, approximately 28 percent of the four-county total. Manatee County had approximately 17 percent, and Hardee County had approximately 1 percent of the four-county total (TEC, 1992a).

In terms of total vacant units, Hillsborough County contained the highest number (42,868 units) and greatest proportion, at approximately 43 percent of the four-county total. Polk County had approximately 30 percent of the total, followed by Manatee at approximately 24 percent, and Hardee at approximately 3 percent. The highest number of vacant seasonal units was reported in Manatee County, followed by Polk, Hillsborough, and

Table 3.7.3-3. 1990 Housing Stock

County	Total Units	Total Vacant Units	Vacant Seasonal or Recreational Units*	Vacancy Rate, Home-owner† (%)	Vacancy Rate, Rental† (%)	Occupied Homeowner Units‡	Median Value (Census)	Occupied Rental Units‡	Median Monthly Contract Rent (Census)
Hardee	7,941	1,550	664	1.6	15.5	4,844	$40,300	1,547	$257
Hillsborough	367,740	42,868	6,188	3.6	13.5	204,966	$73,100	119,906	$374
Manatee	115,245	24,185	14,669	3.7	11.8	64,574	$79,400	26,486	$397
Polk	186,225	30,256	13,130	3.3	12.6	109,885	$61,000	46,084	$300
Total/ Average	677,151	98,859	34,651	3.48§	13.07§	384,269	$63,450	194,023	$359

* Vacant units intended for use only in certain seasons, for recreational or other occasional use throughout the year.
† Percentage relationship of vacant units for sale to total homeowners inventory, or for rent to total rental inventory.
‡ Usual place of residence of the person or group of persons living in the unit at the time of census enumeration.
§ Weighted average of the four counties.

Sources: BEBR, 1991.
ECT, 1992.
TEC, 1992a.

Hardee Counties. Homeowner vacancy rates ranged from 1.6 percent to 3.7 percent in the four-county area. The 1990 rental vacancy rates ranged from 11.8 percent to 15.5 percent (TEC, 1992a).

Single family detached housing is by far the most predominant type of owner occupied housing unit in the four counties. Over 97 percent of owner occupied units in Hardee County are single family detached (including mobile homes). Both Polk and Hillsborough Counties are also above 90 percent at 95 and 91 percent, respectively. Manatee County has the lowest percentage of single family detached units as a percent of all units with 82.2 percent.

The four closest municipalities to the proposed Polk Power Station site, Bowling Green (11.5 miles), Fort Meade (11 miles), Mulberry (10.5 miles), and Bartow (13 miles), had a combined total of 27 single-family new home construction permits in 1991. The majority, or 19 of these 27 residences, were permitted in Bartow, with six permits issued in Fort Meade, two permits recorded in Bowling Green, and none in Mulberry (BEBR, 1992a; TEC, 1992a).

3.8 LAND USE, RECREATION, AND AESTHETIC CONDITIONS

3.8.1 Land Use

3.8.1.1 Existing Land Use

As shown on Figure 3.7-1, the proposed Polk Power Station site lies entirely within Polk County bordering the Polk/Hillsborough County line on the western property boundary. The proposed Polk Power Station site is also within the jurisdiction of CFRPC and SWFWMD. No public lands are located directly adjacent to the proposed Polk Power Station, or within a 5-mile radius of the site.

Existing land-use and land-cover characteristics within the proposed Polk Power Station site and the surrounding area within a 5-mile radius primary study area drawn from the IGCC unit exhaust stack have been studied in detail in the SCA (TEC, 1992a). The predominant land form within the proposed Polk Power Station site is extractive (i.e., mining). This land use is associated with the extraction of phosphate ore and includes mined areas, spoil banks, sand tailings areas, settling ponds, and reclaimed areas. The existing land-use features within this site include recently mined areas containing water-filled mine cuts between over-burden spoil piles, older mined, reclaimed and unreclaimed areas, and minimal areas which are undisturbed. A more detailed description of on-site vegetation and land cover is contained in Section 3.5.2 and Table 3.5.2-1. The majority of the proposed Polk Power Station site has been used for phosphate mining and is in a disturbed state.

Existing land uses found adjacent to the proposed Polk Power Station site boundaries are primarily extractive, and include areas currently utilized for phosphate mining, and reclaimed and unreclaimed phosphate mining areas. From a land-use perspective, those reclaimed areas currently function as agricultural land. Several land uses adjacent to the proposed Polk Power Station site are known to exist based on review of aerial photographs and field evaluations. These areas include: a single-family residence located east of the site in Section 1 of Township 32 South, Range 23 East within a parcel where a hazardous waste incinerator is proposed; a low-density residential (14 homes) area located southeast of the site along Mills Road in Section 18 of Township 32 South, Range 24 East; low-density residential (115 homes) areas located adjacent to the west of the site north of SR 674 in Section 12 of Township 32 South, Range 22 East; the Alafia Bible Camp, a religious/recreational facility located along Bethlehem Road in Section 5 of Township 32 South, Range 23 East; and the Bethlehem Primitive Baptist Church and Cemetery located at the western edge of Bethlehem Road in Section 1 of Township 32 South, Range 22 East.

The only other areas of residential and commercial development found within a 5-mile radius of the proposed Polk Power Station site are located approximately 4.4 miles to the north, in the unincorporated community of Bradley Junction. Other land-use and land-cover types located within the 5-mile radius study area are: residential, single-unit, low-density (less than two dwelling units per acre); residential, single-unit, medium density (two to six dwelling units per acre); citrus groves; and freshwater marsh.

Several beneficiation facilities associated with phosphate mining operations are located in the study area. These include the IMC Fertilizer Haynsworth mine located in portions of Sections 28 and 29 of Township 21 South, Range 23 East; the Mobil Chemical Company Big Four Mine located in Section 25 of Township 31 South, Range 22 East; and the Agrico Payne Creek Mine located in Section 29 of Township 32 South, Range 24 East. These facilities are considered part of the extractive land use.

As previously described, the only areas containing urban (i.e., residential, commercial, and/or institutional) development within the 5-mile study area are residential areas along Albritton, Bethlehem, and Mills Roads, and mixed uses in Bradley Junction. While Bradley Junction is predominantly a residential area, residential, single-unit, medium-density uses (two to six dwelling units per acre), a few scattered commercial uses (convenience store and gas stations), a few institutional uses (post office, fire station, and churches), and a park (Bradley Junction Recreational Park) are contained in this unincorporated community.

Data contained in the Polk County Comprehensive Plan as Appendix B (Future Land Use Element Support Documentation) illustrate that no Developments of Regional Impact (DRIs) or large residential, commercial, recreational, institutional, and/or industrial development applications were submitted or approved within proposed Polk Power Station's 5-mile radius study area or within 0.5 mile of the proposed northern transmission line corridor. Development patterns within the proposed Polk Power Station site and the northern transmission line corridor study areas are primarily characterized by phosphate mining lands and processing facilities with scattered small residential and agricultural land uses.

Information contained in the Florida Institute of Phosphate Research 1990 Regional Study of Land Use Planning and Reclamation reveals that three phosphate mining DRIs are located within or near the 5-mile radius study area. These include the 2,600-acre Brewster Phosphates DRI and the 6,859-acre Seminole Fertilizer DRI (both located east of the Polk Power Station) and the 5,720-acre Mobil Chemical Company DRI (located to the west of the project and to the north of the South Prong Alafia River within Hillsborough County).

As discussed, other power plants in the region include the Hardee Power Station to the south and the FPC power station proposed to the northeast of the proposed Polk Power Station site. A hazardous waste incinerator has also been proposed adjacent to the east of the proposed Polk Power Station along Fort Green Road. All proposed hazardous waste incinerators in Florida are currently on hold while FDEP conducts a study of the need for facilities in Florida.

The FDOT District I, which has jurisdiction over state roads in the study area, currently has one project planned within the 5-mile radius study area. This project consists of widening and resurfacing SR 37 from SR 630 north to Mulberry resulting in 12-ft lanes with a 2-ft shoulder and extended drainage structures

(FDOT, 1993). Polk County has no improvements planned in the study area (Polk County Department of Planning, 1993).

The proposed Polk Power Station site lies predominantly in Conceptual Utility Planning Area 12 as discussed in the Polk County Comprehensive Plan Infrastructure Element (Imperial Polk County 1989). Within this area no wastewater treatment facility improvements or solid waste system improvements were programmed. One minor water treatment plant project to remove a package pump station, replace a hydropneumatic tank, and add a 0.16 mgd/1,000 gpm well with pump is proposed for FY 1997 to the Rolling Hills West Water Treatment Plant located approximately 7 miles north of the proposed site.

3.8.1.2 Land-Use Plans and Zoning

Various state, regional, and local comprehensive plans and local zoning ordinances affect the Polk Power Station site. These include:

- State Comprehensive Plan
- Central Florida Regional Policy Plan
- Polk County Comprehensive Plan
- Polk County Zoning Ordinance

A review of the compatibility of the proposed Polk Power Station with the goals, objectives, and policies of these plans is contained in Section 4.8. A map of future land-use categories found within a 5-mile radius of the proposed Polk Power Station site is shown in Figure 3.8.1-1.

<u>Land Use and Comprehensive Plan</u>

The entire proposed Polk Power Station site is designated as phosphate mining in the Future Land Use Element of the Polk County Comprehensive Plan (1991). The construction and operation of certified electric power generating facilities (power plants subject to certification under the PPSA) are conditional permitted uses within this future land-use category. County review and approval of such facilities described by the Comprehensive Plan is implemented by a CUP.

The following excerpt from Appendix B 2.100 of the Comprehensive Plan Future Land Use Support Document discusses the suitability of the proposed Polk Power Station site within southwestern Polk County for the development of an electric generating facility:

> Southwest Polk County possesses several advantages [for a power plant location] relative to other locations:

1. This area is predominantly reclaimed phosphate mining lands that do not contain a large amount of environmentally sensitive land;

2. This area of the county is relatively close to population centers along the west coast of the state;

3. This area of the county possesses a full complement of requisite infrastructure (rail spurs, adequate road network, plentiful water supply, etc.) for facilities such as this.

Zoning

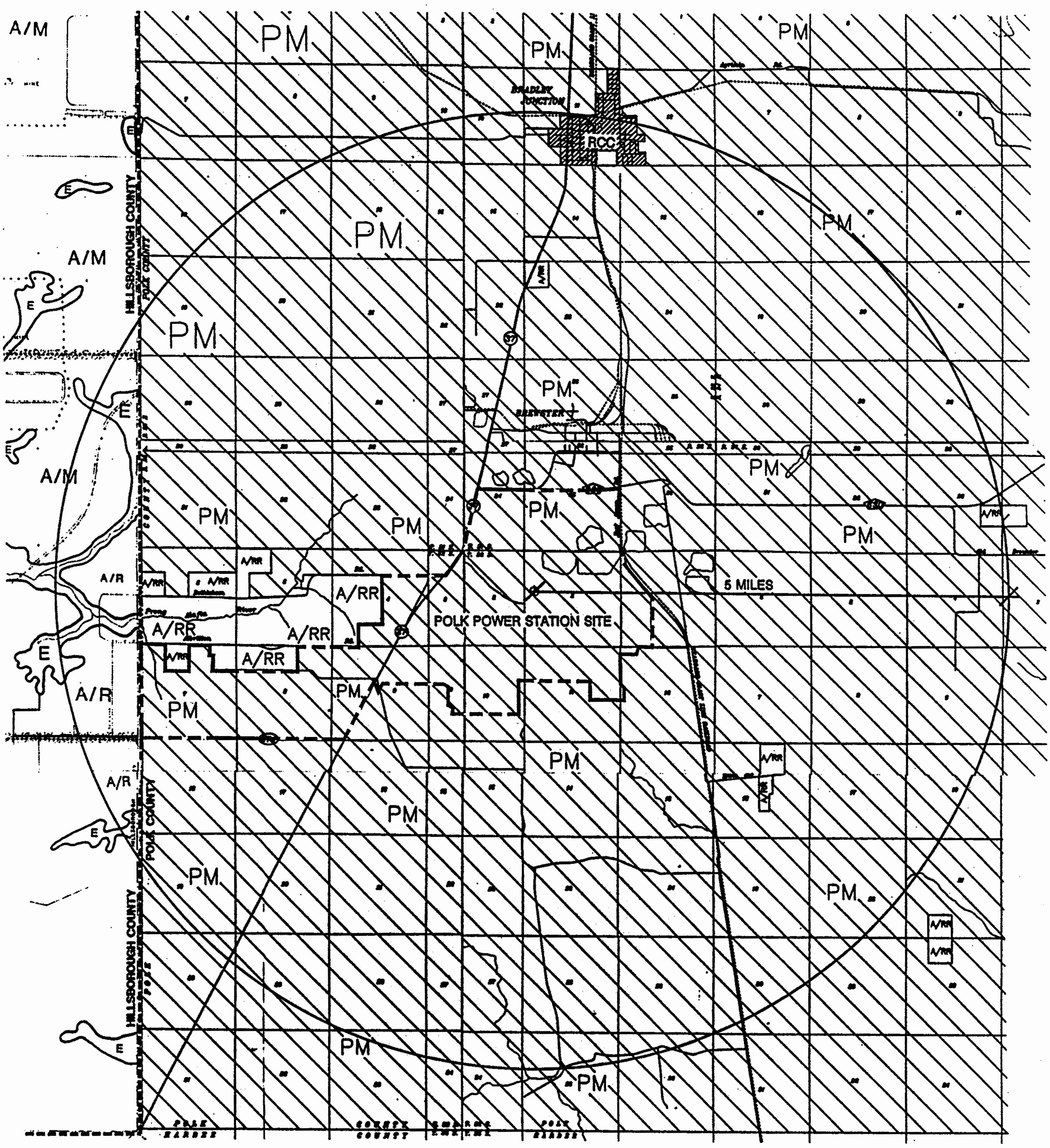
Zoning districts located within a 5-mile radius of the proposed Polk Power Station site are shown in Figure 3.8.1-2. The proposed Polk Power Station site is zoned Rural Conservation (RC), a district which provides for low-density, agricultural, and open space uses (Polk County Board of County Commissioners, 1983). This zoning district allows electric generating facilities as a conditional use as reviewed and approved through a CUP.

The proposed Polk Power Station is considered a Class III Essential Service by the Polk County Zoning Ordinance, and is an allowable conditional use within the RC zoning district subject to submittal of a CUP and discretionary zoning approval by the Polk Board of County Commissioners (BOCC) upon review by the appropriate Polk County staff and subsequent recommendation made to the BOCC by the Polk County Zoning Advisory Board.

On January 17, 1992, a Pre-Application Meeting for the CUP was held in the offices of the Polk County Planning Division between Polk County staff members and representatives of Tampa Electric Company. The CUP application was filed with Polk County Development Services on January 24, 1992, with supplemental information provided on February 12, 1992. This information was reviewed by Polk County staff and their comments were provided to representatives of Tampa Electric Company in an Impact Review Meeting held on March 16, 1992, at the Polk County Planning Division offices. Responses to comments generated during the Impact Review Meeting were submitted on March 30, 1992, and another review meeting was held on April 1, 1992. The Zoning Advisory Board recommended approval of the CUP on May 13, 1992, and the BOCC approved the CUP on June 2, 1992.

Land Use and Zoning in the Transmission Line Corridor

The proposed northern transmission line corridor primarily crosses disturbed lands currently or previously utilized for phosphate mining. Approximately 13 homes are located within the northern corridor. An



SCALE: 1 : 63,360
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(SCALE IN MILES)
0 1.25

0 1 2
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LEGEND

FIVE-MILE RADIUS STUDY AREA

POLK COUNTY

PM: PHOSPHATE MINING CATEGORY
A/RR: AGRICULTURAL/RESIDENTIAL-RURAL CATEGORY
RCC: RURAL-CLUSTER CENTER CATEGORY

HILLSBOROUGH COUNTY

A/M: AGRICULTURAL/MINING CATEGORY
A/R: AGRICULTURAL/RESIDENTIAL CATEGORY
E: ENVIRONMENTALLY SENSITIVE

FIGURE 3.8.1-1.
Future Land Use Categories within a Five-Mile Radius of the Polk Power Station Site.

SOURCES: Polk County, 1991; Hillsborough County, 1991; ECT, 1992; TEC, 1992a.

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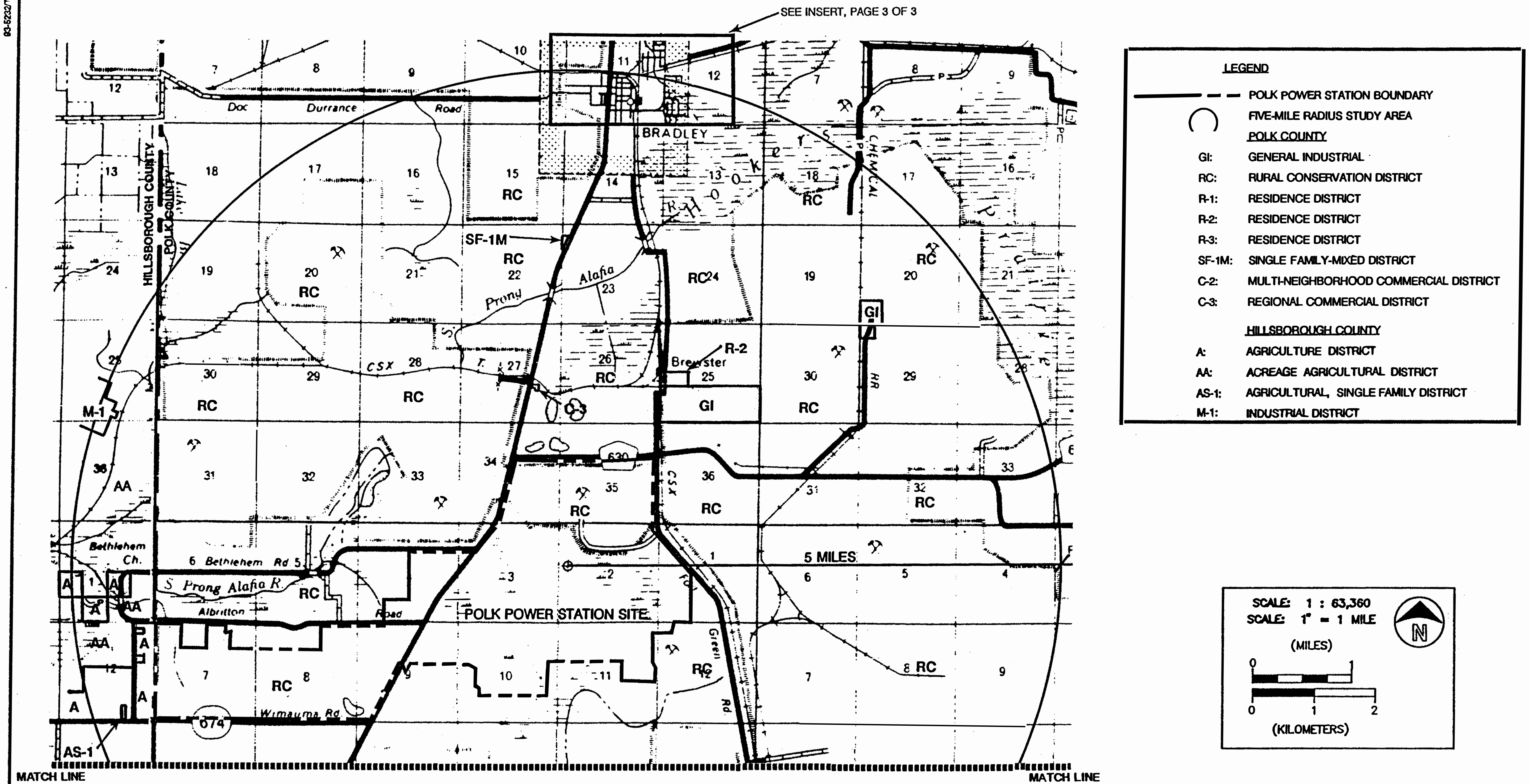

FIGURE 3.8.1-2. (1 of 3)
Zoning Districts within a Five-Mile Radius of the Polk Power Station Site.

SOURCES: Polk County, 1991; ECT, 1992; TEC, 1992a.

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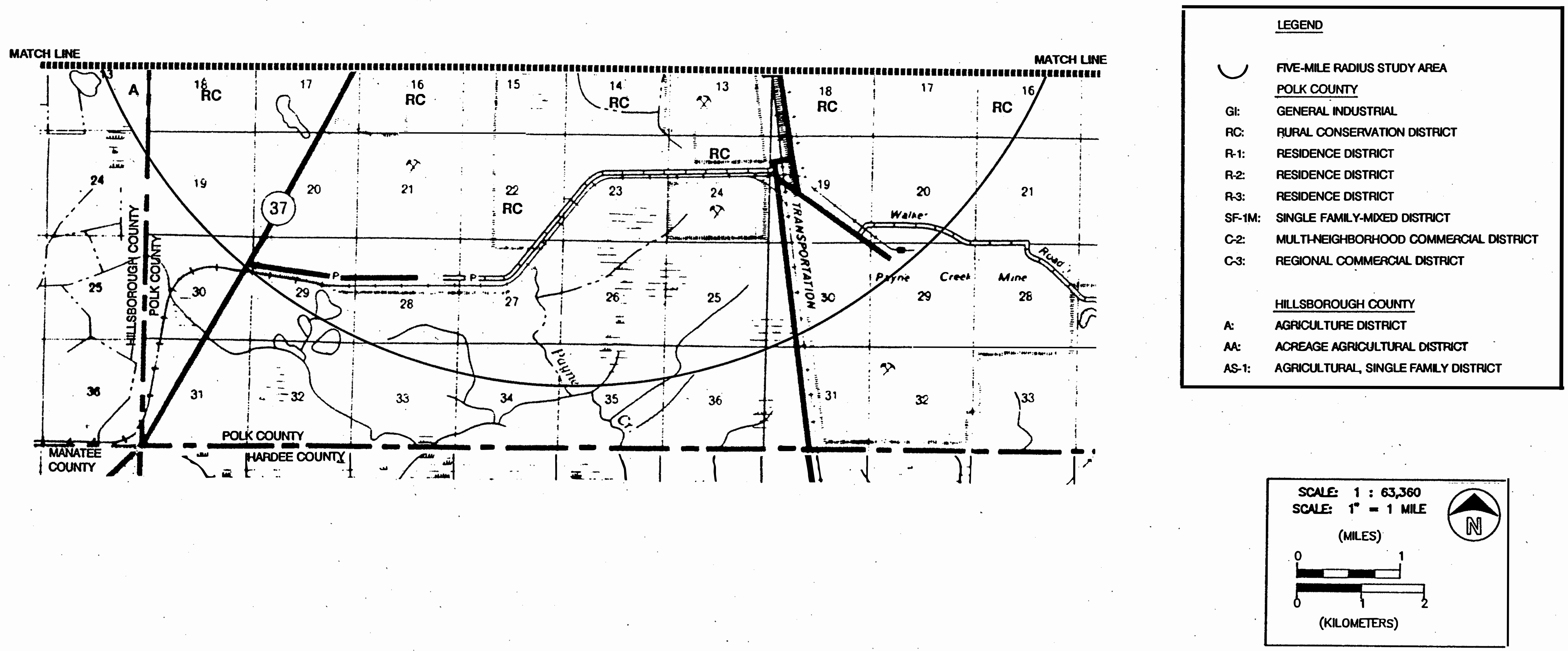

FIGURE 3.8.1-2. (2 of 3)
Zoning Districts within a Five-Mile Radius of the Polk Power Station Site.

SOURCES: Polk County, 1991; ECT, 1992; TEC, 1992a.

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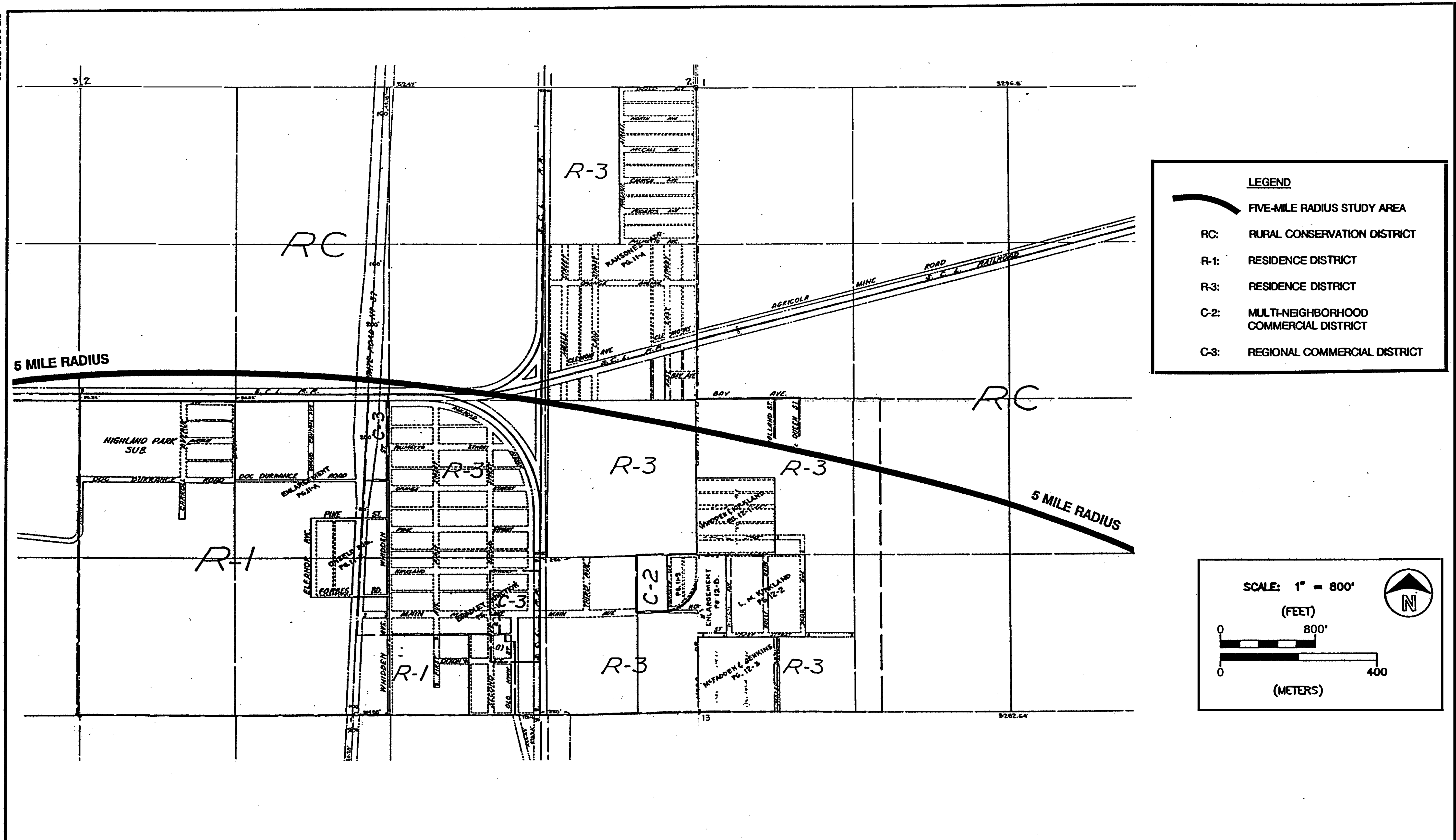

FIGURE 3.8.1-2. (3 of 3)
Zoning Districts within a Five-Mile Radius of the Polk Power Station Site.

SOURCES: Polk County, 1991; ECT, 1992; TEC, 1992a.

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abandoned commercial structure is located approximately 0.5 mile north of CR 630 east of SR 37. No schools or other sensitive institutional uses or structures are contained within this corridor.

As shown in Figure 3.8.1-3, the proposed northern transmission line corridor mainly crosses lands within the phosphate mining future land-use category, with a small area of Agricultural/Residential Rural (A/RR) located approximately 1 mile south of Bradley Junction. Within the 0.5-mile of the corridor, the Rural-Cluster Center (RCC) future land-use category is also encountered, corresponding to the unincorporated community of Bradley Junction.

Figure 3.8.1-4 shows zoning districts within 0.5 mile of the proposed northern transmission line corridor. FDEP guidelines require analysis of an area extending 0.5 mile from the edge of the corridor. The majority of lands within the northern transmission line corridor are zoned RC. The RC district was established to provide for low density residential development, agricultural and open space, and recreational uses. At the corridor's widest point southwest of Bradley Junction, the corridor crosses lands zoned Residence (R-1). This district was established to allow for the exclusive development of large homes on large lots. The northern transmission line corridor also crosses a small triangular tract of land zoned Single Family-Mixed (SF-1M) along the western edge of SR 37 approximately 1.5 miles south of Bradley Junction. The SF-1M district was established to provide for a mix of mobile homes and conventionally constructed homes in a low density setting.

The proposed northern transmission line corridor also crosses a small tract of commercially zoned land. A commercial tract within the proposed northern transmission line corridor located along the eastern edge of SR 37 and situated more than 0.5 mile north of CR 630 is zoned C-3. The C-3 district allows for commercial development. The parcel zoned as C-3 located within the corridor corresponds to an abandoned gasoline service station. The proposed on-site eastern transmission line corridor traverses primarily lands that were previously mined for phosphate ore. No residential, commercial, or institutional structures are located within this corridor.

The development of transmission lines associated with the proposed Polk Power Station are currently permitted uses according to the Polk County Comprehensive Plan and Zoning Ordinance. According to Policy 2.125-D1(b) of the Comprehensive Plan, electric transmission lines are permitted as specialized uses in all future land-use categories, in conjunction with the county approval of the CUP for the certified electric-power generating facilities. Electric transmission lines are defined as Class I Essential Services according to the Polk County Zoning Ordinance. Class I Essential Services are associated with the transmission systems of utilities. Class II Essential Services include lift stations, pumping stations, and booster stations, while Class III services include production generators, treatment, and similar facilities.

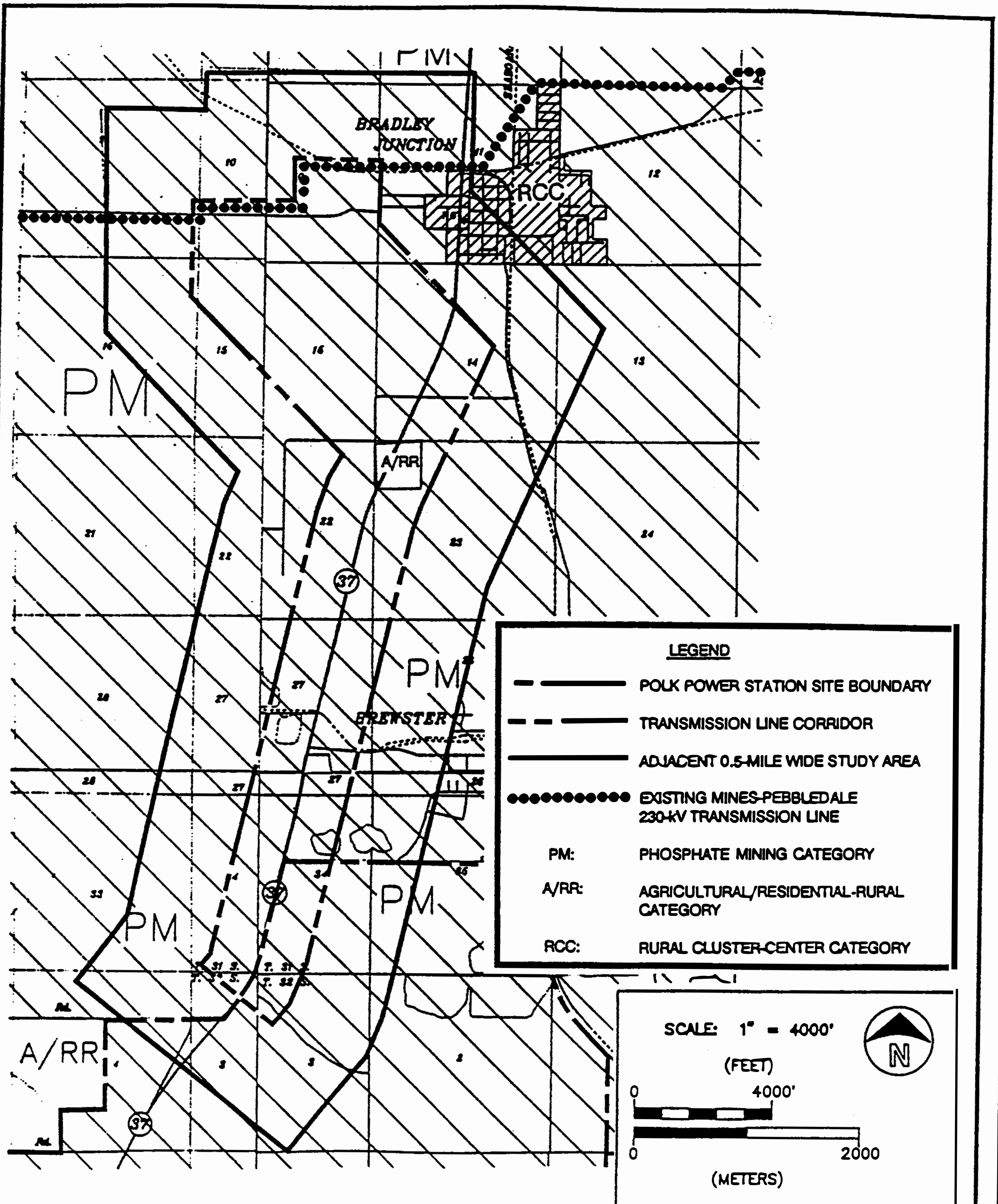

FIGURE 3.8.1-3.
Future Land Use Categories within 0.5 Mile of the Proposed Northern Transmission Line Corridor.

SOURCES: Polk County, 1991; ECT, 1992; TEC, 1992a.

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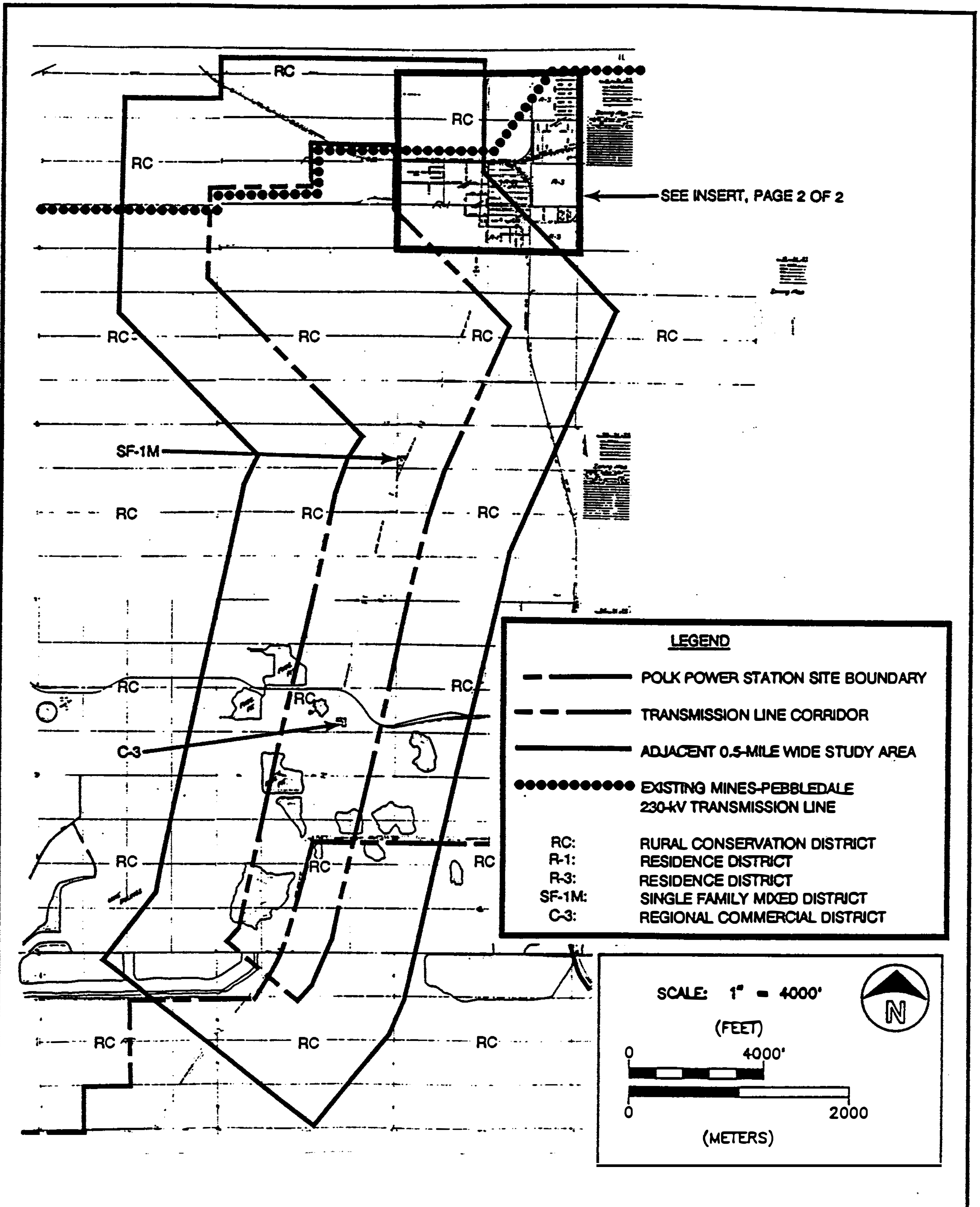

FIGURE 3.8.1-4. (1 of 2)
Zoning Districts within a 0.5 Mile Radius of the Proposed Northern Transmission Line Corridor.

SOURCES: Polk County, 1991; ECT, 1992; TEC, 1992a.

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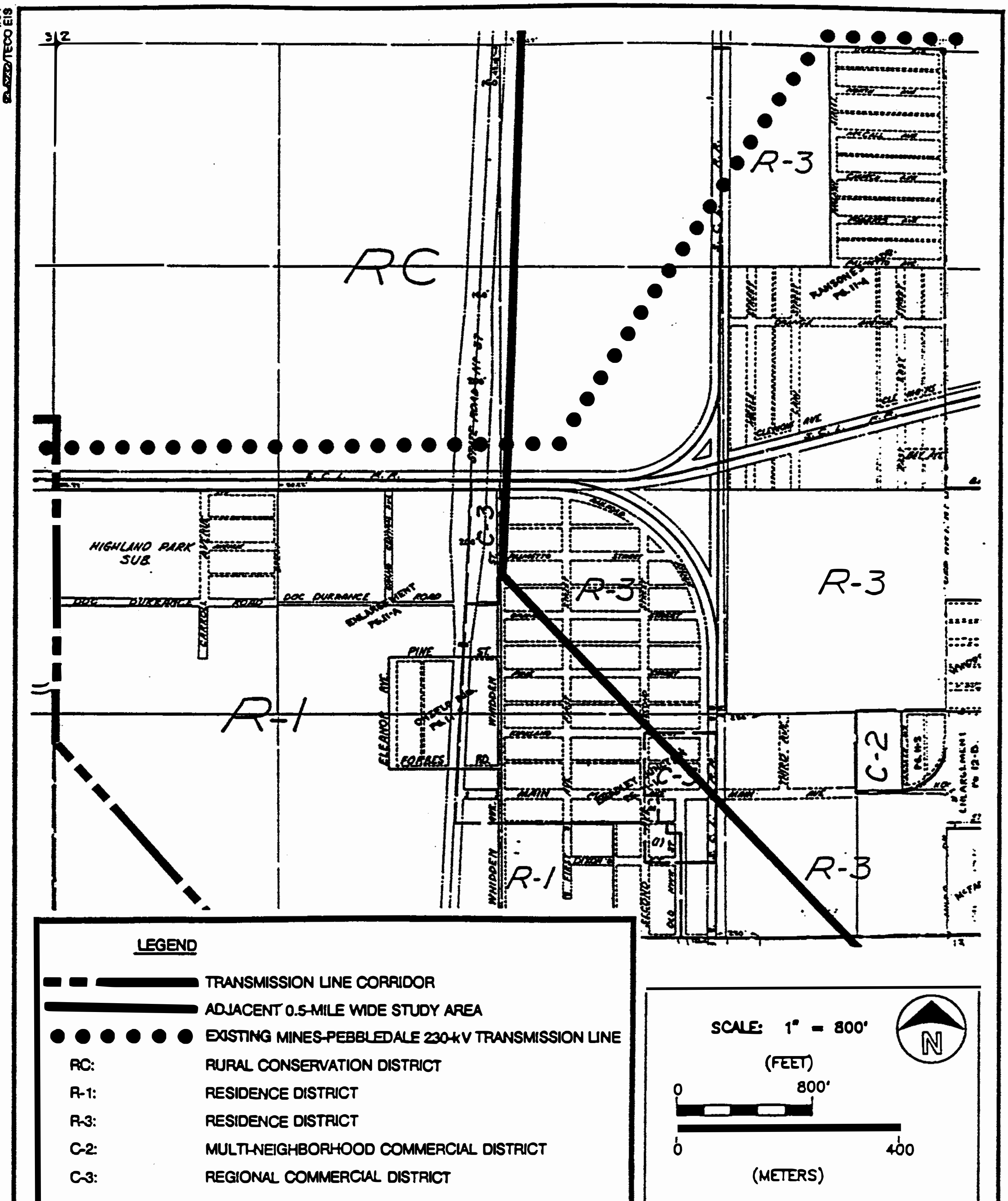

FIGURE 3.8.1-4. (2 of 2)
Zoning Districts within a 0.5 Mile Radius of the Proposed Northern Transmission Line Corridor.

SOURCES: Polk County, 1991; ECT, 1992; TEC, 1992a.

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Growth Management/Concurrency

The proposed Polk Power Station is required to satisfy requirements governing adequate public infrastructure as contained in the Polk County Concurrency Management Ordinance 92-10. As this project is subject to the PPSA, the concurrency determination will be approved as part of the SCA process.

State and Regional Plans

A discussion of the proposed Polk Power Station in relation to applicable state and regional plans is contained in Section 4.8.

3.8.2 Recreational Resources

No recreational areas, open space, or public lands are located adjacent to, or in the immediate vicinity of the proposed Polk Power Station site. The nearest recreational facility to the proposed Polk Power Station site is the Bradley Junction Recreational Park, located near the outer edge of the 5-mile radius primary study area. This 1.5-acre neighborhood park is located on Pine Street between Whidden and First Streets and contains a baseball/softball field, basketball court, and small playground.

3.8.3 Aesthetic Conditions

The aesthetic character of lands within the boundaries of and adjacent to the proposed Polk Power Station site are largely influenced by present and past mining operations. Because these lands have been previously disturbed by mining operations, there are virtually no areas of aesthetic or visual importance and significance.

Additionally, no federal, state, regional, or local scenic, cultural, or natural landmarks are contained within the 5-mile study area surrounding the proposed Polk Power Station site.

3.9 TRANSPORTATION FACILITIES CONDITION

Transportation facilities servicing the proposed Polk Power Station include roadways and rail. No public or private airport facilities are located within a 5-mile radius of the Polk Power Station site. Regional transportation facilities are shown on Figure 3.9-1 (TEC, 1992a).

Major roadways within a 5-mile radius of the proposed Polk Power Station site include SR 37, SR 674, and CR 630. Those within a 10-mile radius include CR 640, CR 39, and SR 62, while major roadways outside of a 10-mile radius include SR 60 (11 miles), U.S. Highway 17 (11 miles), U.S. Highway 98 (11 miles), Interstate 4 (21 miles), and Interstate 75 (24 miles) (TEC, 1992a).

The proposed Polk Power Station site is provided with direct rail access by the CSX Railroad via an existing north-south rail line adjacent to the east along Fort Green Road. Additional regional CSX rail lines traverse to the northwest from Bradley Junction through unincorporated Keysville in Hillsborough County through unincorporated Brandon west to Tampa and east from Brandon to northeast through Lakeland and Winter Haven (TEC, 1992a).

As previously stated, no public or private aviation facilities are located within a 5-mile radius of the proposed Polk Power Station site. The nearest private airports to the proposed Polk Power Station power block include the Circle K Airport, approximately 14.5 miles to the north, and the Anderson Airport, approximately 18 miles to the west along SR 674 in Hillsborough County. The closest public airports to the proposed Polk Power Station power block area include the Wauchula Airport, approximately 17.5 miles to the southeast, Lakeland Municipal Airport, approximately 18 miles to the north, and Bartow Municipal Airport, approximately 19.5 miles to the northeast. TIA lies more than 37 miles to the west-northwest (TEC, 1992a).

The proposed Polk Power Station site is bounded by SR 37 to the west, CR 630 to the north, SR 674/Wimauma Road to the south, and partially by Fort Green Road to the east. Figure 3.9-2 shows 1990 a.m./p.m. peak-hour traffic for major roads within the Traffic Impact Area. The Traffic Impact Area for the proposed facility is based on the draft Polk County Traffic Impact Methodology and Procedures, includes any roadway segment on the Concurrency Determination Network on which the project traffic consumes 5 percent or more of the peak hour LOS C FDOT generalized planning capacity (Lincks and Associates, 1992). SR 37 is a two-lane highway classified as a minor arterial which currently functions at LOS B from the Manatee County line to CR 640, based on 1990 traffic counts of 2,951 average annual daily trips (AADT) and 184 peak hour, peak direction trips. From CR 640 to Cameron Street in Mulberry, SR 37 currently functions at LOS C with 1990 volumes of 6,649 AADT and 416 peak hour, peak direction trips. CR 630 from SR 37 to U.S. Highway 98 is a two-lane highway functionally classified as a major collector currently functioning at LOS A with a 1990 AADT of 2,294 with 207 peak hour, peak direction trips. Fort Green Road/CR 663 is a two-lane highway classified as a minor collector currently functioning at LOS A, with a

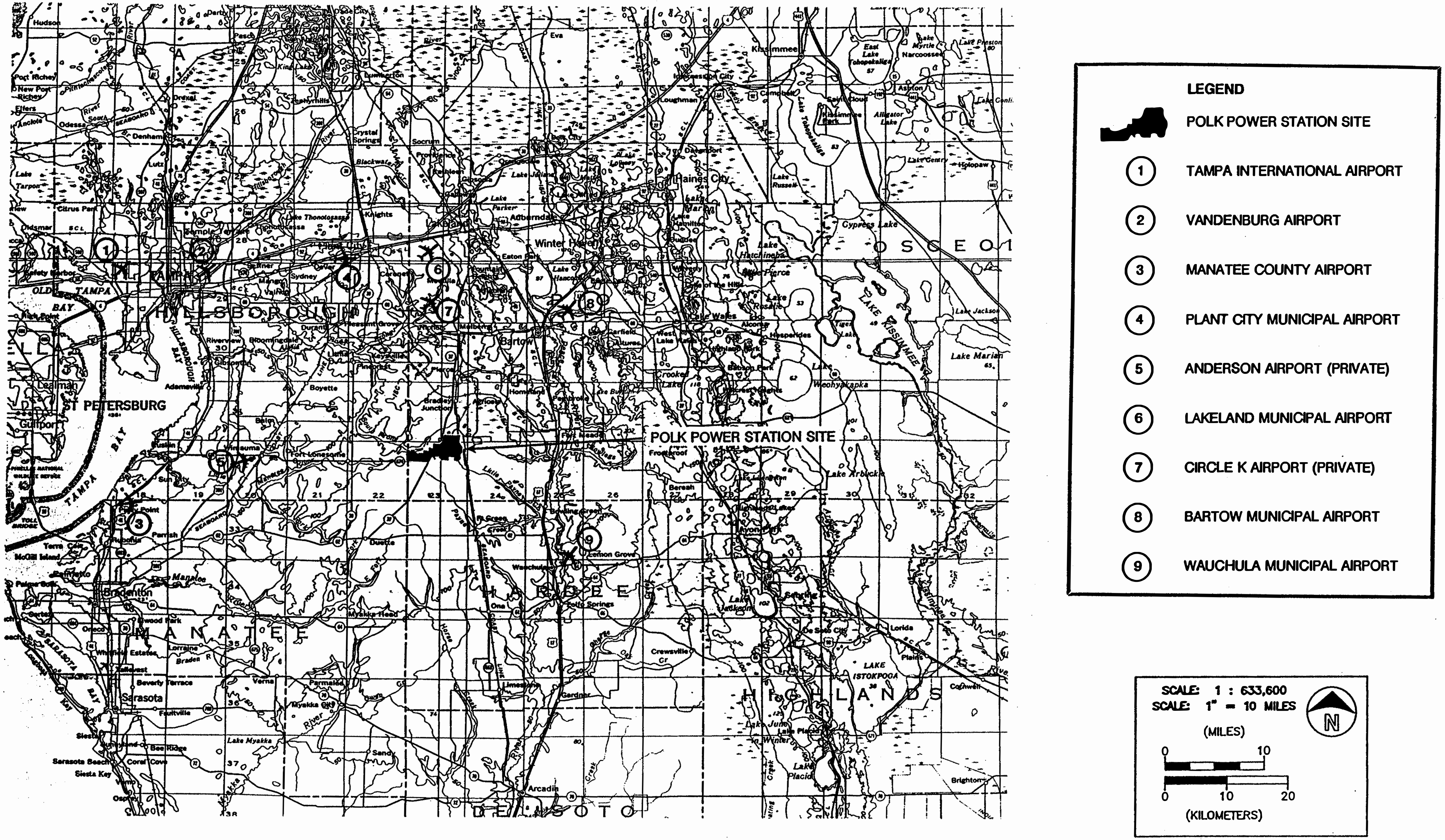

FIGURE 3.9-1.
Transportation Facilities.

SOURCES: ECT, 1992; TEC, 1992a.

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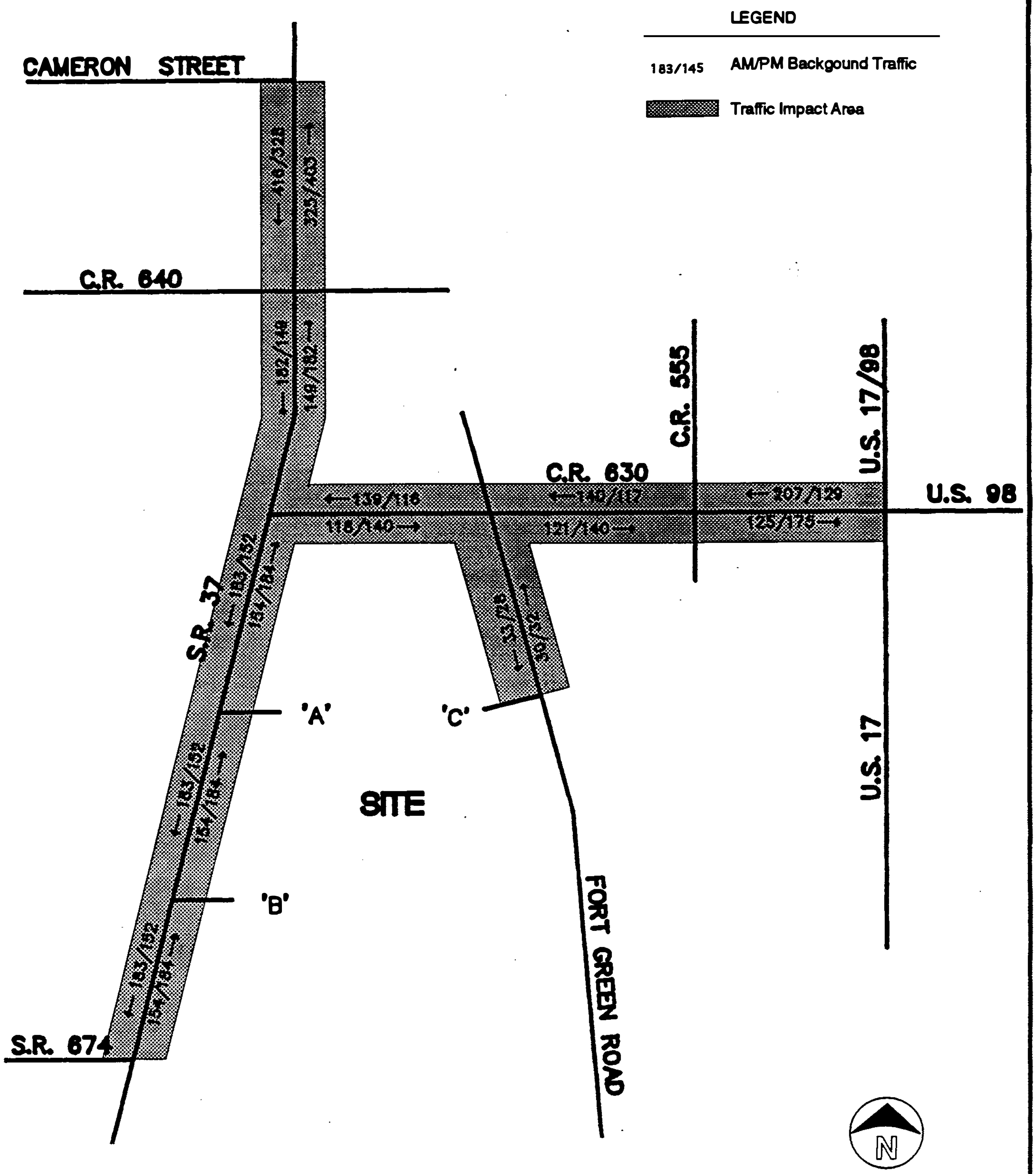

FIGURE 3.9-2.
AM/PM Background Traffic (Link Volumes).

SOURCES: Uncks, 1992; TEC 1992a.

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1990 AADT of 519 and 33 peak hour, peak direction trips. The county minimum LOS standard for rural arterial and collector roads is LOS D.

3.10 CULTURAL RESOURCE CONDITIONS

The presence and potential presence of artifacts and/or structures that are of a cultural or historical value must be identified prior to the construction of the proposed Polk Power Station. Correspondence, dated February 27, 1992, from SHPO of FDHR to Tampa Electric Company stated that one prehistoric site had been previously recorded in the project area. This site is not eligible for listing on the *National Register of Historic Places*, nor is considered significant at a regional or local level (see DEIS, Appendix Q).

By letter dated January 10, 1991, FDHR requested that a cultural resources assessment be conducted in Section 4 of Township 32 South, Range 23 East only (FDHR, 1991; TEC, 1992a). A cultural resources assessment was conducted by Tampa Electric Company in 1991 in accordance with Chapter 403 and 167, F.S., and FDHR guidelines (see DEIS, Appendix P). No archaeological or historic sites and no historical structures were discovered or recorded as part of this assessment. The assessment also indicated that no cultural resources eligible for nomination to the *National Register of Historic Places* would be affected by the proposed Polk Power Station project. FDHR concurred with the findings of the cultural resource assessment, and a copy of this confirmation letter is provided in the DEIS as Appendix Q.

EPA, as the federal Lead Agency for the development of this EIS, subsequently, by letter dated May 13, 1993, requested input for the proposed project from the FDHR pursuant to Section 106 of the National Historic Preservation Act. The request was for the site proposed by Tampa Electric Company in the SCA to the State of Florida and in this EIS. The FDHR response, dated June 1, 1992, stated that the FDHR has ". . .no concerns regarding historic properties at the site submitted for the Site Certification Application." However, the FDHR indicated that the location of project-related power line and natural gas line corridors would still need to be coordinated with the FDHR for potential effects to cultural resources. A copy of both letters are provided in Appendix B. Should a site other than the proposed site be selected and proposed, Tampa Electric Company would conduct a cultural resources assessment for that site as part of this EIS NEPA process if so advised by FDHR.

Tampa Electric Company proposes several linear facilities associated with the proposed Polk Power Station. These are the transmission lines, a natural gas pipeline, a railroad spur, and possibly a fuel oil pipeline. Tampa Electric Company coordination with FDHR regarding cultural resources would be needed for these alignments, which have not been determined or finalized with the exception of the railroad spur. Telephone coordination has occurred with FDHR during this EIS process for the off-site approximately 200-ft alignment proposed by Tampa Electric Company adjacent to the project site proposed by Tampa Electric Company. A telephone log dated October 4, 1993, is provided in Appendix B. FDHR may wish additional coordination for the off-site portion of this alignment.

In addition, Tampa Electric Company would need to coordinate with appropriate federal and state agencies regarding other environmental impact areas of concern along these alignments to specifically assess the affected environment and potential project impacts. This would include coordination with USACOE for jurisdictional wetlands and with FWS for endangered species. On December 23, 1993 during the EIS process, the FWS had already conducted an on-site review of the proposed site and the general proposed transmission line corridor and the off-site railroad spur. The review was specifically for the Florida scrub jay and the red-cockaded woodpecker. The USACOE has made a jurisdictional determination for wetlands that Tampa Electric Company proposes for filling at the proposed project site.

Conducted coordination and additionally needed coordination are discussed in more detail in Sections 2.3.12 and 6.3.

3.11 EXISTING NOISE CONDITIONS

All noise and sound data relate to the A-weighted sound level since this sound level is the closest to the range of human hearing. The A-weighted sound level is measured in decibel (dB) units and is expressed in various metric descriptors that average sound energy over given time periods. Noise conditions in the proposed Polk Power Station are given in decibels and expressed in the following common descriptors: (1) equivalent sound level for 24-hour periods ($L_{eq(24)}$) and (2) day-night average sound level (DNL). The former may be considered a time-weighted average of the sound energy present over 24 hours, while the latter considers the intrusiveness of nighttime noise by adding 10 dB to noise events occurring between 2200 hours and 0700 hours. While there are no federal, state, or local noise standards or ordinances applicable to the site preferred by Tampa Electric Company, existing conditions can be compared to the levels identified by EPA as protective noise levels in EPA report 550/9-74-004 ("Information on Levels of Environmental Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety"), which is generally known as the "Levels Document." These EPA protective levels are summarized in Table 3.11-1.

EPA, like all federal agencies, must comply with the Noise Control Act (NCA) of 1972. In addition, EPA is also responsible for the enforcement of the NCA and, pursuant to Section 309 of the CAA and Section 102(2)(C) of NEPA, has review authority for noise impacts in NEPA documents prepared by other federal agencies. Although funding for the EPA noise program is currently limited to an EPA headquarters office in Washington, D.C., EPA has recently enforced the NCA in a civil case regarding the inaccurate labeling of protective hearing devices (U.S. Department of Justice and EPA, 1993). Relevant to airport noise impacts, EPA is also part of the Federal Interagency Committee on Noise (FICON) that was organized to review federal policies regarding the noise impact assessments of airports, which typically generate substantial noise impacts surrounding inhabited areas. With respect to noise impact assessment, FICON (1992) has recommended criteria for airport analyses, which, although specified for airport noise, are also reasonably applicable to any project that causes an increase in environmental noise. When generalized for such projects instead of airports, the following may be noted:

> If screening analysis shows that noise-sensitive areas will be at or above DNL 65 dB and will have an increase of DNL 1.5 dB or more, further analysis should be conducted of noise-sensitive areas between DNL 60-65 dB having an increase of DNL 3 dB or more due to the proposed... [project]...noise exposure.

Detailed background information on noise entitled "Sound Basics" may be found in Appendix B of FICON (1992). Additional background noise information entitled "Basics of Sound and Noise" is provided in the DEIS as Appendix V. This airport noise information was edited by EPA in order to make it more useful for the proposed and similar projects.

Table 3.11-1. Summary of Noise Levels Identified by EPA as Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety

Effect	Level	Area
Hearing Loss	$L_{eq(24)}$ = 70 dB*	All areas
Outdoor activity interference and annoyance	DNL = 55 dB	Outdoors in residential areas where people spend widely varying amounts of time and other places in which quiet is a basis for use.
	$L_{eq(24)}$ = 55 dB	Outdoor areas where people spend limited amounts of time, such as school yards, playgrounds, etc.
Indoor activity interference and annoyance	DNL = 45 dB	Indoor residential areas
	$L_{eq(24)}$ = 45 dB	Indoor areas with human activities such as schools, etc.

* Based on annual averages of the daily level over a period of 40 years.

Sources: EPA, 1974; TEC, 1992a

EPA believes that actual noise levels, incremental increases and single-event (intermittent peak) levels are important in characterizing and documenting project noise impacts. In general, noise levels of 55 dB or less at project property lines represent a useful target for the protection of the affected human environment. EPA also believes that any noise increase produced by a project may result in a noise impact and that a 10 dB or greater increase is considered a substantial increase. Also, intrusive single-event noise levels (e.g., train whistles, pile driver, etc.) should be documented to supplement the cumulative noise level using metrics (e.g., DNL and L_{eq}), which essentially average noise contributions over a given period of time. EPA also encourages noise avoidance through proper site selection planning and mitigation for unavoidable noise impacts.

Mitigative actions that will be considered, as needed, include:

- Source reduction
- Noise source or receptor insulation
- Public announcement prior to known significant noise events
- Dense evergreen vegetation
- Barrier construction
- Realignments
- Residential displacement compensation (i.e., buy-outs)

In the assessment of noise impacts, several fundamental principles may be noted:

- Noise levels from two or more noise sources are not directly additive. For example, two sources producing noise levels that are equal or differing by 1 dB or less would increase the noise level by 3 dB, while two sources producing noise levels that differ by 10 dB or more would result in an increase of only 1 dB or less.
- A 10 dB noise level increase is perceived by the human ear as a doubling of loudness.
- Increasing the distance from a noise source will generally attenuate the noise level by 6 dB for each distance increase by a factor of two (doubling).
- Earthen berms, noise walls and vegetation located between the noise source and the receptor will attenuate noise by varying amounts. Of these, vegetative barriers do not attenuate as well since 200 ft of dense vegetation would be needed to attenuate noise levels by 10 dB (Federal Highway Administration [FHWA], 1980a).
- In considering environmental noise, it is necessary to distinguish between noise "exposure" and noise "impact". Noise "exposure" is described by metrics such as the single-event metrics, (i.e., L_{max} [maximum level]), SEL (sound exposure level), and the cumulative exposure metrics such as DNL and L_{eq} in dB units. Noise "impact" is the measure of the

adverse effect of noise on sensitive receptors (people in residences, schools, churches, etc.) and depends on the number of sensitive receptors exposed to the noise. For example, the most general metric for noise impact is the percentage of exposed people who are "highly annoyed (%HA) as determined from the "Schultz curve." The Schultz curve shows that, at DNL 65 dB, about 14 percent of the exposed people are highly annoyed (%HA=14). Therefore, if 100 people are exposed to 65 DNL dB and if these are the only people exposed to noise from a project, then the noise impact may properly be described as "14 persons Highly Annoyed."

- When comparing DNL to L_{eq}, it should be noted that higher DNL values (compared to $L_{eq(24)}$ values), would imply higher noise levels at night. For example if the nighttime levels were equal to the daytime levels, the DNL would be 4 dB higher than the $L_{eq(24)}$. If DNL exceeds $L_{eq(24)}$ by more than 4 dB, the nighttime level must be higher than the daytime level.
- Intermittent noise from a source having the same average noise level as a continuous noise level from another source will typically be perceived as more intrusive than the continuous noise. Therefore DNL sound levels for an airport having intermittent fly over noise may be perceived as more annoying than the more continuous noise at the same cumulative sound level of an operating power plant.

In addition to these EPA "identified" protective noise levels and fundamental noise principles, the U.S. Department of Housing and Urban Development (HUD) has established a set of guidelines for noise levels that provide minimum standards to protect citizens against excessive noise in their communities and residential areas. Three categories of acceptability have been defined: acceptable if the DNL is less than 65 dB, normally unacceptable if the DNL is greater than 65 dB and less than 75 dB, and unacceptable if the DNL is greater than 75 dB (HUD, 1979). These noise levels are to be based on noise from all sources, including highway, railroad, and construction-related activities. Some common sound levels and human responses are noted in Table 3.11-2 (Salvado, 1992).

To characterize the existing noise environment, a noise monitoring program was conducted by Tampa Electric Company (TEC, 1992a) for the proposed Polk Power Station site during the period of June 8 through 12, 1991. The locations of the four monitoring stations (NS-1, NS-2, NS-3 and NS-4) are shown in Figure 3.11-1. These monitoring stations were used to establish a site ambient noise baseline for noise modeling of the proposed Polk Power Station. The station locations were determined by the location of noise-sensitive receptors. In this case, the noise-sensitive receptors were identified as Residential Areas 1, 2, and 3 located in the vicinity of the proposed Polk Power Station site (Figure 3.11-1). The following table provides the approximate distances between each residential area and the power block center.

Table 3.11-2. Sound Levels and Human Responses

	Noise Level (dB)	Response	Conversational Relationships
	150		
Carrier Deck, Jet Operation	140		
		Painfully loud	
	130	Limit Amplified Speech	
Jet Takeoff (200 ft)	120	Maximum Vocal Effect	
Discotheque			
Auto Horn (3 ft)			
Riveting Machine	110		
Jet Takeoff (2,000 ft)			
Garbage Truck	100		Shouting in Ear
New York Subway Station		Very Annoying	
Heavy Truck (50 ft)	90	Hearing Damage (8 hr/day for 40 years)	Shouting at 2 ft
Pneumatic Drill (50 ft)			
Alarm Clock	80	Annoying	Very Loud Conversation 2 ft
Freight Train (50 ft) at 20 mph			
Freeway Traffic (50 ft)	70	Telephone Use Difficult	Loud Conversation, 2 ft-- Possible contribution to hearing impairment begins
Air-Conditioning Unit (20 ft)	60	Intrusive	Loud Conversation, 4 ft
Light Auto Traffic (100 ft)	50	Quiet	Normal Conversation, 12 ft
Living Room			
Bedroom	40		
Soft Whisper (15 ft)	30	Very Quiet	
Broadcasting Studio	20		
	10	Just Audible	
	0	Threshold of Hearing	

Sources: Modified from: Sound Levels and Human Responses, Office of Planning Management, USEPA, July 1973; Salvado, 1982; TEC, 1992a.

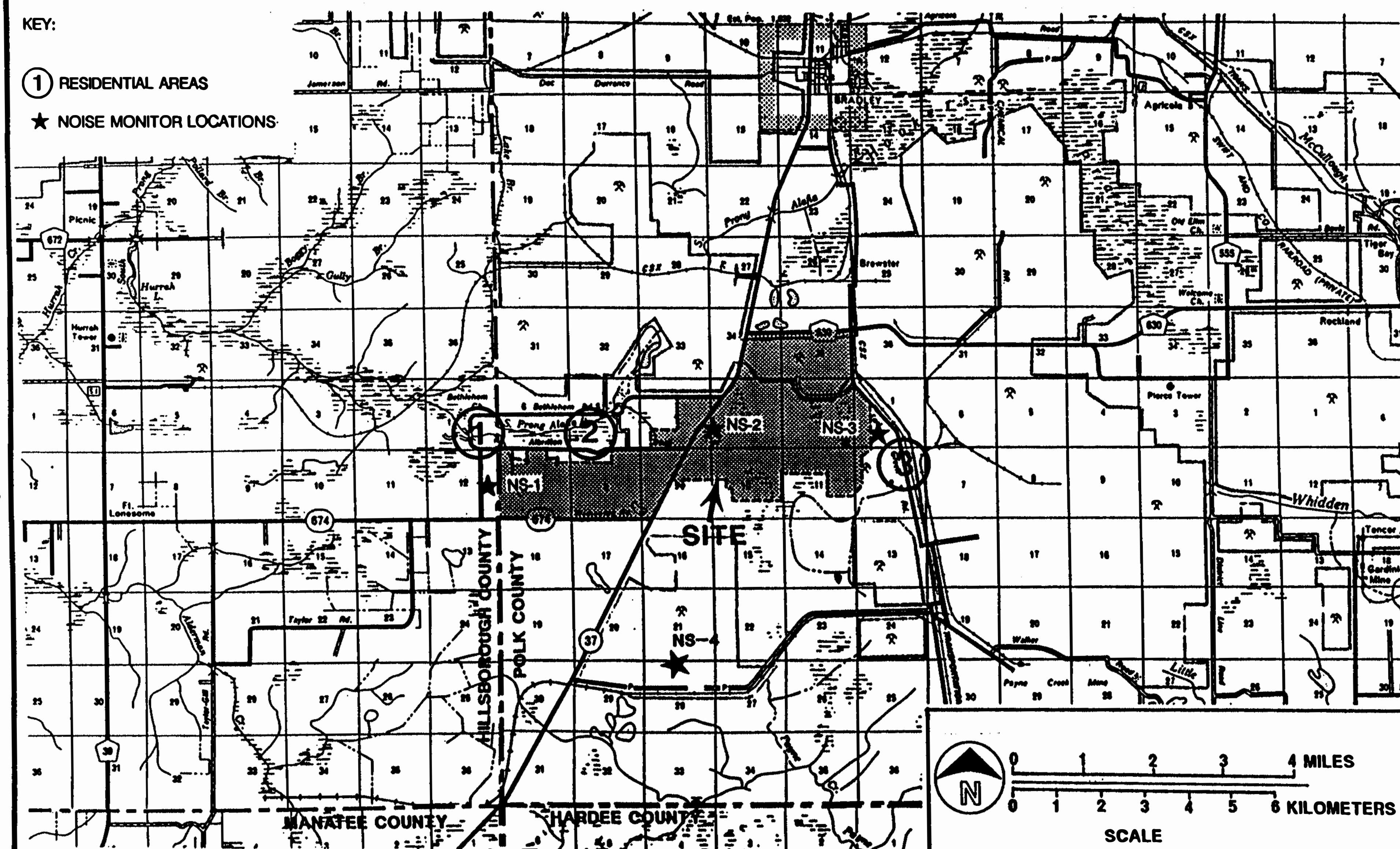

FIGURE 3.11-1.
Locations of Residential Areas (1, 2, and 3) and Noise Monitoring Stations (NS-1, NS-2, and NS-3).

SOURCES: ECT, 1992; TEC, 1992a.

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	Distance to Power Block Center			
Residential Area	Feet	Miles	Number of Residences	Estimated No. of Persons*
1	22,250	4.2	53	134
2	10,125	1.9	45	113
3	8,250	1.6	1	2-3

* Based on an average of 2.52 people per residence (BEBR, 1992a)

Monitoring Station NS-3 was located near Residential Area 3 and approximately 0.25 mile west of the railroad passing east of the site. Monitoring Station NS-4 was located at the Agrico Fort Green Mine located south of the site, to develop a thorough description of noise levels in the area. Other land uses in the study area outside of the proposed Polk Power Station site include citrus groves, recently mined areas, older mined areas, and reclaimed and unreclaimed areas. Primary sources of industrial noise in the area include dragline operations and the Agrico Fort Green Mine. Traffic on SR 37, Fort Green Road and the CSX Railroad are major sources of noise in this area. General aviation and commercial aircraft also impact the entire study area (TEC, 1992a).

Table 3.11-3 lists the averaged hourly noise measurements ($L_{eq(1)}$) observed during the June 1991 program. The highest $L_{eq(24)}$ (56 dB) was observed at the Agrico Fort Green area (Station NS-4). The influence of automobile traffic on SR 37 was observed at Station NS-2 where the $L_{eq(24)}$ (55 dB) was slightly lower than at Station NS-4. The Station NS-1 area, located in an orange grove, had the lowest $L_{eq(24)}$ (50 dB) value despite the constant operations of the dragline approximately 0.25 mile from the site. Station NS-3 was exposed to some automobile traffic on Fort Green Road, train traffic on the CSX Railroad, and activities in the citrus groves.

Data sheets from Tampa Electric Company with descriptions of noise events at the monitoring sites collected during the noise monitoring program are provided in Appendix 11.12 of the SCA (TEC, 1992a).

Table 3.11-3. Ambient Noise Survey Data Hourly Equivalent Sound Level (dB)

Hour of Day	$L_{eq(1)}$ Sound Levels at Monitoring Stations With Start Date			
	NS-1 06/08/91	NS-2 06/08/91	NS-3 06/09/91	NS-4 06/09/91
1000	--	55.0	--	--
1100	--	56.2	45.0	--
1200	49.9	53.8	43.1	--
1300	49.5	54.1	44.7	56.2
1400	48.1	52.8	45.1	53.3
1500	49.4	55.6	41.5	55.0
1600	50.4	54.4	41.4	53.5
1700	51.6	55.6	42.9	53.4
1800	51.6	55.5	42.7	53.8
1900	50.9	56.0	47.7	54.2
2000	49.3	56.9	44.2	55.8
2100	52.1	56.9	48.6	58.2
2200	52.3	57.3	60.1*	57.1
2300	51.6	55.8	48.9	58.2
2400	50.9	53.7	48.6	57.4
0100	51.8	54.2	49.4	56.2
0200	51.4	55.1	46.2	56.8
0300	51.2	52.6	51.2	54.1
0400	50.3	48.7	52.9	53.9
0500	48.8	50.6	48.3	53.2
0600	50.4	58.5	48.3	53.5
0700	48.3	56.0	50.7	58.2
0800	49.3	56.8	43.7	55.5
0900	49.5	57.1	59.9*	54.1
1000	47.8	--	55.4	56.3
1100	48.8	--	--	55.3
1200	--	--	--	55.6
$L_{eq(24)}$	50.4	55.4	51.7	55.7

Note: The symbol -- indicates no monitoring data collected.

* NS-3 is located near a railroad and high levels of noise at 2200 hours and 0900 hours are thought to result from passage of trains.

Sources: ECT, 1992; TEC, 1992a.

3.12 HUMAN HEALTH CONDITIONS

Statistics on the causes of mortality are maintained for Florida and by county by the Florida Department of Health and Rehabilitative Services (HRS). Table 3.12-1 presents the resident death rates in 1990 for selected causes in Florida, Polk County, and counties in the vicinity of the proposed Polk Power Station site. These mortality data indicate that death rates for all causes and for the selected causes in Polk County are similar to those for the State of Florida. The primary reason for the similarity in these death rates appears to be that the age distribution of the resident population in Polk County and the state as a whole are also similar. As shown in Table 3.12-1, the five leading causes of death in Polk County and Florida are heart disease, cancer, stroke, chronic obstructive lung disease, and accidents (including motor vehicle accidents) (TEC, 1992a).

Resident death rates for all causes in Hillsborough and Hardee Counties are generally lower than the rates in Polk County and the state. The lower rates in these counties are expected since the overall resident population in Hillsborough and Hardee Counties is younger than that of the state as a whole. As shown in Table 3.12-1, the leading causes of death in Hillsborough and Hardee Counties are the same as in Florida and Polk County, except that the death rates for accidents (including motor vehicle accidents) in Hardee County are significantly higher than the accident rates in the other areas (TEC, 1992a).

Resident death rates in Manatee County for all causes are significantly higher than those for the state and the other counties. These higher rates are primarily due to the fact that a higher percentage of Manatee County's resident population is in older age groups compared to the state and the other counties (TEC, 1992a).

Table 3.12-1. Resident Death Rates Per 100,000 Population for Selected Causes in Florida and Polk, Hillsborough, Hardee, and Manatee Counties, 1990

Cause	Florida	Polk County	Hills-borough County	Hardee County	Manatee County
Heart disease	343.4	348.7	257.4	284.8	539.3
Cancer	253.5	236.9	209.0	181.3	336.7
Stroke	63.8	61.8	49.5	25.9	81.1
Chronic obstructive lung disease	42.8	45.1	41.6	25.9	67.0
All accidents	38.7	43.9	38.2	60.5	36.3
Motor vehicle accidents	21.5	27.1	24.4	43.2	19.7
Pneumonia and influenza	26.3	24.5	25.1	21.6	31.8
Diabetes	22.3	27.8	21.3	17.3	26.2
Human immunodeficiency virus (HIV)	16.9	7.8	15.8	12.9	8.1
Suicide	15.7	13.2	12.9	21.6	16.1
Chronic liver disease and cirrhosis	12.8	13.7	10.9	12.9	18.6
Homicide	12.0	11.1	12.4	21.6	10.1
Aortic aneurysm	8.6	10.6	4.4	4.3	12.1
Atherosclerosis	8.5	8.0	6.3	0.0	9.1
Perinatal conditions	7.0	5.7	8.8	0.0	7.6
ALL CAUSES	1,010.0	1,010.0	830.0	820.0	1,390.0

Sources: Florida Department of Health and Rehabilitative Services, 1991; TEC, 1992a.

CHAPTER 4.0

Environmental Consequences of the Alternatives

4.0 ENVIRONMENTAL CONSEQUENCES OF THE ALTERNATIVES

The environmental consequences of the proposed project are addressed in this chapter. As previously indicated (see summary in Section 2.3.13), project design modifications and improvements proposed by Tampa Electric Company for the preferred alternative, i.e., Tampa Electric Company's proposed project (Preferred Alternative With DOE Financial Assistance), occurred during the EIS process. Relevant design aspects not documented in the published DEIS are incorporated in this FEIS. The preferred alternative documented in this FEIS essentially constitutes Tampa Electric Company's final design proposal, although this remains a somewhat ongoing and dynamic process. The design modifications have resulted in overall design improvements, cost reductions, and general environmental impact reductions.

The most significant design changes relative to environmental impacts are the proposed use of coal silos instead of an on-site coal pile and the increases in size and hours of operation of the auxiliary boiler. Other changes may have engineering significance but are considered minor with regard to project environmental impacts.

The shift from an on-site coal pile to the use of coal storage silos is predicted to result in the following changes in environmental impacts:

- Reduction of over 30 acres in the area needed for power plant facilities
- Elimination of leachate materials (particularly metals) from the coal pile in the wastewater system and in the water and sludge produced by this system
- Reduction in anticipated fugitive dust generation and associated particulate matter impacts on air quality
- Use of Tampa Electric Company's nearby Big Bend plant for coal storage beyond the on-site coal storage silos

The increases in size and operating hours for the auxiliary boiler are predicted to result in the following change in environmental impacts:

- Slight increases (0.3 percent and 1.2 percent, respectively) in ambient air quality impacts from sulfur dioxide and nitrogen oxides
- Slight increase (1.3 percent and 1.0 percent, respectively) in ambient air quality impacts from CO and PM
- Required monitoring of continuous NO_x and opacity on auxiliary boiler emissions

All of the other changes are predicted to have minor influences upon the environmental impacts of Tampa Electric Company's proposal. The cumulative effects of these other changes are as follows:

- The storm water management plan has changed slightly due to deletion of a small detention basin and minor changes in drainage area caused by other changes in layout
- The land needed to be developed has been reduced slightly (about 30 acres)
- The generation of contaminated wastewater has been additionally reduced
- Changes in stack locations, number of stacks, and building dimensions have resulted in minor changes in air quality impacts (see Table 2.3.2-2)

Although instances of increases in individual environmental impacts due to design changes exist, the design changes are not predicted to result in environmental compliance changes, i.e., aspects of the proposed Polk Power Station did not come out of or into compliance since the DEIS stage due to the proposed design modifications and improvements. However, FDEP may choose to modify the PSD permit for Polk Unit 1 (see Final PSD Determination in Appendix D) due to certain air quality impact changes, such as an increase in the number of plant emission stacks. Also, the use of Tampa Electric Company's nearby Big Bend plant for coal pile storage beyond the on-site silos would not require a facility modification but would require an FDEP permit modification, which was pursued by Tampa Electric Company. The permit modification was approved by FDEP on March 31, 1994.

4.1 AIR QUALITY IMPACTS

Under the CAA, PSD air pollution permits are required for new major stationary emission sources before commencing construction. A new emission source is considered major if it has the potential to emit any pollutant regulated under the CAA in amounts equal to or exceeding specified major thresholds (100 or 250 tpy) for the source's industrial category. Since the proposed Polk Power Station's generating facilities would have the potential to emit more than 250 tpy of one or more regulated pollutants in an attainment area, application for a PSD permit is required. An applicant for a PSD permit is required to conduct air quality analyses of ambient impacts associated with the construction and operation of the proposed stationary source or modifications. The primary objective of this analysis is to demonstrate that the source's predicted emissions, in conjunction with applicable emissions from existing sources, will not result in, or contribute to, any violation of the National or Florida AAQS or the allowable PSD increments. Noncriteria pollutant impacts must also be evaluated. The Polk Power Station will also emit pollutants addressed in the air toxics review strategy from FDEP, so emissions from the proposed facility also must be compared to state-established No-Threat Levels. The air quality impacts resulting from the construction and operation of the proposed Polk Power Station, as described in detail in the PSD application in Volume IV of the SCA submitted to the State of Florida in July 1992, are discussed in this section.

In this EIS, the National AAQS (or NAAQS) and the State of Florida AAQS are jointly referred to as AAQS. For the six criteria pollutants regulated under both of these standards, the Florida AAQS are equivalent or more stringent than the NAAQS.

Information concerning the emissions and the air pollution control equipment that would be used is contained in Section 2.3.5 of this document.

4.1.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

Tampa Electric Company has determined the need for 1,150 MW in additional resources in order to meet customer needs into the 21st century. Based on this forecasted growth in demand, the proposed Polk Power Station was developed. Facility details are outlined in Section 2.3 of this document.

4.1.1.1 Construction-Related Impacts

During construction, three kinds of activities are most likely to generate air emission of pollutants: (1) land clearing, site preparation, and vehicle movement; (2) open burning of cleared land debris; and (3) the use of internal combustion engines. The quantity of any pollutant released during the construction process generally would be low and would vary on an hourly and daily basis as construction progresses. The initial construction phase would last approximately 27 months. On a much smaller scale than in the initial phase, additional construction activities would periodically occur on the site for the future generating units beginning in 1998 through 2009.

Fugitive dust emissions will be greatest during the land clearing, site preparation, and active construction periods because large land-clearing equipment and several construction material delivery vehicles would cause increased vehicle traffic on the site. Open burning would result in emissions of PM, CO, NO_x, and hydrocarbons. This activity would be conducted for short periods at a time. The land clearing and construction debris generally would consist of wood products and other relatively clean-burning materials. Emissions would depend upon the amount and moisture content of the debris. Emissions of NO_x, CO, and other compounds from internal combustion engines would occur during site preparation and facility construction due to the use of equipment for site excavation and grading, concrete placement, and major equipment installations. Many units of heavy equipment may be on site during the 27-month construction period.

Potential minor sources of VOC include evaporative losses from on-site painting, refueling of construction equipment, and the application of adhesives and waterproofing chemicals. The emission of VOCs due to construction is expected to be small and would have no significant long-term impacts on the ambient air quality of the area.

The degree of air quality impacts caused by construction activities would depend on the intensity and the nature of the activity, the weather conditions while the activity is occurring, and emission control measures applied to the activity. However, even under extreme conditions, the emissions would be expected to affect air quality only slightly, while staying well below the applicable AAQS. Accordingly, the air impacts to the area due to construction would not be significant.

4.1.1.2 Operation-Related Impacts

Tampa Electric Company conducted a detailed air quality assessment of potential operational impacts of the proposed Polk Power Station for comparison with applicable AAQS and PSD increments. The assessment involved computer modeling analyses under EPA and FDEP guidance. The approach and techniques utilized in the modeling analyses were described in detail in the PSD permit application in Volume 4 of the SCA (TEC, 1992a). The following sections summarize the approach and findings described in the SCA.

Emission Sources

Polk Power Station would consist of several different types of generating units phased-in over a period of several years (Table 1.2.2-1). An advanced CT will be combined with an HRSG, ST, and CG facilities to create an overall 260-MW IGCC unit (Polk Unit 1). The Polk Unit 1 will operate at up to a 100-percent capacity factor on syngas with the backup option of operating at a 10-percent capacity factor on fuel oil. For the first two years of IGCC operation (the demonstration period), a CGCU system capable of full flow in parallel with an HGCU system capable of 10 to 15 percent flow will be in operation to provide the clean syngas for the CT. The primary air emission source from Polk Unit 1 is the advanced CT unit (GE 7F).

At full build-out, four 75-MW CTs capable of running in single-cycle or CC modes and configured as two 220-MW CCs would be added. These units would operate at up to a 100-percent capacity factor on natural gas and up to a 25-percent capacity factor on backup fuel oil. Six simple-cycle 75-MW CTs operating at up to a 50-percent capacity factor on natural gas, and up to a 10-percent capacity factor on backup fuel oil, would also be added. Other combustion sources include an oil-fired auxiliary boiler, a flare, and a thermal oxidizer associated with the HGCU system.

Apart from the combustion sources mentioned above, there would also be process and fugitive emissions from the following systems and operations:

- Coal handling and receiving
- Coal grinding and slurry preparation
- Air separation unit
- Gasification and syngas scrubbing and cooling systems
- Acid gas removal unit
- HGCU system
- H_2SO_4 plant
- Slag handling and storage
- Power production

Air Quality Impact Analyses

The goal of the air quality analysis portion of the PSD application is to demonstrate compliance with AAQS and allowable PSD increments. Figure 4.1.1-1 outlines the basic steps in air quality analyses. Dispersion models are the primary tools used in the air quality analysis. Dispersion modeling analysis involves two distinct phases: (1) a preliminary analysis and (2) a full-impact analysis. During the preliminary analysis, only potential emissions from the proposed new source are modeled. If the modeled ambient impacts of the preliminary analysis are above federally-established Air Quality Significance Levels, a full-impact analysis is required. The full-impact analysis involves modeling the emissions from the proposed facility as well as the emissions from existing and planned sources. EPA does not require a full-impact analysis for a particular pollutant if emissions of that pollutant would not cause a modeled ambient impact which exceeds the established significance level. The following sections summarize: (1) air quality analysis to demonstrate compliance with AAQS, and (2) air quality analysis to demonstrate compliance with PSD increments. All references to modeling of the proposed facility in the subsequent sections correspond to the full build-out (1,150-MW) scenario.

Ambient Air Quality Standards

General Methodology--Ambient air monitoring for a period of up to one year is required for any air pollutant that the facility proposes to emit in significant amounts. However, Florida and EPA regulations provide an exemption that excludes the monitoring requirement with respect to a particular pollutant if the ambient concentration of that pollutant is less than established *de minimis* levels.

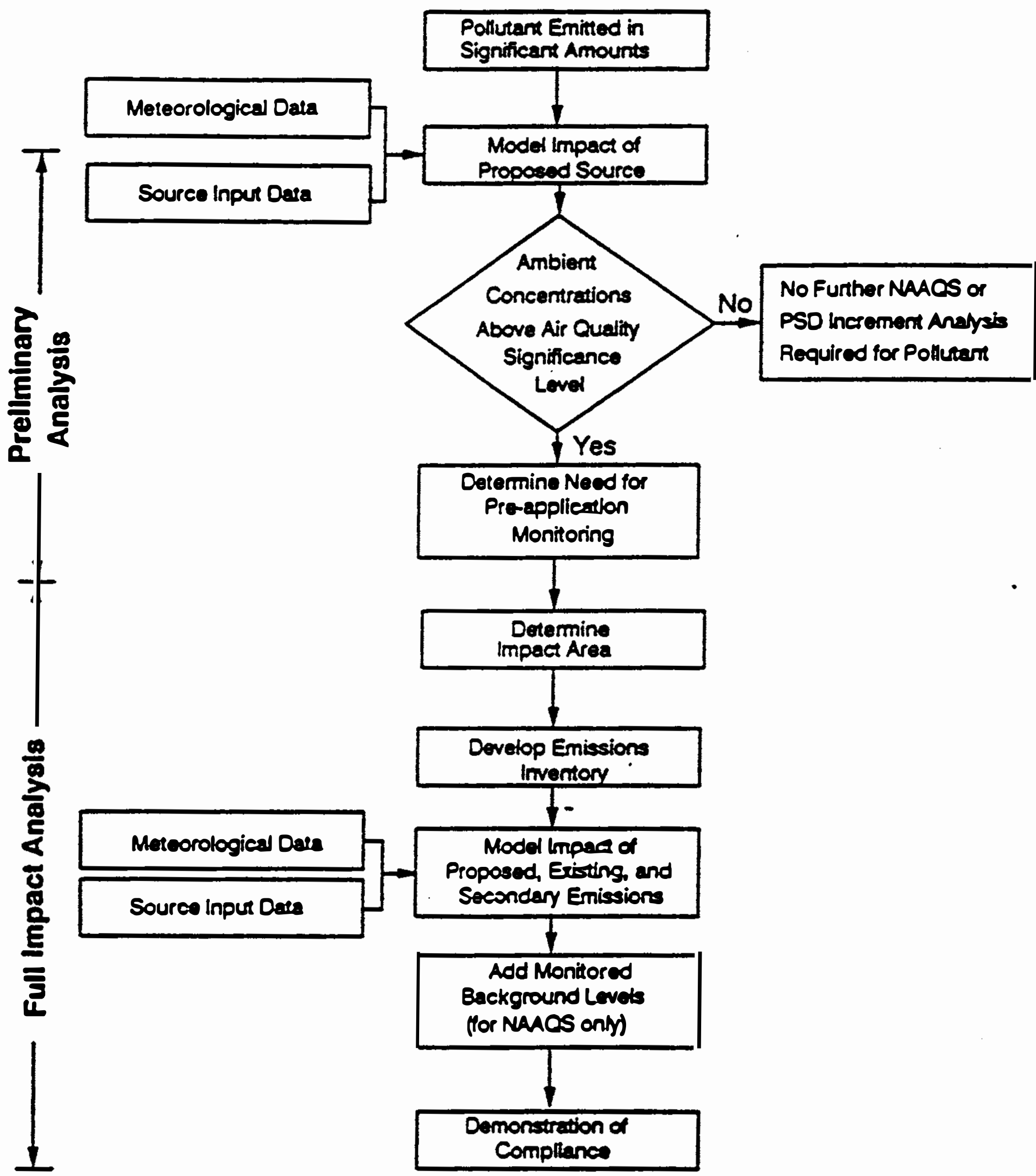

FIGURE 4.1.1-1.
Basic Steps in the Air Quality Analysis (NAAQS and PDS Increments).

SOURCE: EPA, 1990a.

U.S. Environmental Protection Agency, Region IV

Environmental Impact Statement

Polk Power Station
Polk County, Florida

Dispersion modeling was performed to determine the appropriate monitoring exemptions for the proposed project. The highest projected facility impacts at build-out were then compared to the *de minimis* levels. For those pollutants that did not meet the air monitoring exemption criteria (SO_2, PM, O_3), an FDEP-approved monitoring plan was implemented to establish background air quality concentrations. These background levels were then used to determine whether the air quality before or after construction is or would be approaching AAQS.

Dispersion modeling results were also compared to significant impact levels to determine the pollutants for which full-impact analysis would be required. Full-impact analysis was performed on all pollutants whose concentrations exceeded the significant impact levels in order to demonstrate compliance with the AAQS (SO_2, NO_x, and PM).

Preliminary Analysis--Dispersion models were used to determine which pollutants would require ambient air monitoring and full-impact analysis. The process began with the SCREEN model (version 88300, October 1988). SCREEN is a simple dispersion model that calculates 1-hour average concentrations over a range of worst-case meteorological conditions. The goal of the screening analysis was to predict worst-case operating configurations for short-term impacts (i.e., $\leq$24 hours) for each generating unit at build-out (i.e., emission rate, stack velocity, stack gas temperature, and ambient temperature).

The 7F CT was screened over a range of representative load conditions and ambient temperatures. The fuels considered were oil, syngas with 100-percent CGCU, and syngas with 50-percent HGCU and 50-percent CGCU. The 75-MW CTs were screened in both CC and simple-cycle modes firing oil for various loads and ambient temperatures. The use of natural gas was not a scenario because of the greater emission of all criteria pollutants by the units when firing oil. Building downwash effects were considered where appropriate. The emission rates input to the SCREEN model were received from vendors or from fuel specifications.

The output from the SCREEN model was used to calculate the maximum impact for each configuration. The greatest maximum impact value for each unit type corresponded to the worst-case configuration to be used in more refined dispersion modeling.

Next, the Industrial Source Complex (ISC2) model, (version 93109, May 1993) was selected for short-term and long-term dispersion modeling. The ISC2 model utilizes the steady-state, Gaussian plume theory and can be used to assess impacts from a variety of sources. The Industrial Source Complex Long-Term (ISCLT2) model was used to assess long-term effects and the Industrial Source Complex Short-Term (ISCST2) model was used to assess short-term effects. Hourly emission rates for the worst-case scenarios (as determined by the SCREEN model) were input to the ISCST2 model to assess short-term (1-hour, 3-hour, 8-hour, and 24-hour) impacts. Annualized emission rates, which took into consideration maximum working capacities for both primary and backup fuels, were used for the

ISCLT2 model. Receptors for ISC2 modeling were chosen for locations beyond the public access boundary, which were considered to be representative of ambient air that is accessible to the general public.

The highest annual and short-term facility-related impacts, as determined by the ISC2 models, were compared to the *de minimis* levels (as established in Chapter 17-2.500 FAC) (see Table 4.1.1-1). Monitoring exemptions were appropriate for all criteria pollutants with the exception of PM_{10}, SO_2, and O_3.

A FDEP-approved monitoring plan was put in action to determine O_3 ambient levels. The results revealed a range of 53-99 ppb for the monthly maximum 1-hour O_3 concentrations, but an overall average 1-hour concentration of below 60 ppb. The AAQS for O_3 is 120 ppb; therefore, results show no exceedance of the AAQS. However, no further attempt was made to define the background O_3 concentration, as there is currently no approved modeling technique to assess the impacts of an isolated source located outside an urban area. A full-impact analysis is not normally required for O_3.

The highest annual and short-term impacts were also compared to Air Quality Significance Levels (see Table 4.1.1-2). The impacts due to SO_2, NO_x, and PM were determined to be significant, and it was therefore necessary to evaluate off-site sources for a full-impact analysis.

Full-Impact Analysis--It should be noted that the results indicated in Tables 4.1.1-1 and 4.1.1-2 are the results of revised modeling analyses prior to EPA publication of the DEIS. That modeling was conducted because the plant layout was revised to remove a sulfur recovery unit and tail gas treating unit and to expand the H_2SO_4 plant to treat 100 percent of the offgas. Subsequent to issuance of the DEIS, revised modeling analyses have been conducted to address additional changes in the plant layout and structure and stack dimensions, the change in coal storage from open piles to enclosed silos, and the increase in size of the auxiliary boiler, based on detailed project design changes proposed by Tampa Electric Company. However, the total SO_2, NO_x, and PM impacts within the Polk Power Station Significant Impact Areas (SIAs) were not redetermined for comparison with AAQS or PSD increments in the revised modeling updates. A redetermination was deemed unnecessary because the revised SIAs were smaller than the earlier SIAs, and were contained within the areas analyzed for AAQS and PSD increment consumption impacts. Therefore, the following summary of the full-impact analyses for AAQS increment consumption refers to the original modeling results. The original modeling was performed using version 92062 (March 1992) of the ISC2 model.

The modeled concentrations above the various significant levels for each pollutant were used to determine an impact area for each applicable averaging time (i.e., 3-hour, 24-hour, and annual). The largest of the applicable areas was used to define the impact area for that pollutant. That impact area set the boundary within which the full-impact analysis needed to be performed.

Table 4.1.1-1. Summary of Projected Facility Impacts Compared to *De Minimis* Levels

Pollutant	Averaging Time	Impact ($\mu g/m^3$)		*De Minimis* Level ($\mu g/m^3$)
		High	HSH*	
NO_x	Annual	1.19	NA	14
Lead	Quarterly	0.0011	NA	0.1
SO_2	24-hour	16.0	14.4	13
TSP/PM_{10}	24-hour	19.1	14.8	10
Mercury	24-hour	0.005	0.004	0.25
Beryllium	24-hour	0.00075	0.00069	0.001
CO	8-hour	49.6	43.5	575

* Highest-second highest.

NOTE: This table has changed from the DEIS because of modifications to the design of the proposed facility. See tables in Chapter 2.0 for more detail.

Sources: ECT, 1992; TEC, 1992a; Bechtel, 1994.

Table 4.1.1-2. Maximum Polk Power Station Criteria Pollutant Impacts

Pollutant	Averaging Time	Maximum Impact ($\mu g/m^3$)	Significance Level ($\mu g/m^3$)
SO_2	Annual	1.50	1.0
	24-hour	16.0	5.0
	3-hour	54.8	25.0
NO_x	Annual	1.19	1.0
PM	Annual	1.14	1.0
	24-hour	19.1	5.0
CO	8-hour	49.6	500
	1-hour	132.2	2,000
Lead	Quarterly	0.0011	NA*

* The AAQS for lead is 1.5 $\mu g/m^3$.

NOTE: This table has changed from the DEIS because of modifications to the design of the proposed facility. See tables in Chapter 2.0 for more detail.

Sources: ECT, 1992; TEC, 1992a; Bechtel, 1994.

To evaluate the impacts of off-site sources for the full-impact analysis for SO_2, NO_x, and PM, information was obtained from the following:

- Data from FDEP Air Pollution Information System
- Other data received directly from FDEP staff
- Information on recently applied-for facilities contained in FDEP permit application files

The facilities to be included in the AAQS inventory were selected using the 20D method. Facilities were included if annual emissions (in tpy) for a specific pollutant were greater than 20 times the distance (in km) between the facility and the Polk Power Station.

Background concentrations were added to Polk Power Station air quality impacts and the impacts of other sources in the area, as determined by ISC2 modeling, to derive the total modeled impacts. Whereas actual monitoring for background concentrations was performed for SO_2 and PM, no monitoring was required for NO_x. An estimated background for NO_x was derived from doubling the annual average NO_x concentration observed in 1988 at the rural Archbold research site in Highlands County, the nearest rural monitoring station to the proposed site (approximately 75 km southeast of the proposed site).

The estimated total impacts were then compared to the AAQS to demonstrate compliance.

Results--The results of the AAQS comparative evaluations are presented in Table 4.1.1-3. As shown, all estimates of predicted total impacts were found to be less than the AAQS; therefore, there is no predicted violation of any AAQS due to this project. The estimated 24-hour concentration of PM is close to its respective standard, but the proposed facility had no significant contribution to this estimated concentration (i.e., other sources impacted the results). A realistic estimate of the 24-hour PM concentration, with a higher proposed project related impact, is 125 $\mu g/m^3$. This number represents the sum of the second highest of the highest-second highest (HSH) modeling data (i.e., 79.4 $\mu g/m^3$) and the background emissions. (These data are shown in Table 4.1.1-3.)

A similar approach was taken with the short-term SO_2 concentrations. HSH model results indicated minimal proposed project related impacts. A refined modeling grid was used to show the HSH concentrations that had more proposed project related impacts. These data are shown in Table 4.1.1-3 as "refined grid project impacts."

In any case, all projected concentrations are shown to be less than the AAQS.

Table 4.1.1-3. Summary of Impact Analyses for AAQS

Pollutant	Averaging Time	Modeled Impact* (μg/m³)	Background Concentration (μg/m³)	Total Projected Impact (μg/m³)	Refined Grid Total Projected Impact (μg/m³)	Florida AAQS (μg/m³)	NAAQS (μg/m³)	
							Primary	Secondary
SO_2	Annual	40.4	5	46	36	60	80	NA
	24-hour	213.7†	13	227	176	260	365	NA
	3-hour	616.1†	26	642	547	1,300	NA	1,300
NO_x	Annual	5.85	10	16	--	100	100	100
PM (PM_{10})	Annual	15.4	18.4	34	--	50	50	50
	24-hour	101.5†	45.4	147	--	150	150	150
		79.4‡	45.4	125‡				

* Impact from Polk Power Station and other sources.
† HSH modeled impact, Polk Power Station contribution not significant.
‡ Second highest of the HSH data.

Sources: ECT, 1992; TEC, 1992a.

TECO.4[WP]\4-1\T411-3.TAB 020194

Prevention of Significant Deterioration Increments

The PSD regulations include a system of area classifications. There are three area classifications that differ in terms of the amount of growth allowed before significant air quality deterioration would be deemed to occur. Significant deterioration is said to occur when the amount of new pollution would exceed the applicable PSD increments of the area classification. A PSD increment is the maximum allowable increase in concentration that is allowed to occur above a baseline concentration for a pollutant. Class I areas have the smallest increments (which corresponds to the smallest degree of air quality deterioration allowable), Class II areas have larger increments to accommodate normal well-managed industrial growth, and Class III areas have the largest increments to allow for larger amounts of development (EPA, 1990a). In the case of the Polk Power Station, there are two different class increments to consider in the air quality analyses: Class I and Class II. The Class I area is the Chassahowitzka NWA, which comprises the majority (26,000 acres) of the Chassahowitzka National Wildlife Refuge, located approximately 120 km to the northwest of the proposed site. The Class II area is the area in the vicinity of the proposed plant site.

PSD increments are currently established for SO_2, TSP matter, and NO_2. To determine the amount of increment available, increment consumption calculations must reflect the ambient pollutant concentration change attributable to existing and new sources after a specific baseline emission source inventory date. It should be noted that air quality cannot deteriorate beyond the concentration allowed by the applicable AAQS, even if not all the PSD increment is consumed.

General Methodology--The first step in this analysis involved gathering the appropriate inventory of information for use in the models. The PSD Class I inventory (i.e., the list of all sources emitting SO_2 and impacting the Class I area) for SO_2 was obtained from FDEP staff and updated following detailed inspections of FDEP inventory files in Tampa and FDEP pending permit files in Tallahassee. The final inventory was approved by FDEP. The PSD Class II inventory for SO_2 was the subset of the Class I inventory that included all sources within 75 km of the Polk Power Station site.

The PSD Class I inventory for NO_x was obtained from FDEP staff and updated following conversations with FDEP staff. The Class II inventory for NO_x was the subset of the Class I inventory that included sources within 50 km of the Polk Power Station site.

The PSD Class I inventory for PM was obtained from FDEP staff and updated based on telephone conversations with FDEP. The Class II inventory for PM was also obtained from FDEP staff and updated based on telephone conversations.

- PSD Class I

The first step in the PSD Class I analysis was to use ISC2 models to predict increment consumptions from Polk Power Station sources. Per FDEP direction, these results were then compared to the National Park Service (NPS) significant impact levels. Like the significant impact levels for criteria pollutants, the FDEP has adopted the NPS significant impact levels concept in order to minimize the extent of analyses for sources with little potential impact to a Class I area. For those pollutants which the Polk Power Station was shown to have significant impacts, ISC2 and MESOPUFF-II (model version 4.0, April 1987) modeling of all PSD sources was performed to establish the total Class I increment consumption. The maximum predicted impact for each pollutant for each averaging time was then compared to the PSD Class I increment to determine compliance.

It should be noted that the PSD Class I increment analyses were not redetermined following changes in the facility layout, as the distance between the Polk Power Station and the Chassahowitzka NWA negates the impacts of the modifications. Additionally, the modifications resulted in a decrease in facility emissions, which would have lessened the impacts on the Chassahowitzka NWA.

- PSD Class II

The ISCLT2 and ISCST2 models were used to determine the impacts due to all sources in the PSD Class II inventory for each pollutant (SO_2, NO_x, PM). Those impacts were then compared to the PSD Class II increments and evaluated for compliance.

Preliminary Analysis: Class I Area--The ISC2 models were used to produce conservative estimates of Class I increment consumption for Polk Power Station sources. The emission rates and stack parameters used with the ISC2 models were the same as those used in the AAQS modeling analyses. The 13 receptors used in this analysis were placed at the boundary of the Chassahowitzka Class I area and were consistent with guidance received from FDEP.

The results of the ISC2 models were compared to the NPS significant impact levels (Table 4.1.1-4). Like the significant impact levels for AAQS analysis, the FDEP has adopted the NPS significant impact levels concept in order to minimize the extent of analyses for sources with little potential impact to a Class I area. Modeled SO_2 concentrations exceeded the NPS significant levels for all averaging periods, as did the modeled 24-hour TSP and annual NO_x concentrations. Therefore, a full-impact analysis for SO_2, TSP, and NO_x was required.

Full-Impact Analysis: Class I Area--ISC2 modeling of all PSD sources was performed for SO_2, TSP, and NO_x to establish the total Class I increment consumption. The assumptions of the ISC2 models include: (1) constant, uniform wind for each hour (steady-state Gaussian plume dispersion); and (2) straight-line plume transport to all downwind distances. These assumptions are not reasonable for long-range transports (over 50 km) and result in overly conservative concentration results; consequently, the ISC2 models are usually not recommended for transport distances of greater than 50 km (EPA, 1986a). Instead, the MESOPUFF-II model, which is capable of accounting for several long-range transport and dispersion phenomena that are not addressed in conventional air quality models, is normally recommended for estimating impacts at receptors 50 to 100 km or more from the source. Given the deficiencies of the ISC2 models in determining impacts past 50 km, the MESOPUFF-II model (version 4) was utilized to assess impacts of sources located past 50 km. The model was run exercising the full range of deposition and transformation options. The 3- and 24-hour

Table 4.1.1-4. Significant Impact Levels for Class I Analyses

Pollutant	Averaging Period	Highest Modeled Results ($\mu g/m^3$)	Concentration ($\mu g/m^3$) NPS*
SO_2	Annual	0.045	0.025
	24-hour	1.13	0.07
	3-hour	6.98	0.48
PM (TSP)	Annual	0.01	0.025
	24-hour	0.47	0.07
NO_2	Annual	0.04	0.025

* Currently used as Class I significant levels by the FDEP.

Source: TEC, 1992a.

average concentrations produced by the ISCT2 models for sources within 50 km were added directly to the corresponding concentrations produced by the MESOPUFF-II model for sources greater than 50 km from the Chassahowitzka NWA. Those values represented the total impacts.

Preliminary Analysis: Class II Area--The concept of significant levels does not apply to PSD Class II air quality analysis. Full-impact analyses must be performed.

Full-Impact Analysis: Class II Area--ISC2 modeling was performed to predict ambient concentrations due to all sources in the PSD Class II inventory for SO_2, NO_x, and TSP. These pollutants are the only criteria pollutants for which PSD Class II increments currently are established. The modeled results were compared to the PSD Class II increments to determine compliance.

Results--The ISC2 modeling results for the Class I and Class II increments showed exceedances for only 24-hour and 3-hour SO_2 Class I increments. The more refined MESOPUFF-II/ISC2 modeling showed compliance with these increments. Therefore, no exceedances of the Class I and Class II increments are predicted. The development of the Polk Power Station project should not cause significant deterioration of air quality in the project vicinity or on the Chassahowitzka NWA. The results of the PSD Class I and Class II increment analyses are summarized in Tables 4.1.1-5 and 4.1.1-6, respectively.

Air Toxics Assessment

Systemic Toxicity Assessment

ISC2 models were used to predict the maximum impacts of potential air toxics emissions from the proposed Polk Power Station. The predicted values were then compared to FDEP's No-Threat Levels to determine the potential for systemic toxic effects. See Section 4.12 for further details on this assessment.

The results of the systemic toxicity analysis indicate that public health in Polk County would not be jeopardized with respect to the direct inhalation of toxic air pollutants from the proposed plant. The results of this analysis are presented in Section 4.12.2.

Inhalation Cancer Human Health Analysis

Of the possible emissions from the proposed Polk Power Station, the pollutants analyzed in step 5 in Section 4.12.2 represent those that are classified as either human carcinogens or probable human carcinogens. Therefore, an analysis of the potential impacts of these emissions on human health was evaluated through an inhalation cancer human health analysis. The estimated maximum individual risk (MIR), which is the estimated increased lifetime risk for an individual exposed to the predicted highest annual average concentrations of the pollutants of concern, was determined to be 1.789×10^{-6}, or two in one million. An estimate of the number of people in the entire affected population that would suffer an increased incidence of cancer due to Polk Power Station emissions was calculated as one

Table 4.1.1-5. Summary of Impact Analyses for PSD Class I Increments

Pollutant	Averaging Time	Maximum Predicted Impact ICS2 Model ($\mu g/m^3$)	Maximum Predicted Impact MESOPUFF-II/ISC2 Models ($\mu g/m^3$)	PSD Class I Increment ($\mu g/m^3$)
SO_2	Annual	0.4		2
	24-hour	7.5*	3.8*	5
	3-hour	29.6*	12.9*	25
NO_2	Annual	0.8		2.5
PM (TSP)	Annual	1.1		5
	24-hour	5.7*		10

* HSH modeled impact.

Sources: ECT, 1992; TEC, 1992a.

Table 4.1.1-6. Summary of Impact Analyses for PSD Class II Increments

Pollutant	Averaging Time	Maximum Predicted Impact ISC2 Model ($\mu g/m^3$)	PSD Class II Increment ($\mu g/m^3$)
SO_2	Annual	0.0*	20
	24-hour	27.0†	91
	3-hour	104.0†	512
NO_2	Annual	3.3	25
PM (TSP)	Annual	5.4	19
	24-hour	31.8†	37

* Increment consumption was negative over the entire receptor grid.

† HSH modeled impact.

Sources: ECT, 1992; TEC, 1992a.

additional case of cancer every 4,000 years. It can be concluded that operation of the Polk Power Station would not result in a significant increase in inhalation cancer risks.

4.1.1.3 Other Potential Impacts on the Chassahowitzka National Wilderness Area

The potential for Polk Power Station emissions to affect Air-Quality–Related Values (AQRVs), particularly, visibility, soils, vegetation, and wildlife at the Chassahowitzka NWA, were evaluated. Visibility impacts were predicted with the VISCREEN program, version 88341, (EPA, 1988), the results of which show that the potential for visibility impairment would be negligible due to the low emissions rate from the Polk Power Station and the distance of the proposed plant from Chassahowitzka NWA (see Table 4.1.1-7). The results also showed that potential impacts at Chassahowitzka NWA of gaseous emissions from the proposed project would be insignificant and that no detrimental effects on soils in the wilderness area would be expected.

4.1.1.4 Other Air Quality-Related Impacts

Impacts Due to Associated Growth

The proposed Polk Power Station would be constructed in phases. It is estimated that an average of 650 workers would be hired during the initial construction phase for a 27-month period, with a 7-month peak of 1,400 construction workers. In addition, an average of approximately 65 to 140 workers would be periodically employed during other construction phases. Most of these construction personnel would be drawn from Polk and Hillsborough Counties and would commute to the job site from nearby cities, including Bartow, Winter Haven, Lakeland, and the Tampa metropolitan area. Because of the lack of available quantitative data, detailed analyses concerning the impacts caused by the increased traffic emissions due to the temporary growth in vehicle-miles traveled (VMT) in the area were not performed. Nevertheless, such increases in mobile source emissions are judged to be insignificant.

Anticipated full build-out employment at the Polk Power Station is 210 workers, plus up to 100 annually contracted maintenance workers to be hired for periodic routine services. Most of these persons would be drawn from the region. When compared to 1990 populations of 70,576 persons in Lakeland and 405,382 persons in Polk County, 210 employees for plant operation is quite small. The increase of emissions from mobile sources or as a result of the proposed project is judged to be insignificant.

Although the operation of a new industrial facility would likely stimulate the growth of other industrial or commercial business in the area, given the site's proximity to Bartow, Lakeland, and the Tampa metropolitan area, the existing commercial infrastructure should be more than adequate to provide any support services which might be required by the proposed facility. Thus, no air quality impacts from associated industrial or commercial growth would be expected. Moreover, any significant industrial development resulting from the establishment of the Polk Power Station would be independently

Table 4.1.1-7. Level 1 Visibility Screening Results for the Chassahowitzka NWA

Background	Theta*	Delta E†		Contrast‡	
		Threshold	Plume	Threshold	Plume
Sky	10	2.00	0.115	0.05	-0.000
Sky	140	2.00	0.045	0.05	-0.002
Terrain	10	2.00	0.017	0.05	0.000
Terrain	140	2.00	0.005	0.05	0.000

* Theta is the scattering angle between direct solar radiation and the line of sight. Theta equal to 10 degrees (°) is the worst-case sun angle for forward scattering, and theta equal to 140° is the worst-case for backward scattering.

† Delta E, the color difference parameter, indicates the perceived magnitude of color and brightness changes; it is the basis for determining plume perceptibility. The threshold value of 2.00 is used to determine if there is potential for visibility impairment from the plume. If the absolute value of the plume contrast is greater than the threshold value, the potential is present for visibility impairment.

‡ Contrast is a measure of the difference in light intensity between the plume and the background. The threshold value of 0.05 is used to determine if there is the potential for visibility impairment from the plume. If the absolute value of the plume contrast is greater than the threshold value, the potential is present for visibility impairment.

Source: ECT, 1992.

subject to PSD and other environmental review requirements. Any development having intolerable adverse impacts on the environment of the area is unlikely to be approved.

Impacts on Visibility

Due to the types and quantities of emissions from the proposed power plant, it is expected that the opacity of the combustion exhausts from the facility would be low and with no significant visibility impairment at the local level. For example, PM and SO_2 emissions would be low due to the predominant use of low-ash, low-sulfur fuels. Potential fugitive dust emissions caused by materials handling and storage operations would be controlled and minimized. It is unlikely that operation of the proposed project would significantly affect the visual qualities in the area.

Impacts on Soils

Gaseous emissions impacts on soils can cause both acid leaching of nutrients and direct impacts to vegetation; however, such impacts are expected to be weaker due to the existing site's alkaline organic soils. Sulfates and nitrates caused by the deposition of SO_2 and NO_2 can be beneficial for non-acidic soil. Based on the on-site soil types and the minimal emissions levels associated with plant operation, no impacts to soils are anticipated.

Odors

The proposed project would emit about 6.2 tpy of total reduced sulfur compounds. These compounds do include odorous compounds such as H_2S. Based upon an annualized average emission of about 1.5 lb/hr of H_2S, odors beyond the plant's property lines should not be significant.

Acidic Deposition

Environmental effects from acidic deposition were initially observed in Swedish lakes where gaseous emissions from factories in industrialized northern Europe significantly lowered the pH of the aquatic ecosystem. In soft waters where buffering capacity was low, fish were at increased risk from metal toxicity. In aluminum containing soils, acid rain leached this metal into lakes and streams causing toxic reactions in aquatic organisms. Acidic deposition also affects forested ecosystems with an acute to chronic response that can cause reactions ranging from leaf injury to death of sensitive species.

In the United States, public awareness regarding potential impacts from acidic deposition has increased through published scientific reports and the popular press. Early documentation of acid rain effects occurred in the northeastern part of the country. Acidic deposition can occur in rain, snow, fog, and from particulate fallout. Natural sources of acidic substances can be volcanoes, wetlands, oceans, vegetation, and animals. Emissions caused by human activities (anthropogenic) are believed to have increased acidic deposition in natural systems. The substances most responsible for this increase are SO_2 and the NO_x. These two gases, which result from the combustion of fossil fuels, undergo chemical transformation in the atmosphere to produce sulfuric acid and nitric acid. Aside from the impact on natural systems, acidic deposition causes the leaching of nutrients from agricultural soils, thereby decreasing productivity and/or increasing the need for fertilizers. Acidic deposition can also damage building materials such as steel, concrete, limestone, and marble.

Some acid gases would be released under the proposed project, causing limited acidic deposition impacts. Table 4.1.1-8 illustrates the highest annual average concentrations of SO_2 and NO_x (per ISC2 modeling conducted by Tampa Electric Company) for the proposed project. The polar coordinates corresponding to the locations of maximum concentrations are also presented. It should be noted that north is the 0° or 360° radial line. The modeling used meteorological data for the 1982–1986 period. The locations of the highest annual concentrations of SO_2 occurred west of the site for the 1982–1986 period. The locations of the highest annual concentrations of NO_x occurred west of the site for 1982 and 1984, southeast of the site for 1983, and east of the site for 1985 and 1986.

4.1.2 Alternative: Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance)

The alternative proposal for the site is centered around a 500-MW PC unit with FGD replacing the 260-MW IGCC unit and two 75-MW CTs (Table 2.7-1).

Replacing the IGCC unit and two CTs with a PC unit with an FGD system changes the air quality impacts. Table 2.4.3-1 presents comparisons of key facilities and environmental requirements/discharges for nominal 400-MW IGCC and PC with FGD power plants. The IGCC plant referred to in Table 2.4.3-1 should not be confused with the proposed Polk Power Station IGCC unit. This table serves only to illustrate the fact that air emissions from any IGCC plant will be considerably less than the equivalent MW-producing PC plant. The information presented in Table 2.4.3-1 was derived from a study sponsored by the Electric Power Research Institute (EPRI, 1988).

The air pollutant emission rates presented in Table 2.4.3-1 reflect modifications of the rates contained in the EPRI study to represent similar sulfur removal efficiencies (95 percent) for SO_2 emissions and more current assumed performance standards for NO_x emissions from PC units. Even with these modifications to reflect better efficiency and performance of the PC unit, the use of the PC technology would still result in higher SO_2 emissions and over two times higher NO_x emissions than that from the equivalent size IGCC unit. Particulate emissions and toxic air emissions are considerably less from the IGCC unit compared to the PC unit (Table 4.1.2-1). Thus, it is apparent that the PC alternative will result in significantly greater air quality impacts than the proposed project.

Impacts of the alternatives from acidic deposition can be evaluated by comparing the total SO_2 and NO_x emissions from each alternative. The two alternatives with significant acid gas emissions include the Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance) (i.e., a 500-MW PC unit, two 220-MW CCs, and four 75-MW single-cycle CTs) and Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance). The total SO_2 and NO_x emissions from each alternative are summarized in Table 4.1.2-2.

Table 4.1.1-8. Summary of Projected SO_2 and NO_x Impacts from Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance) (Full Build-Out)

	1982	1983	1984	1985	1986
SO_2					
Annual Average					
Highest (μg/m^3)	1.33	1.25	1.35	1.24	1.50
Location					
Distance (meters)	1.310	1,310	1,600	1.310	1.310
Radial(°)*	290	290	270	290	290
NO_x					
Annual Average					
Highest (μg/m^3)	1.09	0.94	1.11	1.07	1.19
Location					
Distance (meters)	2,500	2,000	2,500	2,000	2,000
Radial (°)*	260	140	250	100	100

* North is the 360 degree (or 0 degree).

NOTE: This table has changed from the DEIS because of modifications to the design of the proposed facility. See tables in Chapter 2.0 for more detail.

Sources: ECT, 1993.
TEC, 1992a.
Bechtel, 1994.

Table 4.1.2-1. Comparison of Trace Pollutant Emissions

Pollutant	Emission Rate ($lb/10^{12}$ Btu) Polk Power Station IGCC*	Coal-Fired Plant†
Antimony	0.44	NA‡
Arsenic	0.26	14.4 - 168
Beryllium	0.04	0.52 - 5.9
Cadmium	0.39	1.3 - 21
Chromium	23.0	60 - 477
Cobalt	0.22	NA
Lead	1.97	8,600
Manganese	3.73	31 - 642
Mercury	1.93	8 - 14
Nickel	15.6	47 - 352
Selenium	0.31	3.24- 30.14
Vanadium	0.61	69.8 - 91.8
Ammonia	2,000	6,870
Fluorides	92	9,400
Hydrogen sulfide	175	NA
U_{238}	61.1 $pCi/10^6$ Btu	61.1 $pCi/10^6$ Btu
H_2SO_4 mist	24,870	30,083
Benzene	1.96	NA
Benzo-a-pyrene (POM)	1.96	394.2
Formaldehyde	1.96	170.5
Naphthalene	1.96	NA

Note: * IGCC emissions include CT, acid plant emissions, and HGCU thermal oxidizer. All IGCC values are from GE (1992) and Texaco (1992) except U_{238} (EPA, 1990) and benzene, benzo-a-pyrene, formaldehyde, and naphthalene. The U_{238} emission rate is based on the emission rate factor for a conventional coal-fired boiler. The benzene, benzo-a-pyrene, formaldehyde, and naphthalene emission rates are based on the detection limit of polycyclic organic matter (POM) in the stack exhaust.

† Emissions listed correspond to a PC unit firing bituminous coal with ESP controls (EPA, 1990b)

‡ Not available

Sources: EPA, 1990b.
Texaco, 1992.
GE, 1992.

Table 4.1.2-2. Comparison of SO_2 and NO_x Impacts for the Alternatives

Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance) (Alternative Power Resource Proposal)	Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance) (Proposed Project)
SO_2	
4 single cycle CTs @ 24.9 lb/hr each	6 single cycle CTs @ 24.9 lb/hr each
4 combined cycle CTs @ 41.1 lb/hr each	4 combined cycle CTs @ 41.1 lb/hr each
*500 MW PC Plant @ 897.8 lb/hr	†Polk Unit I @ 408.7 lb/hr
1,161.8 lb/hr	722.5 lb/hr
NO_x	
4 single cycle CTs @ 38.6 lb/hr each	6 single cycle CTs @ 38.6 lb/hr each
4 combined cycle CTs @ 74.7 lb/hr each	4 combined cycle CTs @ 74.7 lb/hr each
‡500 MW PC Plant @ 837.9 lb/hr	†Polk Unit I @ 240.2 lb/hr
1,291.1 lb/hr	770.6 lb/hr

* Represents 90 percent SO_2 removal efficiencies.
† Represents the IGCC unit plus auxiliary equipment.
‡ Represents 50 percent uncontrolled emissions.

NOTE: This table has changed from the DEIS because of modifications to the design of the proposed facility. See tables in Chapter 2.0 for more detail.

Source: Hance and Kelly, 1991.

The estimated total acid gas emission rate of 1,493 lb/hr (sum of SO_2 and NO_x) for the preferred alternative is lower than the alternative power resource proposal, which has a total emission rate of 2,453 lb/hr. The preferred alternative involves the removal of sulfur from the gas stream before combustion, producing a lower SO_2 emission rate than that of the alternative power resource proposal. In addition, the lower combustion temperature resulting from low Btu syngas and the injection of nitrogen would result in lower levels of NO_x emissions being produced by the proposed project.

4.1.3 Alternative: No Action

The no-action alternative represents the situation in which the proposed Polk Power Station project would not be constructed and operated. In this case, all potential environmental impacts of the project operations would be avoided. Under the no-action alternative, the concentration of pollutants in the vicinity of the proposed Polk Power Station site would remain unchanged except fugitive dust emissions would still result from FDEP-required reclamation activities for the site.

4.1.4 Comparison of Impacts

Both the IGCC and the PC with FGD technologies would meet the capacity needs and customer demands for power. The IGCC technology was selected for its relatively better environmental performance. Several potential environmental issues associated with IGCC technology are also associated with PC technologies. Both involve the delivery, handling, and storage of coal, and both generate solid by-products which require development of some on-site storage facilities. However, PC units have more environmental disadvantages in contrast to IGCC units.

From an air impacts perspective, the use of a PC with FGD unit generally results in relatively higher SO_2 and NO_x emissions in comparison to an equivalent IGCC unit. Also, PM emissions and toxic air emissions would be considerably diminished if the IGCC unit technology is employed over the PC unit technology.

4.2 SURFACE WATER IMPACTS

4.2.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

The proposed Polk Power Station will require approximately 336 mgd of recirculating cooling water. In order to maintain water quality compliance within the cooling reservoir, which receives storm water and treated industrial and sanitary wastewater, an average of 3.1 mgd will be discharged to Little Payne Creek. This discharge and other related activities requires EPA permitting under the NPDES.

Other potential surface-water effects would be from construction and reclamation activities and storm water runoff from industrial and nonindustrial areas. Construction and restoration of this area will require temporary disturbance of the land surface, which may temporarily affect surface water quality.

4.2.1.1 Construction-Related Impacts

No significant construction-related impacts to surface water resources are expected as a result of the proposed project. The majority of the power plant and associated facilities will be constructed on land that has been previously mined or highly altered from mining operations. The surface water resources within the areas of the proposed development consist of open water mine cuts artificially created through mining operations and small, isolated areas of unmined but disturbed and hydrologically isolated remnant wetlands. These unmined areas have been highly altered through surface water drainage, groundwater drawdowns, and other disturbances associated with mining activities. All mined areas within the proposed site must be reclaimed to approximate premining conditions according to FDEP regulations. The proposed project will have potential minor effects on the reclaimed hydrology and water quality in the vicinity of the site. Construction activities that disturb five acres or more require an NPDES permit for storm water discharges from the site to ensure the implementation of best management practices (BMPs) to minimize impacts to surface waters. Tampa Electric Company filed a notice of intent on August 25, 1993, for coverage under the General Permit for Storm Water Discharges from Construction Sites, which had previously been issued by EPA on September 25, 1992. As a part of the General Permit, Tampa Electric Company has prepared a Pollution Prevention Plan (PPP) to manage both hydrologic and water quality effects from storm water discharges during construction. Tampa Electric Company has subsequently achieved coverage under this General Permit. This general permit has been approved by EPA. Both structural and nonstructural (vegetative) measures will be designed, implemented, and properly maintained in accordance with BMPs (TEC, 1992a).

Hydrologic Impacts

Construction of the cooling reservoir, plant facilities, and overall site reclamation activities would affect surface hydrology. The primary effect due to construction would be the conversion of the existing mine cuts and highly altered wetlands to the plant site, cooling reservoir, and reclaimed wetlands. This would require extensive site excavation, filling, and grading. Reclamation of the existing mine cuts would be required independently of the proposed action.

Construction of the cooling reservoir would essentially involve moving the overburden piles between the existing on-site mine cuts to form the surrounding and internal berms. The cooling reservoir itself would be primarily below-grade. The surrounding berm would provide above-grade storage to accommodate additional storm water. The water surface area of the cooling reservoir would be 727 acres; the surrounding and internal berms will add 133 acres.

During construction, the cooling reservoir would be divided into three subareas separated by temporary berms. Each subarea of the cooling reservoir would be constructed in phases. The inactive subareas of the cooling reservoir would have sufficient storage capacity and would be used to retain storm water runoff on site under normal rainfall conditions. This would minimize the hydrologic impact of large pulses of storm water flow during construction. The proposed dewatering plan is described in Section 4.3. The on-site retention areas would be designed to retain storm water from the 25-year, 24-hour rainfall event, in compliance with regulatory requirements. Rainfall events in excess of the design event may require some discharge of storm water. This flow would be retained within the cooling reservoir or other containment areas to allow for settling and to reduce peak discharges. These flows would not exceed estimated premining discharges to receiving waters (TEC, 1992a).

Additional excavation activities would be required for building foundations, overall site grading and leveling, road construction, rail spur construction, and general reclamation activities. These would require the moving, leveling, and compacting of soils and filling existing mine cuts. Some of the overburden would be re-distributed to accommodate the plant facilities and replicate premining drainage patterns. Location of roads and railroad spurs would adhere to the erosion and sedimentation plan to prevent alteration of the desired site hydrology.

Overall site reclamation would be performed to restore the approximate premining hydrologic boundaries between the South Prong Alafia River, Payne Creek, and Little Payne Creek watersheds. The on-site post-reclamation acreages within each of these watersheds would be within 1.8 percent of premining acreages (Table 4.2.1-1). No direct effects to the off-site systems of Little Payne Creek, Payne Creek, or South Prong Alafia River from site preparation and plant construction are anticipated since no structures would be constructed either in streambeds or floodplains within the existing drainages.

The premining and post-reclamation peak-storm water flows for the 25-year, 24-hour design storm (approximately 9 inches of rainfall) were determined for each of the three watersheds. The analysis was performed using the hydrologic model HEC-1 (version 4.0, September 1990) developed by the Hydrologic Engineering Center (HEC) (USACOE 1991). Details of the hydrologic modeling are presented in Section 3.8.4 of the SCA (TEC, 1992a). Tables 4.2.1-1 and 4.2.1-2 present the watershed mass flows and peak flows for premining and proposed post-reclamation conditions. Each of the watersheds would experience a small decrease in mass flow for post-reclamation conditions. Peak flows would be significantly reduced due to the detention in reclaimed wetlands and storm water

Table 4.2.1-1. Mass Flow Analysis

Sub-Watershed	Drainage Area (acres) Pre-Mining	Drainage Area (acres) Post-Reclamation	Mass Flow (ac-ft) Pre-Mining	Mass Flow (ac-ft) Post-Reclamation	Ratio (%)
South Prong Alafia River	816	801	411	388	94.4
Little Payne Creek	2,816	2,837	1,441	1,269	88.1
Payne Creek	716	710	380	330	86.8
TOTAL	4,348	4,348	2,232	1,987	

Note: Storm event = 25-year, 24-hour.
Rainfall depth = 9 inches.

Sources: ECT, 1992; TEC, 1992a.

Table 4.2.1-2. Summary of Premining and Post-Reclamation Peak Runoff

Watershed	Drainage (acres)		Peak Runoff (cfs)	
	Pre-Mining	Post-Reclamation	Pre-Mining	Post-Reclamation
South Prong Alafia River	816	801	613	233
Little Payne Creek	2,816	2,837	1,091	143
Payne Creek	716	710	513	16

Sources: ECT, 1992; TEC, 1992a.

management structures. This slower bleeddown would help prevent downstream flooding as well as dry periods in these systems and is in compliance with SWFWMD and FDEP requirements.

The two higher quality water bodies on the site (the old mine cut lake located south of CR 630 and the reclaimed lake near Fort Green Road) would remain essentially unaltered except for minor grading to improve drainage patterns to premining conditions.

Water Quality Impacts

Potential water quality impacts would consist of suspended solids from disturbed soils, BOD and nutrient loading from disturbed vegetation, and oil and grease from construction equipment. According to the FDEP conditions of certification under the SCA process, any storm water runoff discharges from the site from a storm event less than the 10-year, 24-hour storm during construction must meet the discharge quality limits of TSS less than 50 mg/L and pH between 6.0 and 8.5.

The quality of off-site waters would be protected by retention of storm water on site during construction, except for potential discharge during extreme storm events. Swales would be constructed for directing runoff around the construction site to the cooling reservoir or to sedimentation basins. These swales would be excavated, graded, and stabilized with gravel, sod, and such. They would be designed such that erosional flow velocities would not be reached. If additional surface water storage is needed during construction, small isolated sedimentation basins would be excavated, and cleaned out as needed (TEC, 1992a).

Tampa Electric Company would also employ additional vegetative controls of erosion and sedimentation, including seeding of the cooling reservoir berms and swales. Other erosion control structure practices would include, as necessary, the construction of temporary perimeter berms, rip-rap in potentially high-velocity areas, straw bales or other barriers, silt fences, diversionary berms or swales, and graveled road and railroad beds.

Some storm water runoff may need to be discharged to adjacent off-site surface water systems during extreme storm events. The runoff would be initially detained within the cooling reservoir, mined-out areas, or in sedimentation basins to allow settling of particulates and partial removal of other pollutants. Sediment transport associated with any discharges from these areas would be further controlled by use of appropriate BMP measures, such as straw bales and silt fences (TEC, 1992a).

Site preparation and construction of the proposed project are not expected to have adverse hydrologic and water quality effects on off-site surface water bodies, since almost all surface water and storm water would be retained on site except possibly under extreme storm events. Construction activities would not create any surface discharges of sanitary and industrial wastes. Construction would cause no significant consumption of surface water resources. Dewatering water from areas under construction would be detained on the site and sediments in any surface runoff from the site would be controlled by appropriate design measures. Any potential effects of the proposed construction would be similar to those associated with the reclamation of mined-out lands in the site area and would occur from the required reclamation of the site even without the proposed project.

Measuring and Monitoring Programs

In general, all erosion and sedimentation controls would be checked weekly and after major storms, and be maintained as follows:

- Sedimentation basins, if used, would be cleaned
- Gravel and rip-rap would be checked for washout or sediment buildup and replaced or cleaned as necessary
- Straw bale barriers would be checked for washout or deterioration and replaced or reinforced as necessary
- Seeded areas would be checked, re-seeded if necessary, and if required, fertilized carefully so that excess nutrients are not introduced into surface waters
- Silt fences would be checked for washout and would be repaired, reinforced, or replaced as necessary
- Sediment deposits at any of the aforementioned barriers will be periodically removed as necessary

All storm water runoff would be collected and managed using appropriate erosion and sedimentation controls. In accordance with the FDEP conditions of certification, monitoring would be conducted at all point-source discharges for TSS and pH by a grab sample once per discharge, but not more often than once per week. Therefore, no adverse water quality effects would be expected during construction activities on surrounding water bodies.

4.2.1.2 Operation-Related Impacts

Operation of the proposed Polk Power Station would result in three types of discharge to off-site surface waters:

- Cooling water reservoir blowdown
- Storm water associated with industrial activity
- Storm water not associated with industrial activity

Storm water discharged separately from the cooling reservoir blowdown would be treated and discharged in compliance with federal, state, and local regulations and guidelines regarding water quality treatment as well as peak and mass storm water flows.

Based on the draft NPDES permit (see Appendix B), there would be two point source discharges from the proposed Polk Power Station that would be covered in the NPDES permit for the project. The

NPDES permit would cover all discharges of wastewater and storm water from all industrial areas of the site. Outfall 001 would consist of cooling reservoir blowdown. Contributing discharges to the cooling reservoir would include recirculated cooling water, treated industrial wastewater plant effluent, treated sanitary sewage treatment plant effluent, low-volume wastes, contaminated storm water from industrial areas, groundwater seepage, and groundwater makeup. Outfall 002 would consist of storm water runoff from areas associated with industrial activity. Storm water from the areas west and north of the power block would discharge through Outfall 002 to the unnamed mine cut lake north of the power block. The unnamed mine cut lake and Outfall 001 discharge to the reclaimed lake, which in turn discharges through a swale along the west side of Fort Green Road and through a bridge under Fort Green Road to Little Payne Creek. Outfalls 001 and 002 would both discharge to Little Payne Creek Watershed. The watersheds for Payne Creek and South Prong Alafia River would only receive runoff from reclaimed wetland and upland areas with no development. Thus, no operation-related effects would occur in these two watersheds.

As part of the NPDES permit (see draft permit, Part V, in Appendix A), Tampa Electric Company would implement an approved BMP plan and PPP that outlines measures to be taken to minimize the introduction of pollutants to receiving waters through process water discharges and storm water runoff. The BMP plan identifies the BMPs applicable to different operations at the proposed Polk Power Station, and the PPP indicates what pollutant sources should be addressed and how the BMPs should be implemented to minimize the possibility of pollutant sources affecting receiving waters. BMPs would include sedimentation and erosion control, exposure minimization practices, visual inspections, and spill prevention, control, and countermeasures.

The heat dissipation system or cooling reservoir would supply cooling water at the rate of approximately 247,000 gpm (355.7 mgd) to the proposed Polk Power Station. A 727-acre (water surface) cooling reservoir would be used as the cooling water supply and would also receive the warmed water discharge and dissipate heat energy during recirculation. The cooling reservoir would also receive effluent from the IWT plant, sanitary wastewater treatment system, and storm water associated with industrial activity. The reservoir would be designed to maximize water reuse while maintaining water quality in the reservoir. The design features of the reservoir are described in Section 2.3.6 of this EIS.

Effects from cooling reservoir discharge potentially would consist of hydrologic impacts, chemical water quality impacts, and thermal water quality impacts.

Hydrologic Impacts

Hydrologic impacts are expected to be primarily beneficial due to the cooling reservoir providing a steady supply of water to the headwaters of the Little Payne Creek, and the storm water controls applied elsewhere within the site to reduce peak flood flows. However, the proposed Polk Power Station would alter certain land-use patterns on the project site with the inclusion of the proposed reclaimed wetlands, plant facilities, and the cooling reservoir. The hydrologic analysis of the drainage basins acreages and discharges under the 25-year, 24-hour storm event was discussed previously in Section 4.2.1.1. The continued operation of the cooling reservoir would be the primary hydrologic impact of plant operation.

A water level of 136 ft-NGVD (± 0.5 ft) would be maintained within the reservoir by the blowdown structure and volume of makeup water provided to the reservoir. Water balance within the cooling reservoir would determine the amount of discharge from the cooling reservoir. The continuous blowdown structure would be a pipe with an invert elevation of approximately 133.8 ft-NGVD at the inlet. A 10-ft wide rectangular weir would be installed with a controlling elevation at 136.6 ft-NGVD to provide for drainage control during storm events, in compliance with applicable FDEP and SWFWMD requirements. A 200-ft wide emergency spillway would also be provided at approximately 140.0 ft-NGVD to prevent overtopping of the berm during extreme weather conditions.

Discharge from the blowdown structure is expected to average 3.1 mgd annually. Low flows under the maximum makeup water scenario (hot dry conditions and 100-percent capacity) are predicted to be approximately 2.6 mgd. The estimated maximum discharge of 5.3 mgd would occur in response to the 25-year, 24-hour storm scenario.

The continuous average blowdown would increase the average annual discharge of Little Payne Creek at Fort Green Road from an estimated premining discharge of 8.2 cfs (5.3 mgd) (based on 0.8 cfs/mi^2 for the Little Payne Creek basin [TEC, 1992a]) to an average of 11.9 cfs (7.69 mgd). This increased flow would raise the water surface elevation at Fort Green Road by approximately 0.2 ft. These increases would be diminished downstream and are not expected to be a significant effect. The expected increased flow would be a small fraction of the 25-year, 24-hour storm peak discharge and should not affect downstream flooding (TEC, 1992a).

The hydrologic analysis performed by Tampa Electric Company (TEC, 1992a) has shown that the 25-year, 24-hour storm peak flows and total mass flows are reduced in the post-reclamation conditions due to the on-site storm water management systems that include the cooling reservoir, so the additional blowdown would not adversely affect downstream flooding. The dry season flows would be affected by the continuous blowdown since the blowdown would likely become a major component of the stream flow during dry conditions. This continuous flow would have no adverse hydrologic effect on downstream flooding, and is considered to be a beneficial effect. The increased volume and flow would not be anticipated to be significant enough to cause scouring, bank erosion, or deposition of suspended solids in Little Payne Creek.

A potentially significant effect could occur if the perimeter berm was over-topped and subsequently eroded by wave action in high water conditions. This could result in the release of a portion of the large volume of water stored in the cooling reservoir. To estimate the possibility of this occurrence, wave forecast, wind setup, and wave run-up analyses were conducted by Tampa Electric Company (TEC, 1992a) to estimate the effects of wave action. The worst-case scenario was based on the maximum wind speed recorded at Tampa International Airport (67 mph), aligned east-west to provide the maximum fetch, using the shallow water wave forecast method developed by Bretschneider and Reid (1953). The predicted significant wave height would be approximately 3.2 ft with a wave period of 2.8 sec. The calculated wave run-up would be approximately 2.95 ft using the method presented in the Shore Protection Manual (USACOE, 1984). The wind setup would be approximately 0.42 ft based on Ippen (1966). The resulting maximum wash-up (wave run-up plus wind setup) would be approximately 3.37 ft (TEC, 1992a).

If the maximum effect of wave action would occur in concert with a 100-year, 24-hour rainfall event, a wash-up elevation of approximately 140.3 ft-NGVD would result. The top-of-berm elevation would be 145 ft-NGVD, which gives 4.7 ft of freeboard under this worst-case scenario. Even under this worst-case scenario, the perimeter berm would not likely be damaged due to wave action within the cooling reservoir.

Water Quality Impacts

Sanitary Wastewater

Sanitary wastewater would be generated by the projected staff of 210 administrative, maintenance, and operating personnel after full build-out of the proposed Polk Power Station. Discharges from showers, wash basins, bathrooms, drinking fountains, and other facilities are expected to result in an estimated 10,500 gpd (based on 50 gpd/capita) of combined sanitary wastewater flow.

The proposed sanitary waste treatment system would be an extended aeration type package unit capable of handling 10,500 gpd. The treatment system would be designed to ensure compliance with the following state effluent limitations expressed in Chapter 17-600.400, FAC: BOD, 20 mg/L; TSS, 20 mg/L; and pH, between 6 and 8.5. Disinfection would be designed to reduce fecal coliform to a maximum of 200 most probable number (MPN)/100 mL. This effluent would be discharged to the cooling reservoir for further treatment and reuse in the heat dissipation system.

Industrial Wastewater

Table 2.3.8-1 provides the estimated monthly average build-out process flows from each of the wastewater streams. Wastewater from potable and process water treatment and from facility operation, would fall within one of five categories included in the EPA NSPS for steam electric power generating point sources (40 CFR 423.15): low volume wastes, chemical metal cleaning wastes, once-through cooling water, and cooling tower blowdown. Effluent from all industrial wastewater sources would ultimately be discharged to the cooling reservoir for further treatment and reuse in the cooling system.

The low volume wastes would mainly consist of equipment area drains, laboratory wastes, boiler blowdown, and makeup water treatment system waste (filter backwash, RO concentrate, and demineralizer regeneration wastes). This waste stream would typically contain high concentrations of TSS and TDS and possibly minute amounts of plant chemicals or some trace metals, such as copper and iron.

The chemical metal cleaning wastes would contain dirt, organic matter, oil and nonhazardous detergent, variable pH, high TSS, and trace metals, such as copper and iron. These wastes would not be discharged to the cooling reservoir or to surface waters, but would be removed from the site by a licensed contractor for disposal at a licensed disposal facility.

Condenser cooling water would be drawn from the cooling reservoir, recirculated through noncontact cooling loops and discharged back to the reservoir. An oxidizing biocide (e.g., sodium hypochlorite) would be used to protect the cooling system from biological growths.

Table 2.3.8-2 lists the effluent guidelines that apply to the five categorized wastewaters. The IWT system would be designed to achieve the TSS, oil and grease, metals, and pH effluent guidelines for the respective waste streams.

Cooling Water Biocides

The recirculating cooling water would be chlorinated prior to entering the condensers to control the growth of fouling organisms within the cooling system. A maximum of 0.2 mg/L of total residual chlorine would be maintained in the system to the point of discharge to the reservoir.

Chlorine would also be discharged by the sanitary wastewater treatment plant at a concentration of 0.2 mg/L. The reservoir water quality model predicts a blowdown chlorine concentration of 0.0007 mg/L.

Storm Water

Storm water runoff from the slag and H_2SO_4 storage areas; the immediate areas of the power blocks for all the proposed generating units; and paved equipment areas associated with gasification and other process units would be routed to the overall IWT system. Storm water runoff from the other areas associated with industrialized activity on the main power plant facilities site would be collected and routed to the storm water detention basin that would be constructed on the site. The storm water detention basin would comprise approximately 21 acres and would receive the majority of runoff from the main power plant facility area.

The storm water management basin would be designed to detain in excess of the first inch of runoff resulting from the 25-year, 24-hour storm event, in accordance with applicable SWFWMD and Polk County storm water management detention and treatment requirements. Overflow discharges from these basins would be routed through a series of reclaimed wetland and lake areas prior to discharging to the Little Payne Creek headwaters.

Potential impacts to surface waters (and perhaps underlying shallow groundwater) could occur from accidental spills of fuel oil, which would be used as a backup fuel throughout the life of the Polk Power Station. This possibility would be minimized by providing secondary containment around the fuel oil handling and storage facilities in accordance with the requirements of National Fire Protection Association (NFPA) 30 and FAC Chapter 17-762.500. The containment system would consist of an earthen berm lined with a material impervious to the fuel oil, and be capable of holding 110 percent of the volume of one of the three planned storage tanks (3 million gallons each) in the unlikely event of a tank failure.

Storm water collecting in the fuel oil storage area would be routed to an oil/water separator, and thence to the wastewater equalization basin. Inspection and maintenance of the system would be performed according to a Spill Prevention and Control Countermeasure (SPCC) plan developed in conformance with the requirements of 40 CFR 112.7. These procedures call for routine inspection of all facilities, and observation of all storm water for the presence of oily sheen before discharge from the storage area. If a sheen is present, cleanup procedures would be performed.

The measures set forth in the SPCC plan, groundwater monitoring plan, and surface water monitoring, are intended to prevent spills, detect any leak or spill, and clean up any potential spill. As shown in Table 2.3.4-2, the more toxic components of the fuel oil such as naphthalene, benzene, and lead comprise a small percentage (less than one percent). This fact, in conjunction with the measures outlined in these plans, would minimize the potential for impact to wildlife or humans from the use of fuel oil.

Water Quality Modeling

The quality of the wastewater, storm water, and makeup water streams will affect the water quality of the reservoir water based on their relative quantities. Table 2.3.6-1 presents the estimated water quality of wastewater and supply streams discharging to the cooling reservoir. Modeling was performed by Tampa Electric Company (TEC, 1992a) to predict the long-term water quality in the reservoir considering various makeup water, blowdown, and treatment scenarios. The Modular Three-Dimensional Finite Difference Groundwater Flow Model (MODFLOW) released in 1991 (McDonald and Harbaugh, 1988) was used for water flows and chemical mass balance. The Enhanced Stream Water Quality Model (QUAL2E) version 3.12, January 1991, was utilized to determine biologically affected changes in parameters, such as DO, BOD, organic nitrogen, ammonia, nitrite, and nitrate.

The modeling results indicated that the optimum design with the least hydrologic and water quality effects, for both surface water and groundwater, would be a recirculating system having the following design and operating features:

- The reservoir would receive and reuse treated water from the IWT system, sanitary treatment plant, oil/water separators, and RO units. The average quantity of the reused water would be approximately 1.1 mgd.
- The reservoir would be replenished by groundwater from the Floridan aquifer at an average annual rate of approximately 4.7 mgd (or approximately 5.0 mgd to allow for design contingency).
- The reservoir would have an average continuous discharge of approximately 3.1 mgd to control the water quality in the reservoir and of off-site discharges.

The reservoir blowdown structure (Outfall 001) would be utilized to prevent continuous accumulation of dissolved material in the reservoir (Figure 4.2.1-1). Outfall 001 would discharge to the reclaimed lake located along the eastern edge of the reservoir and within the project site. This lake would discharge through a swale to the headwaters of Little Payne Creek.

The results of the MODFLOW and QUAL2E water quality modeling are presented in Table 2.3.6-2. The model predicted that water quality would fluctuate slightly with season and gradually change over time until an equilibrium condition is reached. The values shown are the maximum concentration of each constituent in the reservoir, during a normal year's operation, after the equilibrium condition had been reached. The Florida Class III surface water quality standards (Chapter 17-302, FAC) are also shown in Table 2.3.6-2. Comparison of the results with the standards indicates that cooling reservoir blowdown discharge throughout the year will comply with state surface water quality standards.

Based on the results of the QUAL2E model, the discharges of treated storm water runoff and treated sanitary wastewater to the reservoir will have a fecal coliform concentration of no more than 200 MPN/100 mL. With this loading rate, the long-term fecal coliform concentration will be less than 1 MPN/100 mL, even if the lowest die-off rate found in literature was used for the calculation. Therefore, bacteria in the reservoir will not cause human health concerns or violate water quality standards (TEC, 1992a).

No water quality standard exists for some parameters, so the values were compared to typical values for Florida streams (FDER, 1989) to estimate potential impacts. The estimated concentrations of BOD (0.7 mg/L), total nitrogen (TN) (1.53 mg/L), TP (1.49 mg/L), and TSS (10.9 mg/L) in blowdown water rank in approximately the best 10^{th}, 65^{th}, 92^{nd}, and 67^{th} percentiles, respectively, for Florida streams. The BOD concentration in blowdown water would be very low. Percentiles for the other parameters ranked in the worse two-thirds of Florida streams in the database used by FDER (1989). However, compared to existing water quality measured by Tampa Electric Company (TEC, 1992a) and FDER/PSES (1989) at nearby lakes and streams (see Section 3.2.3), these concentrations do not indicate a significant effect.

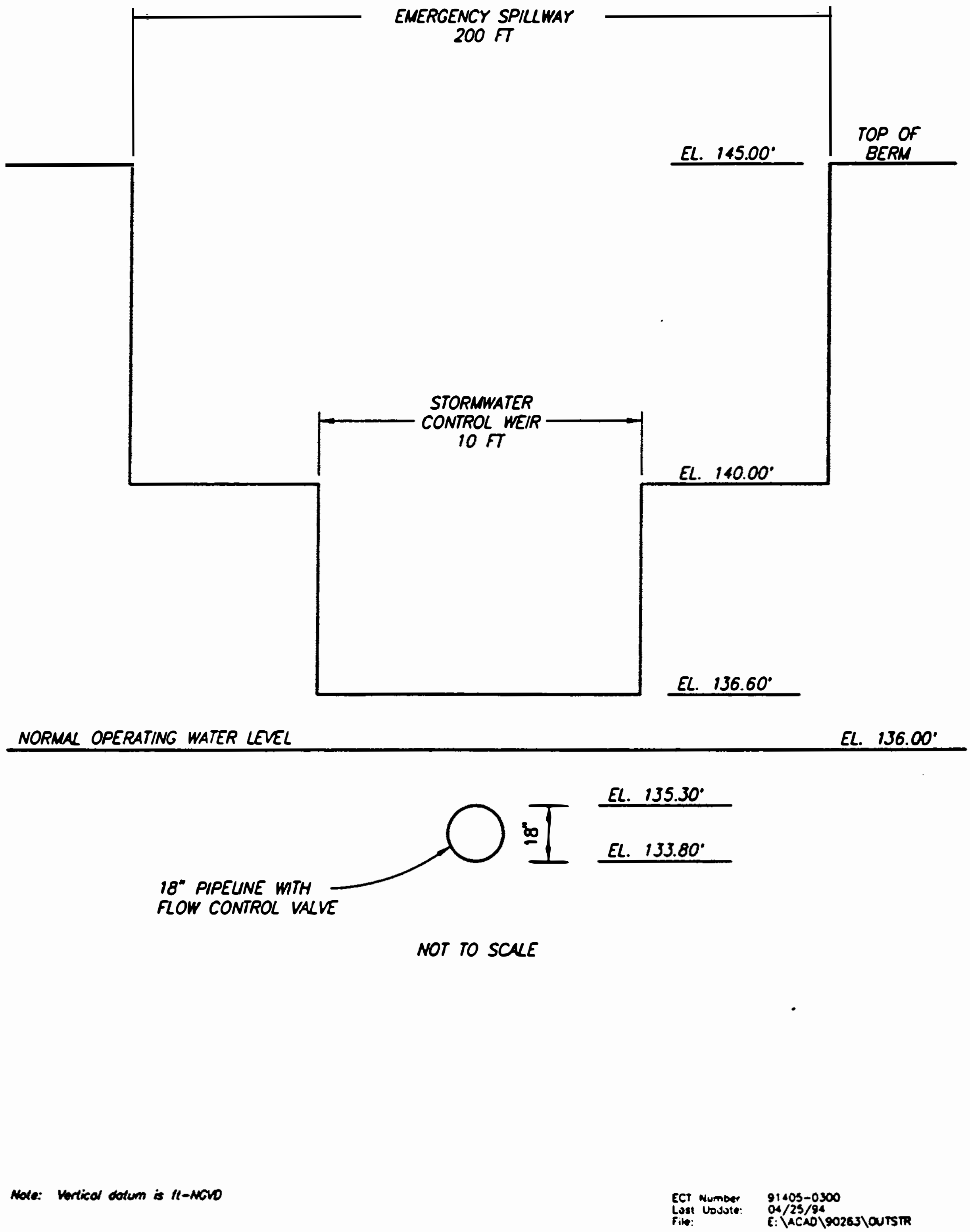

FIGURE 4.2.1-1.
Cooling Reservoir Outfall Structure.

SOURCES: ECT, 1992; TEC, 1992a.

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The predicted TN concentration of 1.53 mg/L is less than the average TN (1.6 mg/L) observed in Little Payne Creek. Other stations ranged from 0.72 to 4.18 mg/L.

The predicted TP concentration of 1.49 mg/L is greater than observed values in Little Payne Creek but is within the range of values observed in other nearby streams and lakes of 0.17 to 6.10 mg/L. The average TP concentrations at three sites on the South Prong Alafia River near the proposed Polk Power Station site were reported by FDER/PSES (1989) to range from 3.05 to 6.88 mg/L.

The TP concentration in blowdown discharge (1.49 mg/L TP) is approximately three times the typical concentrations in Little Payne Creek (SW-5, 0.37 mg/L to 0.61 mg/L TP). During periods of low flow in Little Payne Creek, such as during the February 25, 1991, sampling event (approximately 3.7 mgd, 0.51 mg/L), the 3.1 mgd from blowdown would contribute almost half of the streamflow at SW-5 to produce a composite concentration of approximately 1.0 mg/L. This concentration of TP is not sufficient to result in nuisance conditions in Little Payne Creek nor interfere with the Class III uses since the composite concentration under low flows is near the low end of observations for streams in the site vicinity. Flows typically range three to ten times higher, so the contribution of TP from the blowdown to the creek would be proportionately reduced.

The predicted TSS concentration (10.9 mg/L) falls within the lower range of TSS concentrations for the various lake and stream stations monitored by Tampa Electric Company (TEC, 1992a), which averaged from 6 to 33 mg/L. Five of the Tampa Electric Company stations averaged 11 mg/L or greater (TEC, 1992a).

Thermal Impacts

To evaluate the potential temperature effects of the cooling reservoir operation on the receiving water at Outfall 001, a thermal balance and thermal model were used by Tampa Electric Company (TEC, 1992a) to predict the monthly water temperatures of the cooling reservoir discharges. The methodology of the thermal model is described in Peterson (1971) and the EPA publication by Tetra Tech (1985). The model included the effects of short-wave solar radiation, long-wave atmospheric radiation, heat load from the power plant, reflected short-wave solar radiation, reflected long-wave atmospheric radiation, long-wave back radiation, conductive heat loss, and evaporative heat loss. The forced evaporation due to warmed water was computed according to Harbeck (1964). Various meteorological data, including air temperature, dew point temperature, relative humidity, and wind speed were used for the model inputs (TEC, 1992a).

The water temperature of the reservoir was computed for two scenarios: (1) normal, expected operating conditions, and (2) full load for a full year (highly unlikely) conditions. The monthly temperatures at the water intake, the point of blowdown discharge, and within the reclaimed lake receiving water body are shown in Table 4.2.1-3 for average operating conditions. Monthly

Table 4.2.1-3. **Heat Budget Summary for the Proposed Tampa Electric Company Polk Power Station Cooling Pond--Average Load Conditions**

Item	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ambient air temperature	°F	61.2	62.7	66.0	71.4	76.8	80.6	81.6	82.0	80.5	74.7	66.8	62.3
Ambient air relative humidity	%	75.5	73.0	73.5	71.0	68.5	73.5	76.5	79.0	77.0	76.0	75.5	75.8
Ambient air water vapor pressure	mm Hg	10.4	10.6	12.0	13.9	16.1	19.5	21.0	22.0	20.4	16.6	12.7	10.9
Barometric pressure	mb	1,017	1,016	1,015	1,014	1,012	1,013	1,014	1,014	1,013	1,014	1,015	1,017
	mm Hg	782	781	780	780	778	779	780	780	779	779	781	782
Wind speed	mph	9.1	9.7	10.0	9.7	9.2	8.4	7.6	7.4	8.6	9.1	8.9	8.9
Cloud cover	%	53	47	48	47	46	58	63	61	60	47	46	52
Solar radiation, shortwave at surface	$Btu/ft^2/day$	1,210	1,447	1,754	1,994	2,205	2,124	1,976	1,828	1,672	1,480	1,317	1,110
Net shortwave solar radiation	$Btu/ft^2/day$	1,174	1,403	1,701	1,934	2,139	2,060	1,917	1,773	1,622	1,436	1,278	1,077
Net longwave atmospheric radiation	$Btu/ft^2/day$	2,348	2,359	2,472	2,639	2,817	3,070	3,168	3,195	3,106	2,795	2,503	2,380
Longwave back radiation	$Btu/ft^2/day$	2,986	3,039	3,154	3,291	3,424	3,542	3,576	3,581	3,501	3,321	3,118	2,991
Evaporative heat loss	$Btu/ft^2/day$	518	674	893	1,146	1,404	1,442	1,356	1,242	1,136	859	628	467
Conductive heat loss	$Btu/ft^2/day$	25	56	119	127	121	144	149	140	92	45	28	(7)
Discharge flow	cfs	550	550	550	550	550	550	550	550	550	550	550	550
Reservoir area	acres	727	727	727	727	727	727	727	727	727	727	727	727
Thermal exchange coefficient	$Btu/ft^2/day$	170	186	207	221	230	229	216	212	230	214	184	169
Relative humidity at pond surface	%	100	100	100	100	100	100	100	100	100	100	100	100
Vapor pressure (sat'd at pond surface)	mm Hg	19.9	21.1	24.1	28.3	32.9	37.6	39.9	40.2	36.5	29.7	23.6	20.4
Plant load factor	%	75	75	75	75	75	75	81	81	81	78	78	78
Heat load to cooling pond	$Btu/ft^2/day$	1,410	1,410	1,410	1,410	1,410	1,410	1,520	1,520	1,520	1,460	1,460	1,460
Natural water equilibrium temperature	°F	61.9	64.2	69.1	74.7	80.0	84.6	85.9	86.1	83.0	75.9	67.6	62.1
Thermal increase	°F	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Temperature at condenser intake	°F	63.8	65.7	70.2	75.6	80.8	85.4	87.2	87.4	84.1	77.0	69.3	64.3
Hot side temperature	°F	83.8	85.7	90.2	95.6	100.8	105.4	107.2	107.4	104.1	97.0	79.3	84.3
Blowdown temperature	**°F**	**64.2**	**66.0**	**70.5**	**75.9**	**81.1**	**85.7**	**87.5**	**87.7**	**84.3**	**77.3**	**69.7**	**64.7**
Delta-T (blowdown, ambient)	**°F**	**2.3**	**1.8**	**1.4**	**1.2**	**1.1**	**1.1**	**1.6**	**1.6**	**1.3**	**1.4**	**2.1**	**2.6**

Note: mm Hg = millimeters of mercury.
mb = millibar.
$Btu/ft^2/day$ = British thermal unit per square foot per day.

Sources: ECT, 1992; TEC, 1992a.

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temperatures for full load conditions for a year, which are highly unlikely to occur, are shown in Table 4.2.1-4.

The results of the thermal analysis predicted that under normal operating conditions the water temperature of the cooling reservoir blowdown would not be higher than the receiving water (reclaimed lake) by more than 3.0°F. The worst month of the year in terms of thermal stress is December when the discharge temperature is 64.7°F, approximately 2.6°F above ambient water temperature. The highest discharge temperature would occur in August when the blowdown is 87.7°F, approximately 1.6°F above the ambient temperature. FDEP water quality standards (Chapter 17.302, FAC) state that thermal discharge should not exceed 92°F and should not be more than 3°F higher than the ambient temperature of a receiving lake. Therefore, under normal operating conditions, the cooling reservoir discharge would meet these standards and would not have significant adverse effect in the receiving water (the on-site reclaimed lake to the east of the cooling reservoir).

Under the highly unlikely scenario of the plant facilities operating at full load for one year, the discharge temperature would be 66.2°F in December, approximately 4.1°F above receiving lake temperature, which would exceed the FDEP standards. As shown in Table 4.2.1-4, this temperature standard is also predicted to be exceeded in January, February, and November under these unlikely full load for one year operating conditions. The maximum blowdown temperature is predicted to be 88.7°F in August, approximately 2.6°F above receiving lake temperature. This thermal analysis scenario assumed that the plant loads are 100 percent at all times during the year and for all units after full build-out. Such full load conditions are unlikely to occur, and if they do, would only occur for a few days per year. Therefore, the results of the analysis are extremely conservative (TEC, 1992a). To assess the potential thermal impacts of the cooling water blowdown in the receiving lake under the highly unlikely conditions (long-term full load in December), a mixing zone analysis was conducted by Tampa Electric Company (TEC, 1992a). The thermal mixing zone analysis used a conservative approach in that only the effects of heat exchange in the receiving water were considered, while turbulent mixing, a more effective mechanism of temperature reduction, was not considered in the analysis. Table 4.2.1-5 presents the results of the thermal mixing zone analysis that indicate that within an approximately 200-ft distance from the point of discharge, the temperature would be reduced to less than 3°F above the ambient temperature in the receiving water body. The receiving reclaimed lake is approximately 3,800 ft long and 900 ft wide. This 200-ft radius mixing zone represents approximately 1.8 percent of the total lake surface area.

In addition to the continuous blowdown structure, a 10-ft wide overflow weir would be provided at Outfall 001 to drain excessive rainfall during extreme storm events. The storm water overflow structure would be designed to allow for storm water overflow for storm events greater than 7.2 inches.

Table 4.2.1-4. Heat Budget Summary for the Proposed Tampa Electric Company Polk Power Station Cooling Pond--Full Load Conditions for a 1-Year Period

Item	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ambient air temperature	°F	61.2	62.7	66.0	71.4	76.8	80.6	81.6	82.0	80.5	74.7	66.8	62.3
Ambient air relative humidity	%	75.5	73.0	73.5	71.0	68.5	73.5	76.5	79.0	77.0	76.0	75.5	75.8
Ambient air water vapor pressure	mm Hg	10.4	10.6	12.0	13.9	16.1	19.5	21.0	22.0	20.4	16.6	12.7	10.9
Barometric pressure	mb	1,017	1,016	1,015	1,014	1,012	1,013	1,014	1,014	1,013	1,014	1,015	1,017
	mm Hg	782	781	780	780	778	779	780	780	779	779	781	782
Wind speed	mph	9.1	9.7	10.0	9.7	9.2	8.4	7.6	7.4	8.6	9.1	8.9	8.9
Cloud cover	%	53	47	48	47	46	58	63	61	60	47	46	52
Solar radiation, shortwave at surface	Btu/ft^2/day	1,210	1,447	1,754	1,994	2,205	2,124	1,976	1,828	1,672	1,480	1,317	1,110
Net shortwave solar radiation	Btu/ft^2/day	1,174	1,403	1,701	1,934	2,139	2,060	1,917	1,773	1,622	1,436	1,278	1,077
Net longwave atmospheric radiation	Btu/ft^2/day	2,348	2,359	2,472	2,639	2,817	3,070	3,168	3,195	3,106	2,795	2,503	2,380
Longwave back radiation	Btu/ft^2/day	2,986	3,039	3,154	3,291	3,424	3,542	3,576	3,581	3,501	3,321	3,118	2,991
Evaporative heat loss	Btu/ft^2/day	518	674	893	1,146	1,404	1,442	1,356	1,242	1,136	859	628	467
Conductive heat loss	Btu/ft^2/day	25	56	119	127	121	144	149	140	92	45	28	(7)
Discharge flow	cfs	550	550	550	550	550	550	550	550	550	550	550	550
Reservoir area	acres	727	727	727	727	727	727	727	727	727	727	727	727
Thermal exchange coefficient	Btu/ft^2/day	180	196	216	230	239	237	222	218	236	223	193	177
Relative humidity at pond surface	%	100	100	100	100	100	100	100	100	100	100	100	100
Vapor pressure (sat'd at pond surface)	mm Hg	21.9	23.0	26.1	30.5	35.3	40.0	41.8	42.1	38.3	31.7	25.6	22.1
Plant load factor	%	100	100	100	100	100	100	100	100	100	100	100	100
Heat load to cooling pond	Btu/ft^2/day	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870
Natural water equilibrium temperature	°F	61.9	64.2	69.1	74.7	80.0	84.6	85.9	86.1	83.0	75.9	67.6	62.1
Thermal increase	°F	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Temperature at condenser intake	°F	65.3	67.0	71.3	76.6	81.7	86.4	88.0	88.3	84.8	78.0	70.5	65.7
Hot side temperature	°F	85.3	87.0	91.3	97.6	101.7	106.4	108.0	108.3	104.8	98.0	90.5	85.7
Blowdown temperature	**°F**	**65.9**	**67.5**	**71.7**	**77.0**	**82.1**	**86.7**	**88.4**	**88.7**	**85.2**	**78.4**	**71.0**	**66.2**
Delta-T (blowdown, ambient)	**°F**	**4.0**	**3.3**	**2.6**	**2.3**	**2.1**	**2.1**	**2.5**	**2.6**	**2.2**	**2.5**	**3.4**	**4.1**

Note: mm Hg = millimeters of mercury.
mb = millibar.
Btu/ft^2/day = British thermal unit per square foot per day.

Sources: ECT, 1992; TEC, 1992a.

Table 4.2.1-5. Thermal Mixing Zone Analysis

Distance (ft)	Temperature Difference (°F)	Water Temperature (°F)
0	4.10	66.2
50	3.99	66.1
100	3.68	65.8
200	2.67	64.8
300	1.56	63.7
400	0.73	62.8
500	0.28	62.4
1,000	0.00	62.1

Note:
Blowdown rate = 3.1 MGD.
Heat exchange coefficient = 177 Btu/ft^2/day/°F.
Water depth = 15 ft.
Ambient water temperature = 62.1°F.
Temperature at POD = 66.2°F.

Sources: ECT, 1992; TEC, 1992a.

Although extreme storm events (i.e., 25-year, 24-hour) would create greater discharge, up to 8.2 cfs, from the cooling reservoir than under the normal operating conditions, the on-site runoff into the reclaimed lake would significantly mix the reservoir blowdown as discussed in the SCA Section 3.8.4 (TEC, 1992a). The maximum mixing ratio was estimated at approximately 83:1 at the peak of the storm, decreasing to 1.7:0 after 300 hours (12.5 days) when the predicted reservoir discharge has dropped to 5.5 cfs. In addition to the mixing effects of the on-site runoff, the precipitation will also provide further cooling. Therefore, the increased warmed water discharge from the reservoir during extreme storm events may not create a greater mixing zone than under normal conditions (TEC, 1992a). To quantify the size of the mixing zone during extreme storm events, however, an even more conservative approach than the one described above was used. The analysis assumed the following:

- Cooling reservoir discharge is at a constant rate of 8.2 cfs, which is the predicted peak discharge
- Mixing flow (up to 83:1 mixing ratio) is ignored in the analysis
- Turbulent mixing is ignored
- Cooling effects of the precipitation is neglected
- Only the surface heat exchange is considered in the analysis

The size of the mixing zone given the above conservative assumptions is calculated to be less than 250 ft from the point of discharge, and is estimated to represent approximately 2.9 percent of the total receiving reclaimed lake area.

Based on the results of the thermal and mixing zone analyses, the normal operation of the cooling reservoir would cause no adverse effects in the receiving reclaimed lake. Only during full load and with extremely high water level in the reservoir would a mixing zone of approximately 250-ft radius from point of discharge be expected. The location and size of this highly unlikely thermal mixing zone is shown in Figure 4.2.1-2. The cooling reservoir discharge would have no thermal effects on off-site receiving water bodies (Little Payne Creek) (TEC, 1992a).

In summary, State of Florida Class III water quality standards for receiving water bodies would be met at the point of discharge under expected operating conditions. Under highly unlikely operating conditions, the state standard for receiving lakes (3°F limit above receiving lake temperature) would be met beyond the mixing zone, an area of less than 250 ft from the point of discharge.

It has been determined by EPA that possible variances for thermal discharges under the CWA are not necessary for the proposed project. Section 316(a), which provides for effluent limitations to protect aquatic organisms and wildlife, is not applicable since the proposed discharge is expected to meet surface water quality standards at the edge of the mixing zone. Section 316(b), which seeks to minimize environmental effects from intake structures, does not apply since the cooling water source is groundwater.

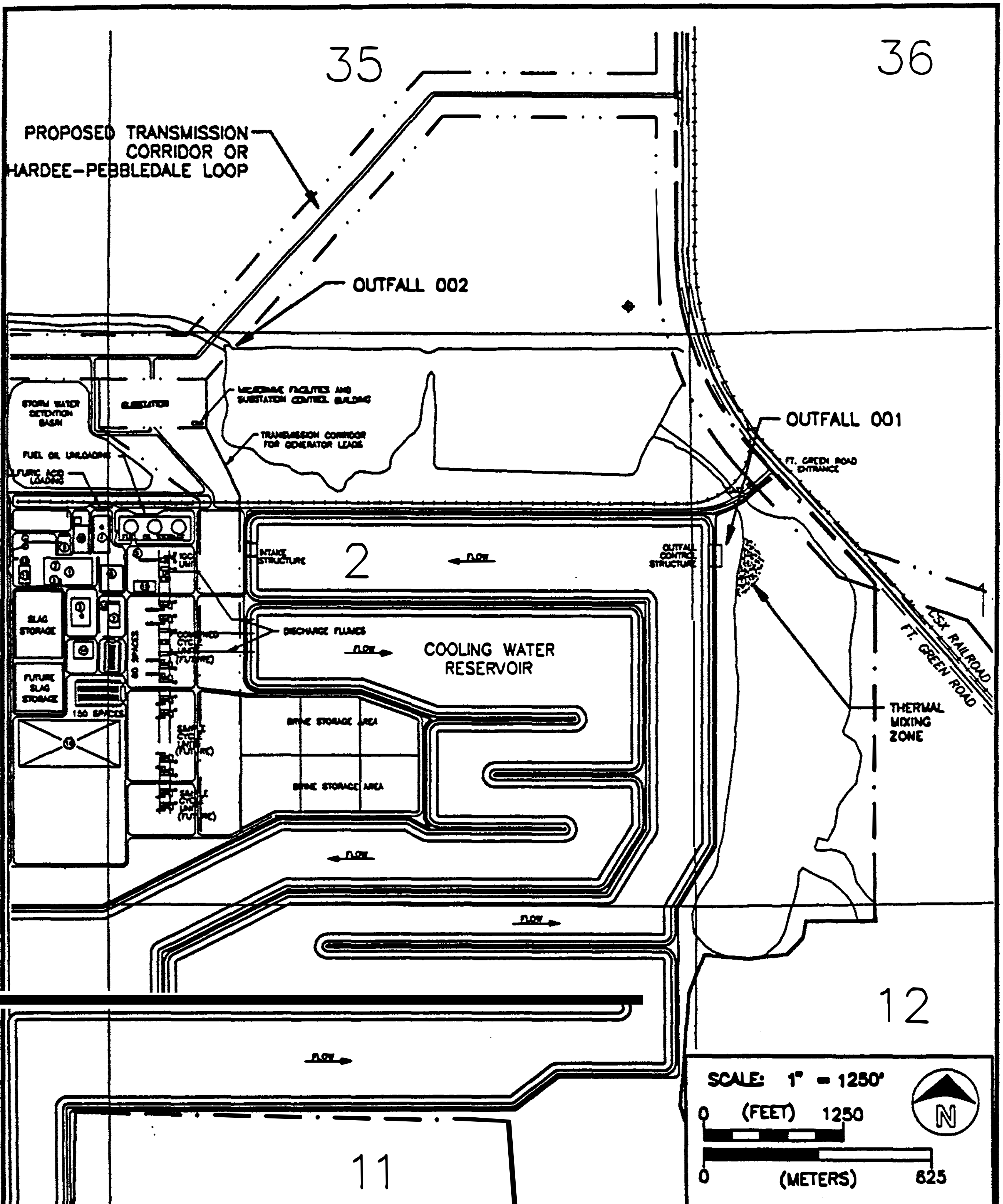

FIGURE 4.2.1-2.
Thermal Mixing Zone (Full Load and Maximum Discharges).

SOURCES: UEC, 1992; ECT, 1992; TEC, 1992a.

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4.2.2 Alternative: Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance)

The use of PC instead of the proposed IGCC technology would not significantly change the effects on surface water resources. A 500-MW PC unit would be required to replace the proposed 260-MW IGCC and two of the CT units. The 500-MW PC would require approximately twice as much coal as the proposed IGCC and would generate over four times as much solid by-products. The storage areas for these materials (i.e., ash and gypsum) would have to be significantly increased.

The larger coal and solid by-product storage areas for the PC unit would increase storm water runoff from these areas. The runoff from the ash and gypsum storage areas would have somewhat of a different chemical composition. These minor differences could be compensated for by adjusting the design parameters of the storm water collection and treatment systems for the coal, gypsum, and ash pile runoff such that no additional effects result. However, since the proposed CG facility for the IGCC unit has zero-process water discharge and coal storage silos rather than open coal piles, the use of PC would result in more process wastewater and storm water runoff from the larger coal and by-product storage areas being discharged to the cooling reservoir, which could potentially degrade water quality within the reservoir without more extensive treatment. The PC facility would also require more cooling water and a significantly larger cooling reservoir, and thus would result in additional land area commitments on the site and increased blowdown discharge to receiving waters. The increased blowdown would probably not cause a significant hydrologic effects.

Cooling reservoir water quality may be decreased with the PC alternative due to more process and storm water runoff discharge; however, this impact may be offset by dilution from the increased makeup water from the Floridan aquifer or more extensive treatment of the process and runoff waters. The thermal mixing zone in the reclaimed lake under extreme full-load conditions may expand, but design changes and expansion of the cooling reservoir would minimize this effect.

4.2.3 Alternative: No Action

The No-Action Alternative would result in the site being reclaimed as lakes, wetlands, and uplands within drainage basins resembling premining conditions in accordance with FDEP reclamation requirements. This condition would not be expected to result in any significant impacts to surface water resources. On-site wetlands and lakes would provide some storm water detention/retention to reduce downstream flooding and supply some supplemental water during dry periods. After reclamation, the reclaimed upland areas would be available for other uses. Historically such reclaimed land has been used as citrus grove and cattle pasture. Therefore, the 1,511-acre area to the west of SR 37 may not be allowed to develop as a managed wildlife habitat/corridor area as planned under the proposed project.

4.2.4 Comparison of Impacts

Hydrologic effects would be greatest under the PC alternative due to its larger land area and makeup water requirements for the cooling water reservoir and blowdown discharge. Water quality effects may also be greater under the PC alternative since the proposed IGCC has zero-process water discharge at this facility. These differences in effects may not be significant if the blowdown discharge for the PC alternative meets all applicable water quality and thermal criteria during typical annual operations.

The IGCC alternative probably provides the most stable hydrologic regime for Little Payne Creek. Blowdown would provide small but steady flow to the headwaters, and storm water management systems would control peak storm discharges.

4.3 GROUNDWATER IMPACTS

4.3.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

The proposed Polk Power Station would have potential impacts on groundwater hydrology and water quality. Potential impacts to groundwater hydrology and quality would result primarily from four events: construction and reclamation activities (dewatering for the cooling water reservoir and structures below the water table); withdrawal of cooling water reservoir makeup, potable, and process water from the upper Floridan aquifer; seepage of the cooling reservoir water into the surrounding water table (surficial aquifer); and accidental spills of substances which would potentially reach the surficial aquifer.

4.3.1.1 Construction-Related Impacts

No significant long-term effects to groundwater resources are expected to result from construction of the proposed Polk Power Station. The proposed site preparation and facility construction activities for the Polk Power Station would have short-term effects on groundwater in the surficial aquifer within and adjacent to the site due to temporary dewatering activities. Dewatering would last for approximately one year and would occur primarily during the excavation and construction activities for the cooling reservoir and reclaimed wetland areas within mined-out areas on the site. Some additional temporary (3 to 7 months) dewatering would also be required for several plant facilities that have foundations or locational requirements below the water table (TEC, 1992a).

These temporary dewatering activities are expected to be of similar scales and have similar effects on the surficial aquifer system as the previous and ongoing phosphate mining activities and during the agency-required land reclamation activities for mined-out lands in the central Florida phosphate district. These activities are not anticipated to affect the intermediate and Floridan aquifers within or near the site due to the thick confining layers present (see Section 3.3). Therefore, the proposed temporary dewatering activities for the Polk Power Station are not expected to adversely effect on-site and off-site sources of groundwater.

The primary dewatering requirements would involve the excavation, earthmoving, and construction activities for the cooling reservoir and its surrounding and internal berms, and for the reclaimed wetland areas within mined areas on the site. The proposed use of existing mine cuts for construction of the cooling reservoir would limit the amount of disturbance to soils and groundwater systems required for the facility. Since the average design bottom elevation of the cooling reservoir is 120 ft-NGVD, the reservoir area would need to be dewatered to a depth of approximately 119 to 120 ft-NGVD to allow for the proposed earthmoving activities. This would also be the approximate dewatering depth for the on-site mining activities.

The areas to the west and northwest of the main power plant facilities to be reclaimed as wetlands (i.e., Subareas B and C in Figure 4.3.1-1) would have bottom elevations of approximately

129 ft-NGVD. Therefore, these areas would need to be dewatered only to this depth, instead of the 120-ft-NGVD depth for the cooling reservoir areas.

The site preparation and construction activities for the cooling reservoir, main plant facilities, and adjacent reclaimed wetland areas on the site tract to the east of SR 37 would involve the sequential dewatering of five subareas, shown in Figure 4.3.1-1. One subarea at a time would be dewatered to allow for earthmoving and other construction activities, and the other subareas would be used for water storage. The proposed schedule and plan for these dewatering activities, including the modeled, estimated dewatering withdrawal rates, are provided in Table 4.3.1-1. No withdrawn water would be anticipated to be discharged off site, except to enhance mitigation efforts at off-site recharge ditches (see Monitoring Plan and Construction Dewatering Monitoring and Mitigation Plan, DEIS, Appendix S).

The proposed withdrawals from the surficial aquifer system would be balanced by the increased infiltration of water from the adjacent water storage subareas, since this water would be retained on site. The anticipated surficial aquifer effects from dewatering activities for the cooling reservoir, plant facilities, and adjacent reclaimed wetland areas on the site tract to the east of SR 37 would be limited and short-term.

In order to assess the extent of potential impacts, a groundwater model of the surficial aquifer in the site and vicinity (approximately 26 mi^2) was developed by Tampa Electric Company (TEC, 1992a) using MODFLOW (McDonald and Harbaugh, 1988) developed by the USGS. This model is widely used and accepted in hydrogeologic studies. MODFLOW is capable of simulating confined, unconfined, and semi-confined aquifer conditions with groundwater at steady state or transient conditions.

A model grid of the site (Figure 4.3.1-2), 4.8 by 5.4 miles, was established to cover the cooling reservoir and adjacent areas that may experience some effects of the drawdown. The grid density, and thereby model resolution, was increased in the immediate area of the cooling reservoir. The unique hydrogeologic conditions resulting from previous mining activities, a combination of unconfined and small areas of confinement, were modeled using data from a number of well logs and borings within the study area and applicable literature, primarily Ryder, 1985. The surface water within mine cuts was modeled using the zones of high transmissivity and high storage/porosity (TEC, 1992a). Although some limited hydraulic connection between the surficial and upper intermediate aquifers may exist, the two are typically separated by fairly thick and impermeable confining layer. Due to this condition, the upper intermediate aquifer was not explicitly modeled.

The model was calibrated using observed data for May 1991, and the model verification was performed against observed data for October 31, November 19, and December 31, 1991. Mean error for groundwater elevations at the five well locations ranged from 0.1 to -1.3 ft. Root mean squared

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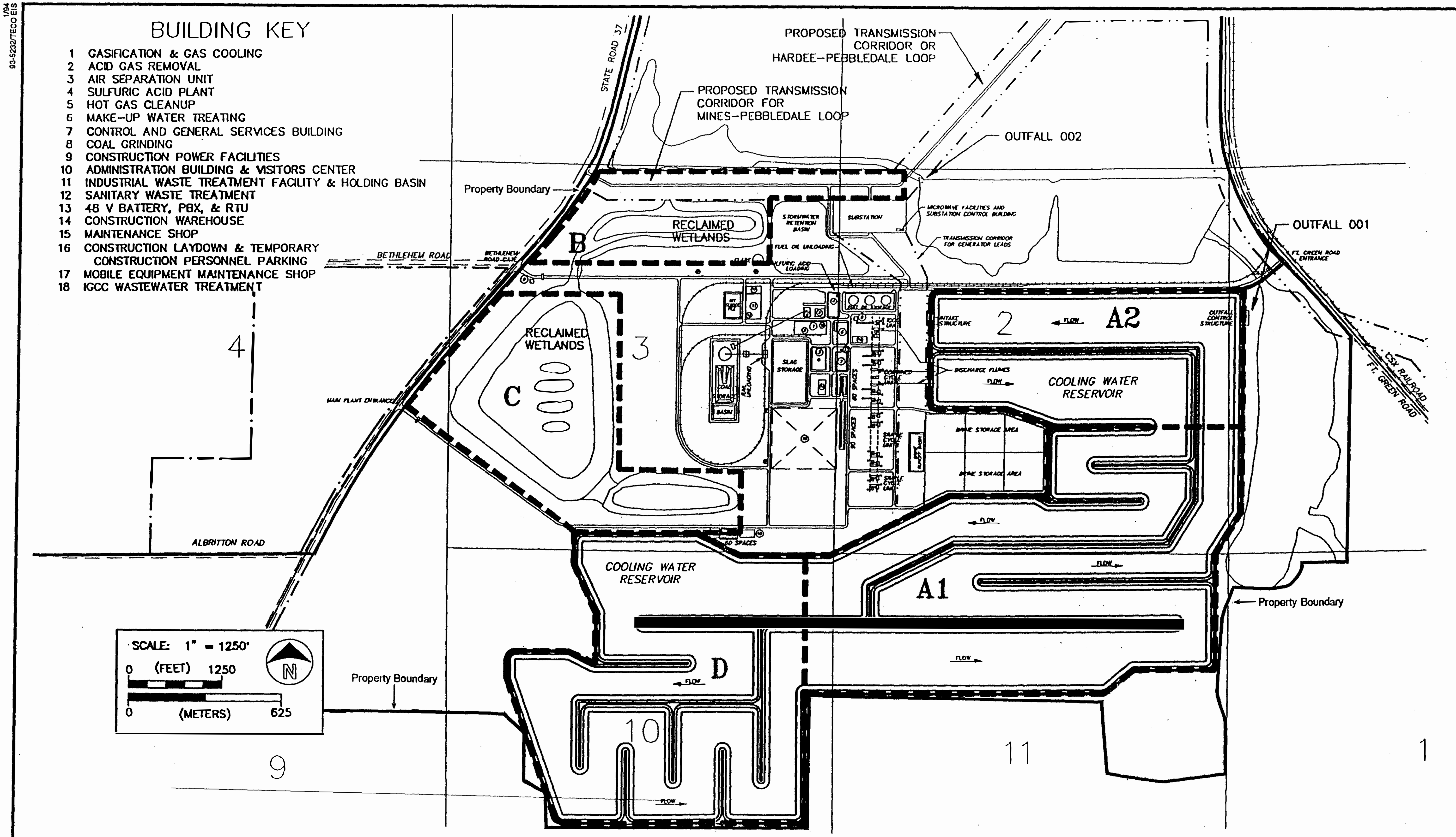

FIGURE 4.3.1-1.
Dewatering Subareas for Cooling Water Reservoir and Wetland Areas.

SOURCES: ECT, 1992; TEC, 1992a.

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Table 4.3.1-1. Tampa Electric Company's Proposed Dewatering Schedule and Plan Summary

Dates	Dewatered Units	Withdrawn Water Application to	Approximate Dewatering Duration (days)	Estimated Withdrawal Rates (gpd)	Estimated Withdrawal Rates (gpm)
		START DEWATERING			
1994	A1	A2 and D	31	87,478,000	60,749
	B	C	31	6,364,000	4,419
	A1	A2 and D	60	32,149,000	22,326
	B	C	60	42,223,000	29,322
	A1	A2 and D	61	34,090,000	23,674
	A2	A1	15	25,576,000	17,761
	A2	A1	61	9,605,000	6,670
		Removing berm 2		--	--
	D	A1 and A2	30	36,386,000	25,268
	C	A1 and A2	30	4,544,000	3,156
	D	A1 and A2	90	8,731,000	6,063
	C	A1 and A2	90	35,000	24
1995		FINISH DEWATERING			
			Average--1994	32,633,800	22,662
			Maximum month--1994	93,842,000	65,168
			Average--1995	8,766,000	6,088
			Maximum month--1995	8,766,000	6,088

Sources: UEC, 1992.
ECT, 1992.
TEC, 1992a.

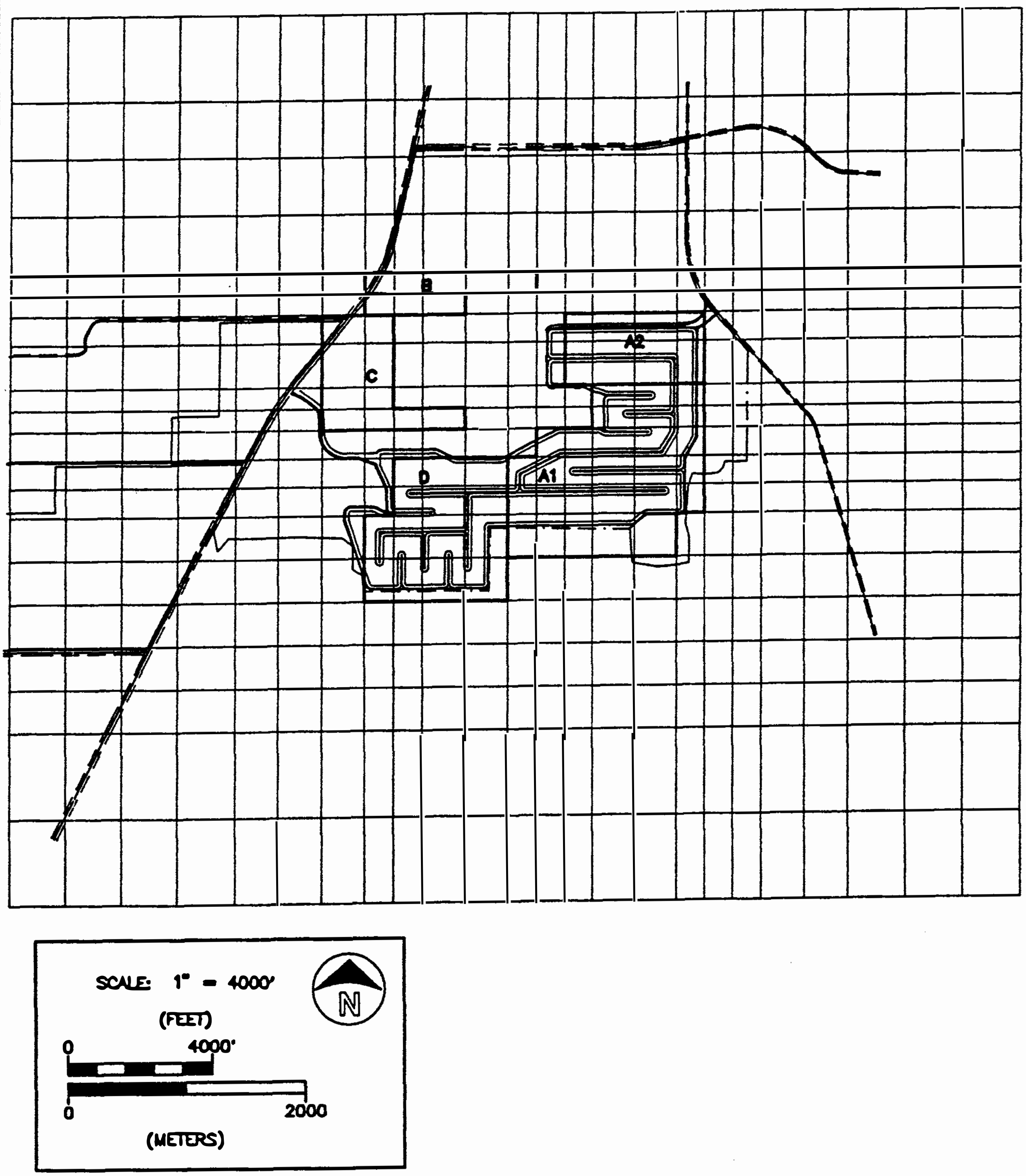

FIGURE 4.3.1-2.
Dewatering Units of Modeling Grid (Dewatering Simulation), Tampa Electric Company - Polk Power Station.
SOURCES: ECT, 1992; TEC, 1992a.

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error (RMS) ranged from 1.3 to 1.7. This was considered to be evidence of sufficiently accurate model development. The model was then run for the full period of construction using the pumpage and storage schedule presented in Table 4.3.1-1 and the storage areas shown in Figure 4.3.1-1.

The model results were presented by Tampa Electric Company (TEC, 1992a) as figures (maps) of modeled drawdown contours and groundwater elevation contours for the later stages of dewatering, which represents the maximum drawdown conditions. The drawdown contours reflect effects more clearly. An example of the model results is presented in Figure 4.3.1-3, which shows the drawdown contours for the proposed February 28, 1995, dewatering conditions. Drawdown contours typically peak at 12 ft within active dewatering areas (Subarea D).

Based on groundwater flow modeling analyses conducted for the project, the primary surficial aquifer drawdown effects would occur within the Polk Power Station site boundaries. Maximum short-term drawdowns at specific locations on the property line are observed when the adjacent subareas are being dewatered. Adjacent to Subarea B (northwest corner of site) drawdowns ranged up to 2 to 4 ft. Along the eastern boundary of the site maximum drawdowns were approximately 2 to 5 ft. The drawdown at the southern boundary, adjacent to the off-site clay settling ponds ranged up to 8 to 10 ft. These drawdown impacts would be of short duration since all dewatering activities should last less than one year. Detailed descriptions of the groundwater modeling analyses and results used to simulate and assess the proposed dewatering activities are provided in Appendix 11.7.6 of the SCA (TEC, 1992a).

Land uses immediately surrounding the Polk Power Station site that may be impacted by drawdowns are predominantly mining, with many previously mined areas currently classified as agricultural, and a few isolated residences. Three potential impact areas were identified by SWFWMD based on the revised surficial aquifer modeling results, to the northwest, northeast, and south of the Polk Power Station site. Temporary drawdowns greater than 0.5 ft in the surficial aquifer would not extend to any residences or crop/grove land uses identified on the land-use map. South of the site, adjacent to dewatering subareas D and A2, are phosphate-mined lands that currently consist of clay settling ponds. These ponds would not be adversely affected (possibly beneficially affected) by the dewatering since their purpose is to dewater suspended clay particles. Reclaimed phosphate mines lie across Fort Green Road to the northeast of the site where dewatering of Subarea A2 would result in maximum drawdowns ranging from 2 to 5 ft. This area contains reclaimed mine cuts, including lakes and wetlands. The reclaimed mines to the northwest of the site (owned by Agrico) consists primarily of pasture. The predicted drawdowns to the northwest and northeast impact areas would be monitored by wells and piezometers and, as needed, mitigated according to a SWFWMD-approved plan that incorporates the use of recharge ditches that would be filled with water by Tampa Electric Company and maintained as necessary to act as a barrier to the drawdown effects between the dewatering subareas and the off-site areas (TEC, 1992a) (see DEIS, Appendix S for details of the Construction Dewatering Monitoring and Mitigation Plan). Further, Tampa Electric Company has obtained written consent and waivers to allow off-site drawdowns from Agrico and American Cyanamid, which own the properties to the south and northwest of the Polk Power Station site, respectively (TEC, 1992a).

Potential for surficial groundwater contamination from off-site sources are low, due to the limited nature of the drawdowns and the lack of adjacent land uses that may introduce contaminants. Due to the short duration of the dewatering events, significant amounts of surficial groundwater should not be drawn from off-site sources. Potential sources of off-site contamination include the clay settling areas to the south and northwest from the site, and, if constructed, from the proposed Florida First Processing, Limited Partnership facility. Potential contamination from these sources would be monitored according to a FDEP and SWFWMD approved monitoring protocol (TEC, 1992a).

In addition to the cooling reservoir and reclaimed wetland areas, plant structures that would require dewatering activities for construction include:

- Underground water and sewer pipelines
- Water pumping facilities
- Gasification structure

The proposed foundation/excavation dimensions and depths and dewatering plans for these structures are provided in Table 4.3.1-2. These additional dewatering areas are much smaller, usually not as deep, and do not last as long as the cooling reservoir dewatering activities. It is not anticipated that the additional dewatering would significantly add to the effect on the surficial aquifer. Other plant facility and structure foundations would not require dewatering activities. Water withdrawn by dewatering to facilitate construction of proposed facilities and structures on the site would be managed and routed to the site subareas, which are planned for the sequential storage of water from the required dewatering of the cooling reservoir and reclaimed wetland areas.

These modeled potential groundwater drawdown effects on the surficial aquifer are similar to the effects of the required reclamation of the mined areas. Based on disturbed conditions of the existing site and adjacent areas, these potential groundwater drawdowns would have no significant effects on wetlands and surface water bodies in the vicinity of the site.

Since the surficial aquifer in the site area would not be used for potable water supply purposes, and due to the confining layer between the aquifers, the temporary surficial aquifer drawdowns would not affect drinking water supplies and other uses of deeper aquifer systems in the proposed Polk Power Station site area.

Potential chemical effects from dewatering activities could result from the disturbance (mobilization) of constituents from the soils into the water and from oxidation of the groundwater. The undifferentiated, surficial soils on the site are composed primarily of quartz sands, with several soluble

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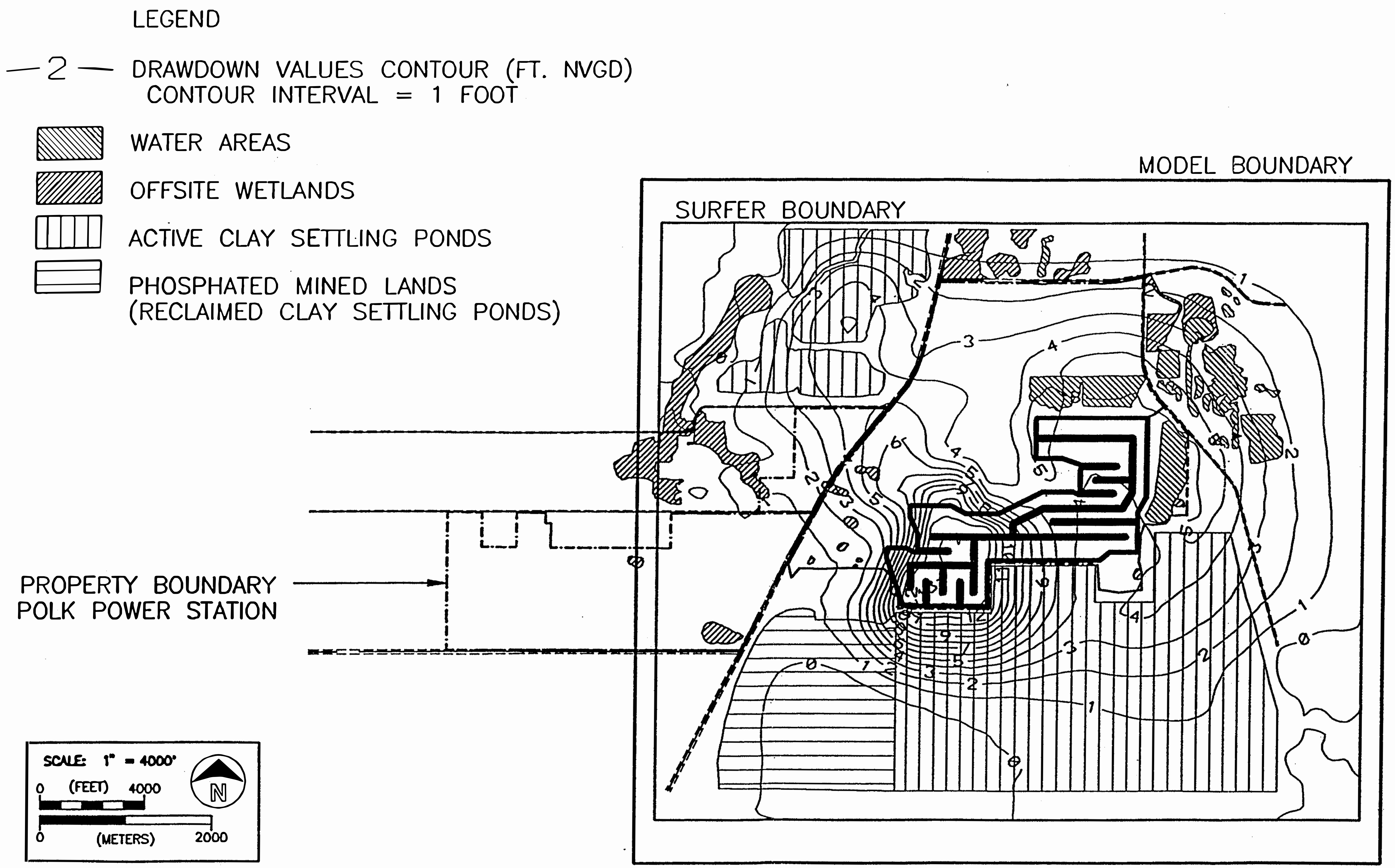

FIGURE 4.3.1-3.
February 28, 1995 - Drawdown Levels (Dewatering Simulation).

SOURCES: ECT, 1992; TEC, 1992a.

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Table 4.3.1-2. Plant Structures Requiring Dewatering Activities and Dewatering Plans

<u>Gasification Structure</u>	
Foundation dimensions	350 ft x 60 ft x 5 ft
Excavation method	Open cut
Dewatering method	Well points or perimeter drain
Dewatering depth	Approximately 5 ft
Pumping duration	5 months
Subarea receiving water	B1 and B2
<u>Recirculating Water Lines</u>	
Excavation dimensions	1,075 ft x 23 ft x 8 ft
Excavation method	Open cut or sheet pile and shoring
Dewatering method	Well points or perimeter drain
Dewatering depth	Approximately 8 ft
Pumping duration	3 months
Subarea receiving water	A1 and A2
<u>Water Pump Structure</u>	
Excavation dimensions	58 ft x 24 ft x 22 ft
Excavation method	Sheet pile and shoring
Dewatering method	Well points or perimeter drain
Dewatering depth	Approximately 22 ft
Pumping duration	7 months
Subarea receiving water	A2

Sources: UEC, 1992; TEC, 1992a; Bechtel, 1994.

constituents including calcite, phosphate, and iron. Oxidation could cause the disassociation of calcite releasing bicarbonate and calcium anions, which can increase the hardness of water. Oxidation of the dissolved iron could cause ferrous iron to form ferric iron. However, in the on-site aquifer system composed primarily of silica sands, the oxidation reactions would be minimal and potential groundwater quality effects would be insignificant (TEC, 1992a). Additionally, the on-site engineering tests indicated that the undisturbed aquifer would act to filter out suspended constituents and limit migration of these constituents within the surficial aquifer.

Measuring and Monitoring Programs

The modeling program used to assess the potential dewatering drawdown effects on the surficial aquifer and the detailed modeling results are described in Appendix 11.7.6 of the SCA (TEC, 1992a). This modeling program used information on the surficial aquifer characteristics that was collected during the site-specific geohydrology monitoring and testing program at the proposed site. A construction dewatering monitoring/mitigation plan has been developed to monitor the physical impacts of the cooling reservoir dewatering activities on surface water bodies and associated wetlands (see DEIS, Appendix S). The primary objectives of the program would include measuring the water table elevation and potential drawdown and impacts and to determine necessary mitigation actions.

In addition to the Construction Dewatering Monitoring and Mitigation Plan, an operational groundwater monitoring plan (see DEIS, Appendix S) would be developed and implemented for the operation of the proposed project in accordance with applicable FDEP and SWFWMD regulatory requirements.

4.3.1.2 Operation-Related Impacts

No significant effects to regional groundwater resources are anticipated as a result of the operation of the proposed Polk Power Station. Groundwater hydrologic effects resulting from plant operation would consist primarily of withdrawal of potable, process, and makeup water from the Floridan aquifer, and secondarily the augmented recharge to the surficial aquifer in the vicinity of the cooling reservoir.

Regional Floridan Aquifer Impacts

Four production wells would be required for full build-out of the power plant. Two 24-inch inside diameter wells, each providing yields of 1,750 to 2,900 gpm, and two 10-inch inside diameter wells would be installed. The yields for the 10-inch wells would range from approximately 230 to 290 gpm. No additional backup wells would be required. The annual average and annual maximum withdrawal rates would be approximately 6.6 mgd and 9.3 mgd, respectively. Of the 6.6 mgd average annual withdrawal, approximately 5.0 mgd would be for makeup water to the reservoir, approximately 1.6 mgd for industrial process service water uses, and 0.01 mgd for potable water uses (TEC, 1992a).

Two production wells, within each of the two well fields, would be spaced approximately 350 ft apart to allow a better efficiency for pumps and wells to operate within their designed ranges. Additionally, this would distribute and minimize the drawdown within the cone of depression (TEC, 1992a).

A regional model of the Floridan aquifer centered on the proposed Polk Power Station was developed using MODFLOW to assess the drawdown impacts associated with the withdrawal of makeup water. Figure 4.3.1-4 shows the model grid, 36 miles by 42 miles (1,512 mi^2), that was chosen to encompass any potential area of groundwater impact. Grid density was increased directly under the Polk Power Station site to improve model resolution at the site of the proposed withdrawal.

The hydrogeologic conditions and parameters, such as transmissivity, leakance, and storage coefficients, were modeled using data from a number of well logs, borings, and pump tests within the study area, and from applicable literature, primarily Ryder (1985). The data indicated that a two-layer model representing the intermediate and Floridan aquifer systems was required to adequately model the water-bearing strata (TEC, 1992a).

The model was calibrated using observed data for September 1989, published by the USGS for both aquifer systems (TEC, 1992a). Model verification was performed against the same observed data. The resulting potentiometric surface predicted by the numerical model was compared graphically to the published potentiometric contours for September 1989. A reasonable match of hydraulic gradients and head values throughout the model grid was considered to be evidence of sufficiently accurate model development. The results of the groundwater model were also compared to analytical drawdown equation (Jacob 1946) results for steady-state, leaky confined aquifer with excellent agreement.

Two different types of simulations were completed with the model. First, a transient 45-day simulation at the maximum average annual withdrawal rate (9.3 mgd), and second, a steady-state simulation at the average annual withdrawal rate (6.6 mgd). Each simulation was also run for a second case that included the drawdown due to the predicted operation of the Hardee Power Station, located approximately 4 miles south of the site. Pumping rates for the HPS site were estimated by Tampa Electric Company (TEC, 1992a) for the transient (8.64 mgd) and steady-state (3.80 mgd) conditions using the Water Use Permit (WUP) granted for that facility. Another power generating facility, the Florida Power Corporation Polk County Power Station, is planned, but pumping data were not available at the time of the modeling performed by Tampa Electric Company (TEC, 1992a).

The simulated pumpage and modeled Floridan aquifer maximum drawdown predictions for the two cases for transient conditions and the two cases for steady-state conditions are summarized in Table 4.3.1-3. The drawdowns presented are the maximum drawdown at the active wellfields. The transient conditions result in larger drawdowns than steady-state conditions, with Case 2 transient conditions providing the largest drawdowns. The effects due to operation of the Polk Power Station

Table 4.3.1-3. Groundwater Numerical Model Simulated Pumpage and Maximum Drawdown Results

Condition Simulated	Simulated Pumpage	Tampa Electric Company Polk Power Station	Hardee Power Station
Simulated Pumpage (mgd)			
Transient (45 days)	Case 1	9.3	NA
Transient (45 days)	Case 2	9.3	8.64
Steady State	Case 1	6.6	NA
Steady State	Case 2	6.6	3.80
Model Predicted Maximum Drawdowns (ft)			
Transient (45 days)	Case 1	8.8	NA
Transient (45 days)	Case 2	10.3	8.6
Steady State	Case 1	6.7	NA
Steady State	Case 2	7.5	4.8

Note: NA = not applicable.

Sources: ECT, 1992; TEC, 1992a.

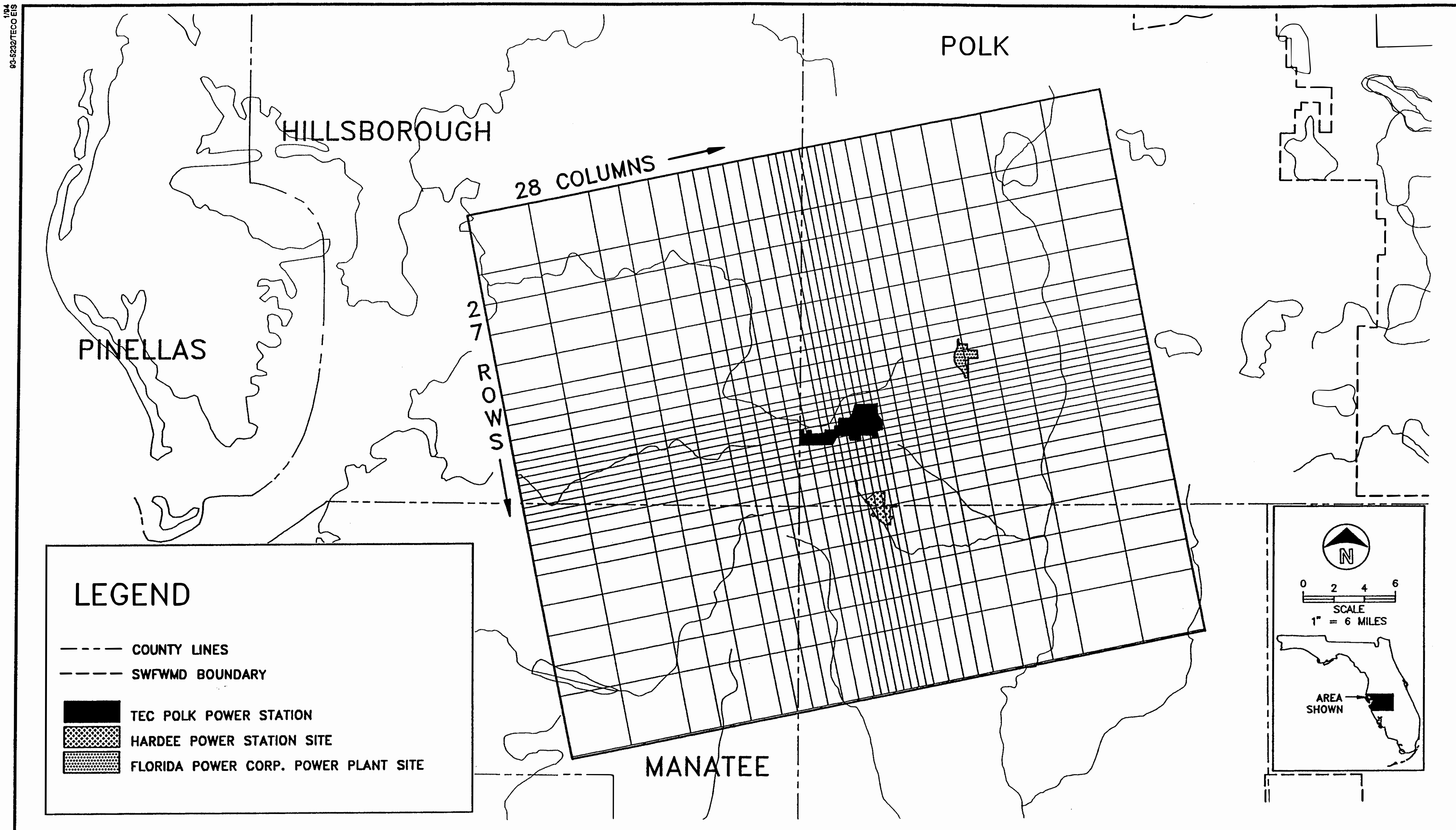

FIGURE 4.3.1-4.
Floridan Aquifer Model Grid, Tampa Electric Company - Polk Power Station.

SOURCES: ECT, 1992; TEC, 1992a.

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under transient conditions (Figure 4.3.1-5) is a drawdown of approximately 4.5 ft at the site boundaries, a drawdown of approximately 1.3 to 1.8 ft at Hardee Power Station, and a drawdown of approximately 0.8 to 1.2 ft at FPC. The greatest pumpage conditions (Figure 4.3.1-6) result in drawdowns of approximately 5.5 to 6 ft at the property boundaries of each facility.

Steady-state drawdowns are less dramatic than transient conditions. Polk Power Station operation drawdowns would be approximately 3.5 ft within the site, 1.5 ft at Hardee Power Station, and 1 ft at FPC. Addition of the Hardee Power Station steady-state withdrawal results in drawdowns of approximately 4 ft at the proposed Polk Power Station property line, 3.5 ft at Hardee Power Station, and 1.5 ft at FPC.

Water level fluctuations in the lower intermediate aquifer system were not explicitly modeled due to its inconsistent nature. The lower intermediate aquifer occurs only in small isolated areas, which may each consist of different sediments and have different aquifer characteristics. The relatively low transmissivities of this aquifer and separation from the Floridan aquifer by confining layers of various thicknesses result in the lower intermediate aquifer relatively isolated from drawdowns in the Floridan aquifer. Subsequent modeling performed by SWFWMD indicated possible drawdowns in the lower intermediate aquifer of up to 2 ft as a result of the operation of the proposed Polk Power Station (TEC, 1993d).

The effects from operation of the proposed Polk Power Station were evaluated using the Case 1 results. Case 2 results would be used to evaluate cumulative impacts, discussed later in Section 4.13. No adverse effects to groundwater supplies were indicated by the modeling results. There are no municipal wells within 5 miles of the site. The modeling results indicated that drawdowns in the Floridan aquifer at the nearest residential area, approximately 2 miles to the northwest of the power block (see Figure 3.11-1), would be approximately 2.5 ft under transient conditions, or 2 ft under steady-state conditions. Most of the residential wells, located primarily to the west of the site, along Bethlehem and Albritton Roads, use one of the two water-bearing units within the intermediate aquifer. Drawdowns in the intermediate aquifer are expected to be much smaller due to the confining unit that separates this system from the Floridan aquifer.

A detailed summary of the regional model including its application and results is presented in Appendix 11.7.7 in the SCA (TEC, 1992a).

The lower intermediate aquifer is separated from the Floridan aquifer by a thick confining layer (the Tampa Clay and possibly portions of the Hawthorn Formation) with extremely low permeabilities (approximately 10^{-7} cm/sec). Some hydraulic connections may exist, but they are not sufficient to tie the two aquifers together in terms of drawdown due to pumping in the Floridan aquifer. The inconsistent nature of the intermediate aquifer also makes it impossible to accurately model. Since predicted drawdowns in the Floridan aquifer were relatively small, the head difference between the two aquifers would not be sufficient to induce a significant flow of water through the confining layer between these two aquifers.

In the event of an accidental spill on the site, the possibility of contamination reaching the Floridan aquifer would be minimal. Due to the two or three confining layers between the surficial, intermediate, and Floridan aquifers, vertical migration would be limited, even with increased potential due to drawdown of the Floridan aquifer. The horizontal transmissivity is much greater (than vertical) so migration would be in a horizontal direction downgradient.

No effects to the Floridan or intermediate aquifer water quality are anticipated as a result of the proposed project due to the extremely low permeabilities of the confining layers between the aquifers (Section 3.3.1). The fact that the proposed Polk Power Station effluent meets all applicable FDEP Class G-II standards and, as discussed in the following section, has only minor exceedances of state drinking water standards indicates that any effluent that reaches the Floridan aquifer will likely have been purified to the point of compliance with all drinking water standards by passing through the 200+ ft of sediments.

No karst features are likely to occur (Figure 3.4.4-1), have been documented (Figure 3.4.4-3), or were detected by the on-site borings at the proposed locations of the Polk Power Station facilities (TEC 1993b). However, ancient karst features within the Polk Power Station site could exist undetected. These features could reactivate naturally, or in response to the pumping and/or surface water management activities associated with the proposed project. An open sinkhole would allow direct discharge of potentially contaminated surface waters to the deeper aquifers (intermediate or Floridan, depending on the depth of the sinkhole) without the benefit of treatment by percolation. In the event of the activation of a sinkhole within the Polk Power Station site, Tampa Electric Company would take reasonable measures such as diversionary berms and/or swales to restrict direct discharge of surface waters to the sinkhole.

Local Surficial Aquifer Impacts

A surficial aquifer model was developed by Tampa Electric Company (TEC, 1992a) using MODFLOW to evaluate effects related to operation of the cooling reservoir. A description of the model setup and cooling reservoir operation is provided in Section 4.3.1.1.

Iterative applications were run to determine the optimal design of the cooling reservoir operations to minimize potential impacts. The results indicated that water level in the cooling reservoir would be maintained at an elevation of approximately 136 ft-NGVD, which is slightly higher than the observed surficial groundwater elevation throughout most of the cooling reservoir area.

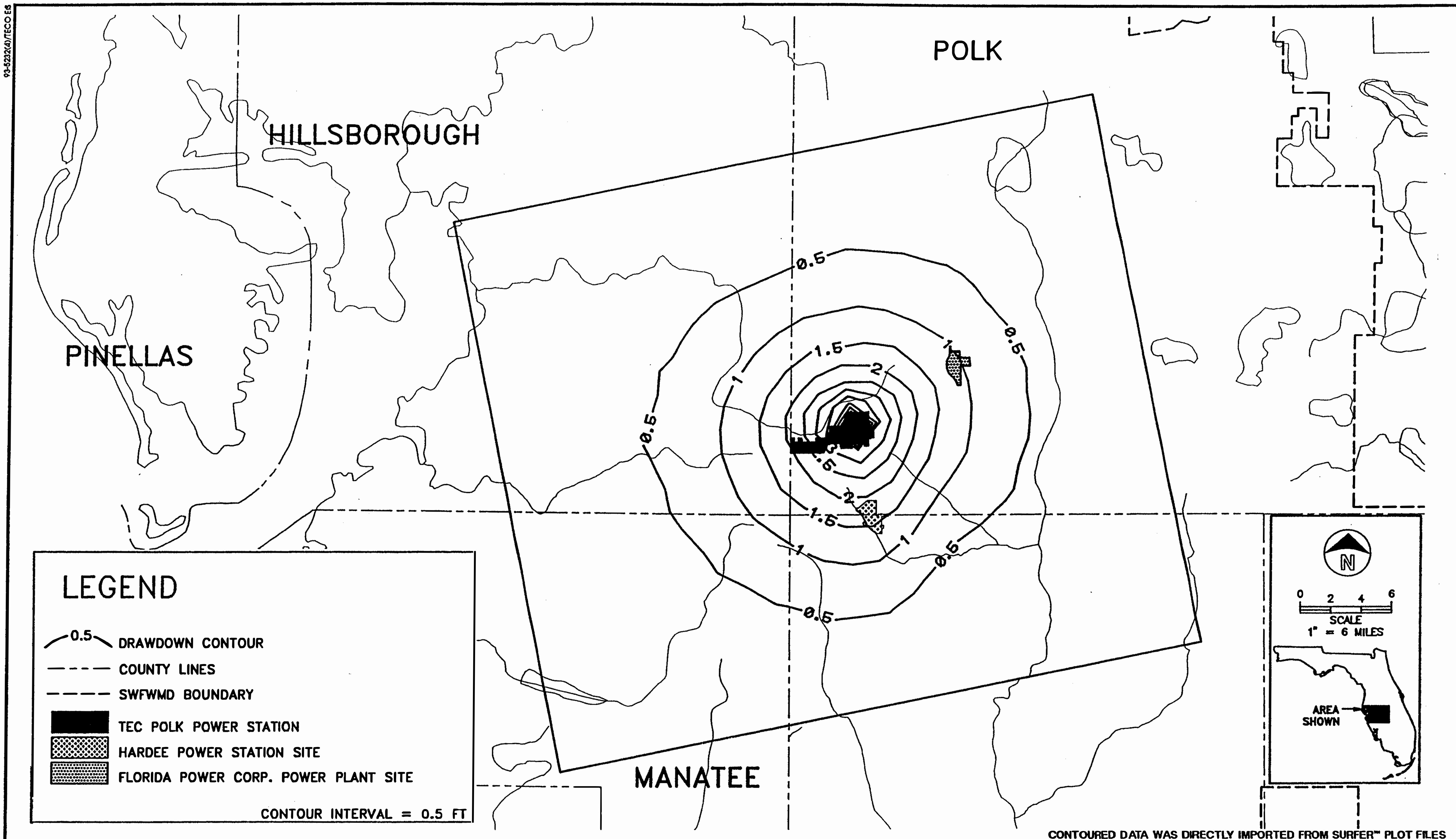

FIGURE 4.3.1-5.
Drawdown in the Floridan Aquifer Transient Conditions - 45 Days (Case 1), Tampa Electric Company - Polk Power Station.

SOURCES: ECT, 1992; TEC, 1992a.

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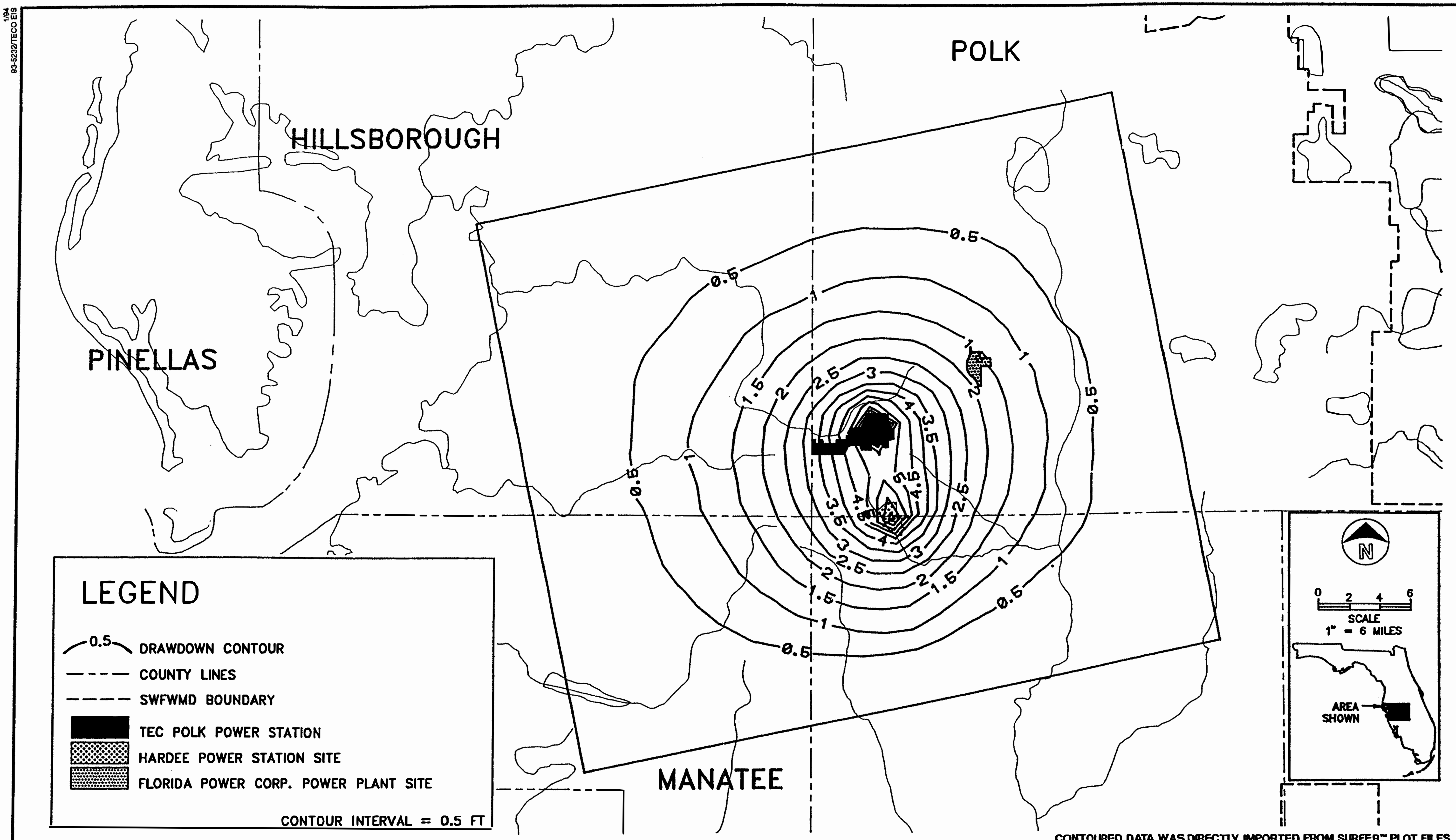

FIGURE 4.3.1-6.
Drawdown in the Floridan Aquifer Transient Conditions - 45 Days (Case 2), Pumping 9.3 MGD at Tampa Electric Company - Polk Power Station and 8.64 MGD at Hardee Power Station.

SOURCES: ECT, 1992; TEC, 1992a.

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The model was run for monthly simulations over a 12-year period. The model flows were considered reasonably stabilized at the last year of the run and were used to evaluate the long-term groundwater exchange between the reservoir and surficial aquifer.

The model results indicated a net average annual seepage of approximately 240,000 gpd from the reservoir into the surficial aquifer. This additional groundwater recharge would stabilize the water table in the vicinity of the site, and enhance recharge to the streams in the area. Therefore, the proposed project would have no adverse hydrologic effects on the surficial aquifer (TEC, 1992a).

Potential chemical effects to the surficial aquifer include accidental spills and the quality of the seepage water from the cooling reservoir. To prevent or manage potential spills from the chemical handling and storage areas, a Preliminary SPCC (see DEIS, Appendix T), a Preliminary RCRA Contingency Plan (see DEIS, Appendix U), and PPP and BMP Plan (see Appendix A) have been developed by Tampa Electric Company. The measures outlined in these plans will limit the possibility of an accidental spill actually reaching groundwater.

The modeled long-term water quality within the cooling reservoir can be used to evaluate the potential effect to surficial aquifer water quality from reservoir seepage. The reservoir water quality modeling is discussed in Section 4.2 and the results are presented in Table 2.3.6-2, as are the applicable G-II (Chapter 17-520, FAC) and drinking water standards (Chapter 17-550, FAC). The reservoir water quality is predicted to meet all primary drinking water standards.

The secondary drinking water standard for iron (0.3 mg/L) and color (15 color units) would be exceeded by the predicted concentrations in the reservoir (0.627 mg/L and 50.49 color units). The goal of the secondary standards is to control contaminants that primarily affect the aesthetic qualities of drinking water (40 CFR 143.1). At considerably higher concentrations of these contaminants, health implications may also exist, as well as aesthetic degradation. The predicted iron concentration may be high enough to cause some aesthetic degradation but no adverse effects to human health are expected (TEC, 1992a).

Surficial aquifer water quality data from FDEP (Table 3.3.2-4) and Tampa Electric Company (Table 3.3.2-5) show that predicted reservoir iron concentrations are well below average for Polk County (3.97 mg/L, FDEP) and at the proposed Polk Power Station site (3.5 mg/L, Tampa Electric Company). Average color at on-site surficial aquifer wells averaged 193 color units. Since naturally occurring concentrations of these parameters are much higher than predicted reservoir concentrations, no adverse water quality effects are anticipated.

4.3.2 Alternative: Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance)

The alternative proposal would have similar potential effects to groundwater resources as the proposed project. The primary difference would be in the size of the reservoir and the amount of makeup water required to replenish the cooling reservoir. Under the alternative proposal, a 500-MW PC unit would be required to replace the proposed IGCC and two CT units.

A comparison of PC and IGCC technologies for resource requirements and environmental discharges was performed by EPRI (1988) and Tampa Electric Company (TEC, 1992a). The results indicate that a 500-MW PC plant would require approximately three times the amount of makeup water as the proposed IGCC plant. This is significantly higher than the transient condition pumpage for the proposed Polk Power Station deep aquifer modeling results. Considering the difference in drawdown between the steady-state and transient conditions, the much greater pumpage for a PC facility may result in an unacceptable drawdown (i.e., greater than 5 ft) at the property boundary and a significantly larger withdrawal in the SWFWMD Water Use Caution Area (WUCA).

Surficial aquifer hydrologic effects would not be significantly different for a PC facility than the proposed IGCC. The cooling reservoir would need to be enlarged for the PC facility, but the head differential between the reservoir and water table could be kept approximately the same so a larger, but not significantly larger, amount of water would infiltrate from the cooling reservoir into the surficial aquifer (TEC, 1992a).

Construction dewatering impacts would probably not be significantly different than the proposed construction.

Since the proposed CG facilities would have zero liquid discharge, storm and groundwater quality effects would be more for a PC facility since more process/service and storm water would be treated and discharged to the reservoir.

4.3.3 Alternative: No Action

The primary difference to groundwater effects between the proposed Polk Power Station and the No-Action Alternative would be the absence of withdrawal from the Floridan aquifer. The No-Action Alternative would have no planned withdrawal from the Floridan aquifer on the proposed site, so drawdown of the aquifer in the area of the site would be from other major users such as the Hardee Power Station and proposed FPC power facilities.

The No-Action Alternative would result in similar construction/dewatering effects to the surficial aquifer due to agency-required mined-area reclamation activities that would require dewatering for the construction of reclaimed wetlands and uplands.

The reclaimed wetlands would have a similar effect of stabilizing the water table, but it would be less pronounced (possibly less beneficial) since they would be maintained at lower elevations and would not receive the additional water inputs from the cooling reservoir.

4.3.4 Comparison of Impacts

No significant groundwater hydrologic effects would result from any of the three alternatives. Construction-related effects primarily affect the surficial aquifer through activities such as regrading, dewatering, and reclamation. These would be approximately the same for all three alternatives.

Surficial aquifer effects from operation of the cooling reservoir would consist primarily of the cooling reservoir providing a constant source of recharge. This is a beneficial effect that would be approximately the same for the IGCC and PC alternatives, and somewhat diminished in the No-Action Alternative.

Floridan aquifer impacts result primarily from the withdrawal of potable, process, and cooling water makeup. This effect would not exist in the No-Action Alternative. The proposed project results in a measurable effect, an annual average withdrawal of 6.6 mgd, which has been determined to have no adverse effect to the supply of potable water in the region. The PC alternative would result in a approximate three-fold increase in the amount of makeup water withdrawal. This level of withdrawal may be unacceptable in a WUCA.

No significant groundwater quality effects would result from any of the alternatives. Potential water quality effects to the surficial aquifer would primarily result from infiltration from surface water bodies. The No-Action Alternative would have only wetlands as surface water bodies to provide infiltration, with water quality similar to observed on-site lake water quality (Section 3.2.3). The proposed project would also provide infiltration from reclaimed wetlands and the cooling reservoir. Cooling reservoir water quality meets all applicable groundwater and drinking water standards, except as described in Section 4.3.1, so no significant effects are anticipated. The PC alternative would also provide wetland and cooling reservoir infiltration, but water quality in the cooling reservoir may be lower than with the proposed project.

4.4 GEOLOGICAL AND SOIL-RELATED IMPACTS

4.4.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

The proposed site preparation and construction activities would involve altering the existing topography of the site to facilitate construction of plant facilities and cooling reservoir and to reclaim other mined areas in accordance with agency-approved reclamation plans. The proposed plans include the reestablishment of drainage system watershed divides and acreages to premining conditions. The general site preparation activities would involve the use of cut and fill soil materials from within the site. Soil materials would not be imported to or exported from the site, except for specific foundation supporting materials, such as crushed limerock and gravel for structures and on-site roads and possibly clay to reduce seepage through the reservoir berms. Therefore, except in the immediate areas of the main plant facilities and roads, general on-site soil conditions, percolation rates, and storm water runoff rates after site development/reclamation would be similar to those that currently exist on the site or existed prior to mining (TEC, 1992a). Since only the surficial sediments would be disturbed, no effects to site geology would occur.

4.4.1.1 Construction-Related Impacts

The general site preparation and construction-related activities associated with the overall development of the project site would include the following:

- Clearing, grubbing, corridor preparation, and construction of the three access roads and rail spur to the main power plant facilities area
- Construction of temporary berms within the cooling reservoir area to provide separate subareas for on-site storage of water from dewatering and storm water runoff from other subareas under construction
- Sequential dewatering of reservoir and reclaimed wetland subareas by pumping to other subareas and excavation and surrounding and internal berm construction activities in dewatered subareas of the reservoir
- Construction of temporary storm water runoff storage basins and drainage ditches to collect and route runoff to on-site water storage subareas within the cooling reservoir area or, as needed, to off-site drainage basins during grading, excavation, and construction activities
- Clearing, grubbing, and cutting of main plant site area and filling the area with materials excavated from cooling reservoir area
- Stabilizing, grading, and contouring main plant facilities area for construction of facilities foundations, interior roadways, and parking lots
- Construction of areas for coal unloading, permanent storm water detention basin, by-product, fuel storage, water and wastewater treatment, and brine storage
- Performing groundwork, as necessary, for construction of facility footings and foundations and underground electrical, water, and other utility piping systems

- Development of substation and on-site and off-site transmission line rights-of-way
- Earthmoving, grading, and contouring for reclaimed wetland and upland areas and re-establishing drainage systems to premining conditions

These site preparation and construction activities are not expected to require the use of explosives. Materials for filling and preparing areas for development would be provided from other on-site areas except for some finishing foundation and bed support materials, such as limestone, crushed rock ballast, and other materials that would be provided from regional, contracted sources.

Main Power Plant Facilities and Cooling Reservoir Areas

The main power plant facilities, excluding the cooling reservoir, would be primarily constructed on lands that have not been mined for phosphate, but have, for the most part, been disturbed by associated mining activities, such as dragline walk corridors, vehicle access roads, and material storage areas. As shown in Figure 2.3.2-1, the area developed for the main power plant structures would be approximately 150 acres or 3 percent of the entire Polk Power Station site. Soils existing in the unmined vicinity of the proposed power station include: Smyrna and Myakka fine sands, Samsula muck, Ona fine sand, and Basinger fine sand. These soils would likely be converted to Arents-Urban Land Complex as a result of the proposed construction. None of these soils is considered prime farmland. These areas include all facilities for the full build-out (i.e., approximately 1,150 MW) of the Polk Power Station site in the 1994 through 2010 timeframe.

The initial site preparation activities for the main plant site and cooling reservoir areas would involve establishing preliminary site access and clearing, grubbing, and initial earthwork activities in the plant site, access road, and rail spur areas. Temporary berms would be constructed within the mined-out reservoir area to establish three subareas for the sequential dewatering, water storage, and construction of the cooling reservoir. Temporary storm water runoff basins and drainage ditches would be developed as needed to route runoff to the on-site water storage subareas. The initial site preparation efforts would also include grading and contouring activities to re-establish drainage patterns on the portion of the site to the east of SR 37 to the Little Payne Creek system, which is similar to premining conditions. Any potential storm water runoff discharges from the site during the construction activities would be routed through these re-established drainage systems.

As construction activities proceed in the dewatered subareas of the cooling reservoir, soil materials would be excavated and used to fill the main plant site area and adjacent reclaimed wetland areas. No adverse effects to on-site topography are anticipated since the re-establishment of premining watershed divides would occur despite the proposed activities. Existing elevations on the plant site area range between 135 and 140 ft-NGVD. This area would be cut, filled, stabilized, and graded to final elevations ranging from 140 to 145 ft-NGVD. Figure 2.3.11-1 presents the finish grade contours and post-reclamation drainage basins on the plant site and cooling reservoir areas to the east of SR 37 and on the remainder of the site to the west of SR 37. After these initial site preparation activities would be completed, construction activities would proceed for the rail spur and loop, the entrance and interior roads, and the permanent storm water management basins and structures. The remaining construction activities on the plant site area would involve specific groundwork needed for the foundations of the power block and associated facilities. These activities would also include the construction and installation of underground electrical, water, and other utility piping systems, including the recirculating water pipelines to and from the reservoir. After final grading, areas of the plant site that do not involve additional construction activities would be grassed to prevent erosion.

The cooling reservoir and reclaimed wetland systems adjacent to the plant site would be constructed on mined-out lands. The entire reservoir facility would include approximately 860 acres of land, including the surrounding earthen berms. These lands currently consist primarily of spoil pile rows (Arents-Water Complex soil type) with elevations generally ranging from approximately 155 to 160 ft-NGVD and up to 170 to 180 ft-NGVD, water-filled mine cuts with bottom elevations ranging from approximately 100 to 120 ft-NGVD, and water surfaces ranging from approximately 125 to 135 ft-NGVD. In addition to the excavation of materials for filling the plant site, site preparation activities for the cooling reservoir would include the construction of a surrounding earthen berm and a series of internal earthen berms. After final contouring, the surrounding and internal berms would have top elevations of approximately 145 ft-NGVD and 141 ft-NGVD, respectively, while the bottom of the reservoir would have an average elevation of approximately 120 ft-NGVD. The berms would have gentle interior and exterior slopes (4:1 horizontal to vertical) and therefore would be structurally stable. The berms would be planted with ground cover vegetation, which would be actively managed and controlled to prevent soil erosion. Stone rip-rap or other appropriate materials would also be used, as needed, along berm areas with relatively higher velocity water flows (e.g., near internal intake and discharge structures and the outfall control structure) to prevent potential erosion impacts.

Wildlife Habitat/Corridor Area

Approximately 86 percent (1,299 acres) of the 1,511-acre portion of the proposed Polk Power Station site to the west of SR 37 has been mined or will be mined and disturbed prior to initiation of the proposed project. Soils in these areas would be converted to Arents-Water Complex as a result. Currently, Agrico has ongoing mining operations on this tract that are expected to be completed in 1994. For the Polk Power Station, this portion of the site would be reclaimed to an integrated system of forested and nonforested wetlands and uplands which would develop as a wildlife habitat/corridor area. The proposed reclamation activities would occur on those portions of the tract that have been disturbed by mining.

Since no power plant facilities or structures would be located on western tract, the proposed site preparation activities would be similar to those used for reclamation of mined phosphate lands in central Florida. These activities generally involve the sequential dewatering of mined-out subareas by pumping water to other mined-out subareas and cutting, filling, and grading earthwork activities in the dewatered subareas.

An appropriately designed soil erosion and sedimentation plan would be implemented during site preparation and construction activities to minimize potential soil erosion. According to this plan, all storm water runoff from areas under preparation and construction during the initial site development phase would be collected and maintained on the site within specific subareas or basins. The plan would also include the use of sediment control measures, such as straw bailing and silt fences, in specific areas under construction. After final grading and contouring, the areas would be seeded and/or planted with other vegetation to stabilize the soils. The on-site storm water runoff management plan after the initial site preparation and construction activities is described in Section 3.8 of the SCA (TEC, 1992a).

The potential for sinkhole development on the proposed Polk Power Station site is relatively low compared to most other areas in Polk County. The proposed site preparation and construction activities, as well as the facility operations, are not expected to adversely effect site conditions for, or be conducive to, potential sinkhole development.

4.4.1.2 Operation-Related Impacts

After construction and final build-out of the facility, no significant effects to on-site topography, geology, or soils are expected from the operational activities of the Polk Power Station.

4.4.2 Alternative: Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance)

The alternative proposal would involve the use of a PC unit instead of the proposed IGCC unit and two proposed stand-alone CT units.

Relative to the proposed IGCC unit, using PC technology as an alternative power source has additional construction related effects on the on-site geology and soils. Based upon adjustments of the figures in Table 2.4.3-1 from a 400-MW to 500-MW PC unit, the 500-MW PC unit would require approximately twice the land for the main power plant and coal storage facilities compared to the proposed IGCC unit. The increase for the PC unit would be primarily due to the need for a larger coal storage area to provide a similar time period of fuel supply based on its relatively higher coal consumption rate. The PC unit would require approximately three times the land area for permanent storage of solid by-products, such as bottom and fly ash and gypsum. The PC unit with a FGD system would also require facilities for the delivery, handling, and storage of limestone which would not be required for the proposed IGCC unit technology (TEC, 1992a).

4.4.3 Alternative: No Action

Approximately 94 percent of the 4,348-acre Polk Power Station site has been, or will be, disturbed by phosphate mining activities. Existing topographic features primarily consist of mine cuts and spoil piles. The highest spoil pile elevations range from 170 to 180 ft-NGVD. The mine cuts, mostly water-filled, generally have bottom elevations ranging from approximately 100 to 120 ft-NGVD.

Under the No-Action Alternative, more than 3,330 acres (more than 76 percent) of the site that has recently been, or will be, mined or disturbed, would be subject to further disturbance by reclamation activities required under FDEP regulations. These required reclamation activities would essentially involve earthmoving and dewatering activities similar to those for the proposed project.

4.4.4 Comparison of Impacts

All three alternatives would involve the reclamation of the mined areas on site as required by FDEP. The excavation and grading required for this activity is not an adverse effect as it re-establishes the premining topography.

An additional effect associated with the proposed project and alternative proposal would involve the construction of power plant facilities and cooling reservoir. Some previously undisturbed soils would be altered in the proposed power block location. The PC alternative proposal would require significantly more land area for power plant facilities and storage areas than the proposed IGCC alternative. Neither of these alternatives is considered to have a significant effect on soils or geology, since a relatively small area of undisturbed soils would be affected.

4.5 TERRESTRIAL ECOLOGY IMPACTS

Expected and potential effects of the proposed project on the terrestrial ecology resources of the Polk Power Station site are discussed in this section. Both upland and wetland impacts are addressed under terrestrial ecology. Open water impacts are discussed in Section 4.6, Aquatic Ecology Impacts.

Section 404 of the CWA requires that an individual Section 404 permit be obtained for each proposed project, or that a nationwide Section 404 permit be issued for a given type of activity before jurisdictional wetlands can potentially be filled. Jurisdictional wetlands are currently defined by USACOE in their 1987 Manual (USACOE, 1987). Section 404 permits apply to wetlands filled on both federal and nonfederal lands.

EPA reviews individual as well as some general Section 404 permit applications for USACOE. In general, EPA's review involves the avoidance of wetland losses and effects consistent with the Section 404(b)(1) guidelines, which require the selection of the least environmentally damaging, practicable alternative that minimizes wetland effects. Avoidance of wetlands is therefore the primary goal of the EPA review, followed by minimization of unavoidable effects. EPA review comments are provided to USACOE and, as the permitting agency, USACOE makes the decision to issue, issue with conditions, or deny the Section 404 permit. In the event EPA does not concur with USACOE's permitting decision, EPA has the authority to veto the decision pursuant to Section 404(c). This option has been exercised by EPA in the past.

4.5.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

4.5.1.1 Construction-Related Impacts, Including Biodiversity and Threatened and Endangered Species

Biodiversity of Plant Communities

Approximately 94 percent of the 4,348-acre property has or will be disturbed by mining prior to Tampa Electric Company's use of the site. The power plant, cooling water reservoir, and other associated on-site power facilities, such as parking lots, by-product storage, storm water detention, wastewater, sanitary and industrial waste treatment basins, substation, transmission line, rail spur, and roads, would occupy approximately 1,090 acres (25 percent) of the proposed site. The main power plant facilities (i.e., power block, fuel and byproduct storage) would occupy approximately 150 acres. The cooling reservoir would occupy approximately 860 acres (including the surrounding earthen berms). Most of the project facilities (primarily the cooling reservoir) would be located on mined, highly disturbed through mining, or otherwise altered/converted land. As a result of past mining activity and the proposed construction of the power plant facility, this environment would have a much lower biodiversity than natural areas in central Florida.

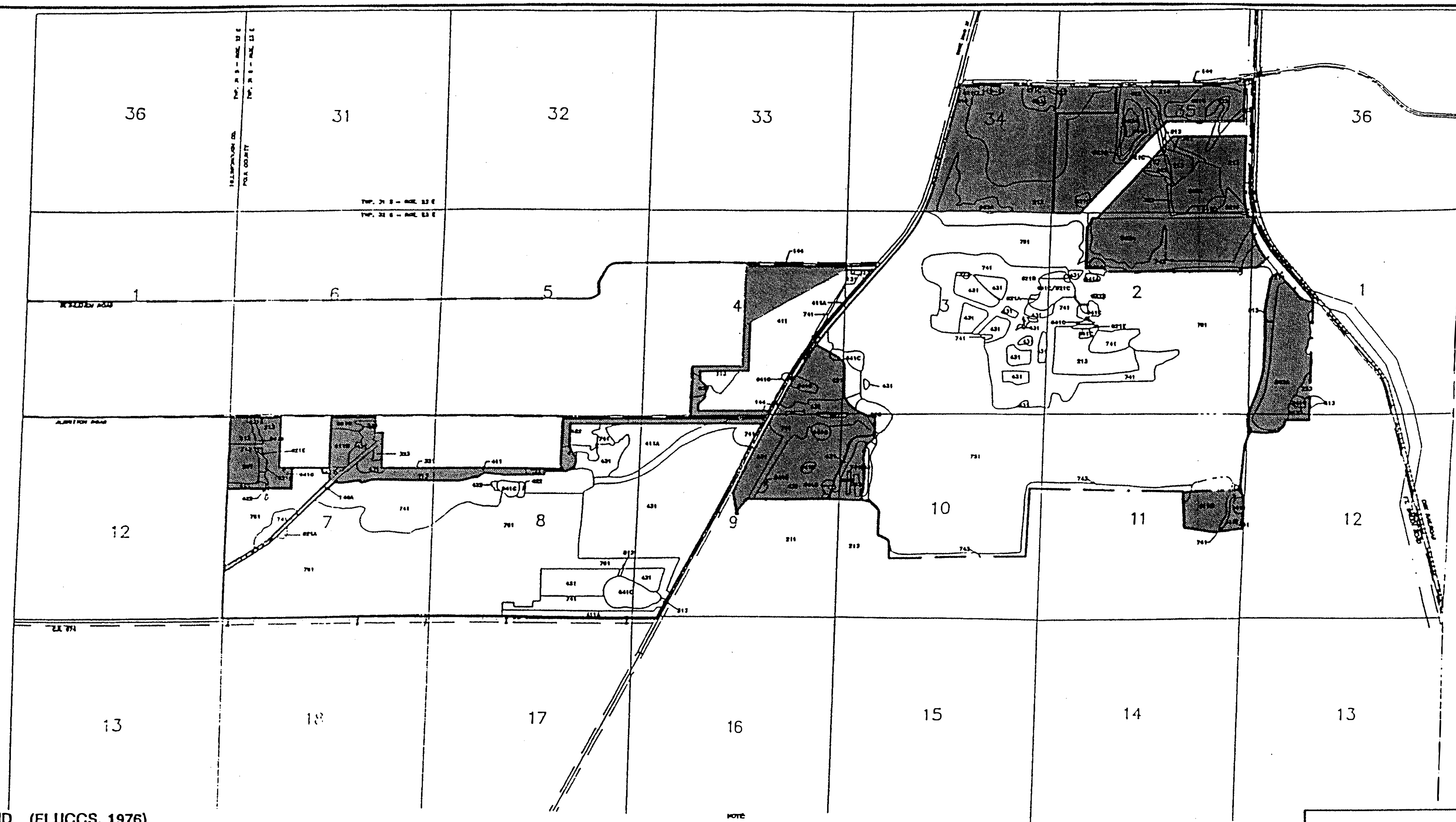
Approximately 253 acres of USACOE jurisdictional wetlands on the proposed plant site (212 acres of mine cuts and 41 acres of disturbed herbaceous and early successional forested wetlands) would be displaced by construction of the proposed facilities. Mitigation for the loss of these wetlands is described in Section 5.2.

The area proposed for development of the power plant facilities contains 41 acres of small, isolated marsh and willow/elderberry swamp wetlands. These wetland areas were compared to reference wetlands during preparation of the SCA (TEC, 1992a). Because these small wetlands are in scattered locations on the unmined plant site area, it would be extremely difficult and costly to design a facility layout that would avoid them. These freshwater wetlands are typically dominated by nuisance species of vegetation. Construction of the power block would result in the loss of this low-value resource. Loss of these isolated wetlands would represent a reduction in the local ecosystem biodiversity. Of the 212 acres of jurisdictional mine cuts, approximately 31 acres would be filled for plant site construction and approximately 181 acres would be filled for construction of the cooling water reservoir. Areas proposed for fill placement are either currently unvegetated or are narrow littoral zones vegetated with a dominance of cattail.

As part of this project, Tampa Electric Company submitted a dredge-and-fill application for the development of these wetlands and mine cuts (see Appendix C). State and federal jurisdictional wetlands are illustrated in Appendix C. A preapplication meeting held with USACOE addressed the proposed wetland reclamation adjacent to the plant site. Mitigation requirements for the proposed filling activities will be part of the Section 404 permitting process. FDEP has withdrawn its request that a binding jurisdictional determination be done for the site (see Appendix C). In addition to the proposed mitigation plan, the proposed development/reclamation plans (Section 5.6) for the Polk Power Station site would result in an overall net increase of 187 wetland acres on site compared to premining conditions. This would provide appropriate mitigation for the loss of these small wetland areas and increase biodiversity of these environments.

Vegetation communities/wildlife habitats that would be relatively undisturbed by the development of the proposed Polk Power Station are illustrated in Figure 4.5.1-1. These relatively intact areas on site, and other undisturbed uplands and wetlands in the project vicinity, have the potential to be indirectly affected. These secondary effects could include a temporary lowering of surface and groundwater levels, increased sedimentation, increased surface runoff, erosion, fragmentation of habitats on site, and fugitive dust.

Clearing of vegetation and subsequent excavations associated with construction would expose soils to erosion by wind and storm water. Fugitive dust from clearing operations may affect vegetation in the vicinity of the project site. Dust particles could accumulate on leaf surfaces, reducing evapotranspiration and photosynthesis. Such long-term exposure could potentially result in the mortality of some terrestrial and epiphytic herbaceous plants. Damage to vegetation could also result as a consequence of vehicular traffic and heavy machinery during construction activities in the area. As discussed in Sections 4.2 and 4.4, potential erosion, sediment transport, and fugitive dust from the site would be



LEGEND (FLUCCS, 1976)

110	RESIDENTIAL	323	SHRUB AND BRUSHLAND	621	WETLAND FORESTED
131	LIGHT INDUSTRIAL	330	MIXED RANGELAND	A	BAY HEAD SWAMP
144	ROADS AND HIGHWAYS	410	CONIFEROUS FOREST	B	RED MAPLE SWAMP
148A	FGT GAS PIPELINE	411A	SLASH PINE FLATWOODS	C	WILLOW / ELDERBERRY SWAMP
148B	TAMPA ELECTRIC COMPANY 230-KV TRANSMISSION LINE (HARDEE-PEBBLEDALE)	411B	LONGLEAF PINE FLATWOODS	D	MIXED HARDWOOD SWAMP
		420	HARDWOOD FOREST	E	PRIMROSE WILLOW SWAMP
		422	OAK HAMMOCK	630	WETLAND - MIXED FOREST
152	OVERHEAD TRANSMISSION LINES	430	MIXED UPLAND FOREST	640	WETLAND - VEGETATED NON-FORESTED
210	CROP AND PASTURELAND	431	MIXED OAK/PINE FOREST	641	NON-FORESTED WETLAND
211	ROWCROPS	520	LAKES	A	MAIDENCANE MARSH
213	IMPROVED PASTURE	513	CANAL/DITCH	B	MAIDENCANE - BUTTONBUSH
230	CITRUS GROVE	563	PONDS	C	DISTURBED MIXED MARSH
231	ORANGE GROVE	560	OTHER WATER AREAS	741	SCRAPED AREAS/OLD FIELDS
310	GRASSLAND	A	MINE PONDS	751	PHOSPHATE MINED LANDS
320	SHRUB AND BRUSHLAND	B	OTHER WATER AREAS	743	VEGETATED SPOIL BANK
321	PALMETTO PRAIRIE	620	WETLAND - HARDWOOD FOREST		

FIGURE 4.5.1-1.
Lands to be Left Intact.

SOURCE: ECT, 1992.

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controlled by a variety of techniques, such as staked hay bales, silt curtains, and soil wetting during the construction of the proposed project. Similar impacts would be expected due to State of Florida required reclamation of mined lands on the site.

The majority of listed plant species either found on site or that have a high probability of occurrence, do occur or are likely to occur in areas not proposed for power plant development. Only 10 listed plant species were actually observed within property boundaries. Eight of these species (asplenium fern, wild azalea, bluestem, golden polypody, dahoon holly, netted chain fern, cinnamon fern, and royal fern) are common associates of forested wetlands in Florida. These listed species were mostly observed within the floodplain swamp contiguous to the unnamed tributary to the South Prong Alafia River in the northwest corner of the site. The forested wetland reaches of this tributary on the property are not proposed to be mined or disturbed by the proposed project. Therefore, no significant adverse effects to regional or local populations of these species are anticipated from the proposed project.

Prickly pear inhabits the drier, unmined forested areas of the property. This state-listed species occurs within the northeastern unmined area of the eastern tract that is scheduled for construction of the power plant. However, this species is common throughout the state and no significant adverse effects to regional populations of prickly pear are expected.

During field surveys conducted by ECT in 1991 (TEC, 1992a), populations in excess of 500 individuals of the wild coco orchid, a federally-listed candidate species, were observed flowering within the old fields on the northeastern portion of the unmined area of the eastern site tract where the main power facilities would be located. Typically, this species inhabits the well-drained sandy soils of sandhill, scrub, and flatwoods communities in central and south Florida. The occurrence of wild coco within the highly altered, scraped-over old field areas on the site attests to its adaptability after major disturbances. Smaller populations of this listed orchid were also observed within the unmined parcel of the southwestern area of the eastern tract. Since this southwestern area is not scheduled for mining or power station development, wild coco should persist and eventually extend into the open, wooded communities to be reclaimed on the site.

Biodiversity of Wildlife

Construction effects to wildlife resources at the proposed Polk Power Station may include direct effects (displacement, mortality) or indirect effects (habitat changes, noise, or human presence). Consideration of any effects due to the station construction activities would be tempered by the fact that the site is extremely disturbed due to past and ongoing mining activities, and that noise and human presence are already present on the site. Also, any such construction effects would occur as the result of State of Florida required reclamation activities for mined-out areas on the site, even if the proposed Polk Power Station project were not constructed.

Proposed power station construction activities, such as habitat alteration, earth-moving, human presence, and noise, would force some species (less motile species such as moles, snakes, mice, rats, lizards, frogs, toads) to be either permanently or temporarily displaced. Some less motile or fossorial species could be lost during earth-moving activities. Species inhabiting the areas outside the power plant facility and reservoir areas could be temporarily displaced while activities are underway. Once the activities would be completed, remaining habitats or newly created habitats would again attract similar species. Water birds and wading birds associated with the reclaimed and unreclaimed lakes on the eastern portion of the site could move elsewhere for feeding and roosting during construction, but should return and utilize these areas once construction is completed. Site preparation and construction activities are not expected to require the use of explosives.

Since recreational use of the site is currently limited and controlled, no effects to the recreational use of the site would occur. Recreational species (game birds, mammals, and fish) on the site are expected to be present after construction is completed (see DEIS, Appendix N).

Threatened and Endangered Species

The Polk Power Station construction is not expected to affect regional populations of any endangered, threatened, or species of special concern. Of the 46 listed wildlife species evaluated for this project (Section 3.5.5), 22 were observed on site or considered to have a moderate to high likelihood of occurring on the site. Of those, the wetland dependent species, such as alligator, little blue heron, great egret, snowy egret, tricolored heron, black-crowned night heron, least bittern, glossy ibis, white ibis, wood stork, sandhill crane, limpkin, and round-tailed muskrat could experience temporary displacement during plant construction activities. However, the proposed net increase in open water/wetland habitats created by this project should increase potential use of the site by these species in the future.

The gopher tortoise and potential commensals, such as indigo snake, pine snake, short-tailed snake, and gopher frog, are generally expected in areas on the site not scheduled for power plant development (Section 3.5.5). Since no gopher tortoise burrows were observed in the proposed plant site area, no effects to these listed species are expected.

A pair of Florida scrub jays was observed once in the area scheduled to be developed for the main plant facilities. However, repeated field survey efforts to confirm their presence or nesting on the site were unsuccessful. Therefore, it is believed its presence on site was transient and no effects to this listed species would occur. On December 23, 1993, a site assessment was made by FWS. Service biologists assessed the project site as well as the rail spur for potential impacts to the scrub jay. FWS found that the project is not likely to adversely affect the Florida scrub jay (see Appendix B).

Other listed upland species, such as the southeastern kestrel, Cooper's hawk, and Sherman's fox squirrel, occur on the fringes of the site or in areas not scheduled for power plant development. No southeastern kestrel nesting areas were observed on site, only one Cooper's hawk was observed during field surveys, and the Sherman's fox squirrels were observed in the northwestern corner of the western tract where no development is planned. Therefore, no effects to these species are anticipated.

The presence of bald eagles in the site area includes one active nest adjacent to the site, and one inactive and one abandoned nest on site. The inactive and the abandoned nests are in areas not scheduled for power plant development or disturbance by reclamation activities (Figure 4.5.1-1). The inactive nest in the northwestern corner of the western tract may be abandoned. This nest was previously unknown prior to field studies for this project and has not been observed for five consecutive years as required by the FWS to be classified as an abandoned nest (FWS, 1987b). The one active nest (previously described in Section 3.5.5) occurs off site along Fort Green Road. Since this nest is 1.5 miles away from the main power block area and 2,500 ft away from the cooling reservoir, construction should not affect this nest. The pair of eagles are also accustomed to human presence and noise due to the fact their nest is located on a farmstead and close to a county road and active railroad. Since both on- and off-site wetland habitats would be available for foraging, the eagles should continue to use this area. After construction is completed, more open water habitat would be available for foraging.

Wildlife Impacts from Fuel Delivery Systems

The proposed Polk Power Station project would involve the delivery, handling, and storage of primarily three fuels: natural gas, No. 2 fuel oil, and coal. Natural gas would be delivered to the site by pipeline from the existing or future gas transmission system in the region. The other fuels are presently planned to be delivered by rail or truck. Except for a short segment (approximately 200 ft) of the rail spur to cross Fort Green Road, the spur and associated material loading and unloading facilities would be located within the boundaries of the Polk Power Station site. The 200-ft rail segment that crosses the railroad and road rights-of-way will cross a drainage ditch by use of a culvert or bridge. It is expected that the potential for threatened or endangered species in this 200-ft segment is not significantly different than that for the site because it is adjacent to the site.

All of the proposed fuel delivery systems would be designed to meet applicable regulatory standards and codes to minimize potential safety concerns and environmental effects. Once the proposed pipeline routes have been determined, Tampa Electric Company would submit appropriate applications and supporting information for agency review and approval. Except for right-of-way clearing (expected to be minimal), the natural gas pipeline, fuel oil pipeline, and railroad spur corridors are not expected to affect plant or wildlife in the area. These corridors would either be located entirely within property boundaries or within existing corridor rights-of-way.

4.5.1.2 Operation-Related Impacts

Potential adverse effects to local or regional upland and wetland vegetation due to plant operation are commonly a result of air emissions, cooling system operation, and groundwater withdrawals. The effects of long-term (chronic) exposure to predicted ambient concentrations of SO_2, NO_x, O_3, fugitive dust, and other air emissions are difficult to accurately predict. Vegetation damage is described as effects resulting in foliar damage. Less apparent vegetation injury is described as a reduction in growth and/or productivity without visible damage as well as changes in secondary metabolites, such as tannin and phenolic compounds. Vegetation damage often results from acute exposure to pollution (i.e., relatively high doses over relatively short time periods). Injury is also associated with prolonged exposures of vegetation to relatively low doses of pollutants (chronic exposure). Acute damages, which have both functional and visible consequences, are usually manifested by internal physical damage to foliar tissues. Chronic injuries are typically more associated with changes in physiological processes.

Air quality emissions from the proposed Polk Power Station were evaluated as to their potential to affect vegetation in the area. The pollutants SO_2, NO_x, O_3, PM (including trace metals), CO, H_2SO_4, and fluorides and synergistic effects among gaseous pollutants were evaluated to the extent supported by the literature. This information is summarized in Tables 4.5.1-1 and 4.5.1-2. Based on this assessment, emissions from Polk Power Station would not be expected to cause harm to vegetation (TEC, 1992a).

Since water quality and temperature (after a short mixing zone) are expected to meet water quality standards and water levels would not significantly increase or decrease in any off-site watercourse (i.e., flooding is not expected to occur outside of historic floodplains), no effects to terrestrial or wetland vegetation are expected outside of the site boundaries.

Following construction of the power station and reclamation of the site, water levels in the created and existing wetlands and water bodies are expected to stabilize. Vegetation could become established along the littoral edges of the cooling reservoir and could vary in species composition and abundance depending on the water level fluctuations associated with surface water runoff, groundwater seepage, discharges, and rainfall. The cooling reservoir with an established littoral zone and the created wetlands may improve site biodiversity (although thermal and possibly water quality conditions of the cooling reservoir would tend to limit this process).

Groundwater withdrawals are not expected to result in significant changes to terrestrial and wetland species. None of the listed plant species discussed in Section 3.5.4 are expected to be affected by plant operations.

Additional effects on wildlife during operation of the proposed plant should be principally limited to vehicular mortality and noise. Small mammals such as opossum and raccoon are expected to be the most frequent fatalities from vehicles. Impact from noise is expected mainly from the flare during start up, up-sets, and maintenance of the CG facilities. These episodes would be of short duration and with a low frequency (i.e., less than 24-hours total in a year period). Therefore, startle effect to

Table 4.5.1-1. General Plant Injury Symptoms and Threshold Concentrations for Important Air Pollutants*

Pollutant	Symptoms	Part of Leaf Affected	Injury Threshold	
			$\mu g/m^3$	Sustained Exposure
Sulfur dioxide	Bleached spots, intercostal chlorosis	Mesophyll cells	785	8 hours
Ozone	Flecking, stippling, bleached spotting, pigmentation; conifer needle tips become brown and necrotic	Palisade or spongy parenchyma in leaves with no palisade	59	4 hours
Nitrogen dioxide	Irregular, white or brown collapsed lesions on intercostal tissue and near leaf margin	Mesophyll cells	4,700	4 hours
Hydrogen fluoride	Tip and margin burns, dwarfing, leaf abscission; narrow brown-red band separates necrotic from green tissue; fungal disease, cold and high temperature, drought, and wind may produce similar markings; suture red spot on peach fruit	Epidermis and mesophyll cells	0.08	5 weeks
Mercury	Chlorosis and abscission; brown spotting, yellowing of veins	Epidermis and mesophyll cells	<8,200	1 to 2 days
Sulfuric acid	Necrotic spots on upper surface similar to those caused by caustic or acidic compounds; high humidity needed	All		

* Hindawi (1970).

Source: TEC, 1992a.

Table 4.5.1-2. Air Pollutant Injury Threshold Concentrations for Plants Cultivated in or Native to Central Florida* (Page 1 of 2)

Common Name	Scientific Name	SO_2	O_3	NO_x	HF	SO_2/O_3 Synergism	SO_2/NO_x Synergism	Mercury Vapor
Red Maple	*Acer rubrum*		>196[d] (chronic)					>50[g] (7 days)
Box elder	*Acer negundo*				4 - 7[c] (9 days)			
Maple	*Acer sp.*	≥5,240[e] (8 hours)	196[d] (chronic)					>50[g] (7 days)
Lambs-quarters	*Chenopodium album*			1.88 x 106[b] (2 hours)				
Orange	*Citrus sinensis*	>5,240[e] (8 hours)		>7,380[b] (2 hours)				
Strawberry	*Fragaria sp*							>50[g] (7 days)
Sunflower	*Helianthus annuus*			>7,380[b] (2 hours)				≥50[g] (7 days)
Morning glory	*Ipomoea purpurea*	131 - 1,310[e] (8 hours)						>50[g] (7 days)
Privet	*Ligustrum sp.*		196[d] (chronic)					≥50[g] (7 days)
Tomato	*Lycopersicon esculentum*			7,380[b] (2 hours)		262/195[f] (4 hours)	13/62[f] (4 hours)	>50[g] (7 days)
Boston fern	*Nephrolepis exaltata*							50[g] (7 days)
Black gum	*Nyssa sylvatica var. bilflora*		>196[d] (chronic)					
Oxalis	*Oxalis sp*							50[g] (7 days)
Virginia Creeper	*Parthenocissus quinquefolia*		196[d] (chronic)					

Table 4.5.1-2. Air Pollutant Injury Threshold Concentrations for Plants Cultivated in or Native to Central Florida* (Page 2 of 2)

Common Name	Scientific Name	SO_2	O_3	NO_x	HF	SO_2/O_3 Synergism	SO_2/NO_x Synergism	Mercury Vapor
Bean	*Phaseolus vulgaris*			7,380[b] (2 hours)				
Caribbean pine	*Pinus caribaea*	131 - 1,310[e] (8 hours)						
Slash pine	*Pinus elliottii*	650[a] (2 hours)						
Peach	*Prunus persica*				4 - 7[c] (9 days)			
Black cherry	*Prunus serotina*		196[a] (4 days)					
Bracken fern	*Pteridium aquilinium*	131 - 1,310[e] (8 hours)						
Blackberry	*Rubus sp.*	131 - 1,310[e] (8 hours)						
Willow	*Salix sp*		196[d] (chronic)					50[g] (7 days)
American elm	*Ulmus americana*	131 - 1,310[e] (8 hours)						

* Concentrations in $\mu g/m^3$ (averaging times shown in parentheses).

Sources: [a] Linzon, 1986.
[b] Taylor and MacLean, 1970.
[c] Treshow and Pack, 1970.
[d] Heath, 1975.
[e] Jones *et al.*, 1974.
[f] Reinert, *et al.*, 1975.
[g] Siegel, *et al.*, 1984.
TEC, 1992a.

wildlife from flare stack operation is expected to be a temporary impact, although the level of impact would be species dependent.

Creation of nesting habitat for aquatic birds is part of Tampa Electric Company's plan for wildlife enhancement. If the proposed project is implemented, small upland islands would be constructed in selected reclaimed wetlands so waterfowl and other aquatic birds have some refuge from predation especially during nesting season.

4.5.1.3 Potential Impacts on the Chassahowitzka National Wilderness Area

The Chassahowitzka NWA is located along the Gulf of Mexico coast approximately 120 km northwest of the proposed Polk Power Station site. The NWA is the nearest Class I PSD area to the site and must be addressed as required by Chapter 17-2.500, FAC. The potential for emissions from the Polk Power Station to affect AQRVs at the Chassahowitzka NWA were evaluated (TEC, 1992a). The AQRVs of interest were visibility, soils, vegetation, and wildlife. Potential effects to visibility and soils are addressed in Sections 4.1 and 4.4 of this EIS. Results of modeling of emissions from the Polk Power Station indicated that potential effects at Chassahowitzka NWA would be negligible. As a result of the low emissions from proposed Polk Power Station and the distance of the plant from Chassahowitzka NWA, it is predicted that no detrimental effects on vegetation or wildlife in the wilderness area are expected (TEC, 1992a).

In keeping with the NEPA concept of anticipating and placing a reasonable upper bound on impacts of proposed projects, estimates of deposition rates at Chassahowitzka NWA were made using the ISC2 dispersion model. This approach would result in an over-prediction of impacts because of the assumptions inherent in the models. These assumptions include:

- Constant, uniform wind for each hour (i.e., steady-state Gaussian plume dispersion)
- Straight-line plume transport to all downwind distances

As discussed in Section 4.1.1.2, this detailed air quality modeling analysis did not change from the DEIS analysis since relevant project design changes were minor and would not significantly affect the detailed dispersion modeling.

Based on the results of this modeling, predictions can be made regarding the upper bounds of possible impacts and significance can be judged based upon the magnitude of these impacts.

The results of the ISC2 modeling predict deposition of sulfate and nitrate at less than 5.7×10^{-5} grams per square meter per year ($g/m^2/yr$) and 6.7×10^{-4} $g/m^2/yr$, respectively. These results should be quite high estimates because no provision for removal of these materials by natural processes other than deposition is included in the model. The sulfates are of concern in the freshwater wetlands of

Chassahowitzka NWA. These wetlands have been described by FWS as having a thin veneer of organic soil over a porous limestone base. Any sulfate deposited upon the organic layer of the freshwater wetlands of Chassahowitzka NWA should be biologically mediated. Sulfate would either be taken up directly by plants or microbially metabolized. Under anoxic conditions, sulfate would be reduced. This reaction would be mediated by hydrogen acceptors to produce water and sulfide (Alexander, 1977). The sulfide is free to react into other biological pathways. Thus, this quite low level of addition of sulfate would be metabolized to relatively harmless compounds, and no significant negative impacts to the organic soil layer are expected.

The average levels of organic nitrogen, as nitrogen in the Waccasassa estuary just north of Chassahowitzka NWA, are 0.46 mg/L (Putnam 1966). The input of nitrogen to the approximately 15,000 acres of saltwater habitat at Chassahowitzka NWA from the proposed project each year is estimated at less than 9.2 kg. The level of organic nitrogen could be increased by no more than 0.036 percent each year from this source, assuming no exchange of water with the Gulf of Mexico and an average depth of 3 ft in the estuary. On the basis of the results of the ISC2 modeling and the levels of organic nitrogen measured in the Waccasassa, the estimated rate of deposition would change the level of organic nitrogen by less than one percent in 25 years of operation.

Mercury and beryllium deposition in the vicinity of Chassahowitzka NWA from the proposed project are both estimated by the ISC2 modeling to be less than 2.5×10^{-9} $g/m^2/day$. Baseline data were not available on existing levels of these materials in the soil, water and biota of the area. However, EPA has published representative metal content typical of soils (EPA, 1987) which reports the common ranges for mercury and beryllium are 0.01 to 0.3 ppm and 0.1 to 40 ppm, respectively. The selected average of these two metals for soils is 0.03 and 6 ppm, respectively. On the basis of the ISC2 modeling and the EPA estimate of average levels of these metals in soils, the estimated deposition rate would change the selected average by less than 0.17 percent in 25 years of operation.

4.5.1.4 Transmission Line Corridor Impacts

Construction

The effects from right-of-way preparation and transmission line construction for the proposed Polk Power Station site would be significantly reduced because of the proposed locations of the transmission line corridors. The northern corridor is centered along SR 37 and its existing right-of-way for much of the northern corridor's 5.2-mile length. The only significant area crossed by the corridor within this segment is the South Prong Alafia River. However, the river's floodplain has already been altered due to road construction, as well as by mining activities north and south of the river. For the remainder of its length, the corridor turns northwest from SR 37 south of Bradley Junction in order to connect to the existing Mines-Pebbledale 230-kV transmission line. Along this segment, virtually all natural communities have been altered by phosphate mining activities.

Although general locations for the proposed corridors have been selected, an exact alignment of the transmission lines within the corridors has not been determined. The eastern corridor and the portion of the northern corridor on the Polk Power Plant site are 400 ft wide. The northern corridor width is increased to 0.5 miles along SR 37 and again increased to 1 mile in width southwest of Bradley Junction to allow flexibility in routing the line around mined areas and phosphate clay settling ponds, and to avoid the existing community of Bradley Junction. If applicable, a separate Section 404 permit would be obtained for the northern corridor upon final location of the right-of-way within the transmission line corridor.

All trees and brush in the right-of-way would be cleared. Equipment used may include bulldozers, shearing machines, chainsaws, or other heavy or light equipment. Burning may be used to initially eliminate slash from the right-of-way. All burning would be conducted in accordance with state and local burning ordinances.

Since much of the corridor areas are either located with SR 37 or traverse previously disturbed lands (mined areas), clearing of canopy vegetation would be minimal. In those portions of the corridors where clearing is necessary, only a relatively narrow strip of canopy would be lost. In these areas, clearing of overstory vegetation would not result in the loss of entire tracts or significant portions of regional wildlife habitat types. If forested wetlands were crossed, clearing would be done by hand or low-pressure ground shear machines to reduce soil compaction and damage to ground cover and hydrology. In nonforested systems, such as marshes and shrub swamps, clearing or alteration may not be necessary. In many instances, these community types could be spanned, thereby eliminating the need to affect wetland habitat.

A decrease in structural diversity would occur in areas formerly forested along the right-of-way due to the permanent loss of a tree canopy layer. Concomitantly, an increase in species diversity would be probable as additional shrubs and herbs would colonize the right-of-way in response to increased sunlight and decreased competition due to canopy removal.

Changes in local wildlife species populations are not expected as a result of transmission line construction. Individuals temporarily displaced from the immediate right-of-way areas during construction activities would be expected to reuse the areas (providing a similar habitat exists) when construction is completed. No significant effects to the resident birds or migratory species are expected since the preferred corridor does not include major staging, breeding, or wintering areas for migratory species (e.g., waterfowl, shorebirds, passerines).

Habitat use would decline during actual construction due to noise and physical activity. Such avoidance behavior would enable wildlife to escape direct effects from construction activities, although some losses of individual vertebrates (e.g., rodents, amphibians) may occur during right-of-way clearing. No habitats unique to the corridor exist and wildlife displaced into adjacent areas would survive if they can be assimilated into the territory of other competing individuals. The location of the preferred corridor along SR 37 and through land transformed by mining and associated activities further limits the potential for wildlife disturbance since individuals in local areas would already be habituated to traffic noise.

No federally designated Critical Habitat or Wild and Scenic Rivers are crossed by the corridor, and no terrestrial or aquatic habitats critical to the continued regional presence of important species would be affected. Any species of importance found in the area would be relocated out of affected areas, or the actual location of tower pads or roadway access would be shifted slightly to avoid affecting to these species.

Operation

Operational effects associated with the transmission corridors would be primarily of periodic maintenance. Mechanical mowing and EPA registered herbicides would be used to keep the right-of-way clear of unwanted vegetation. Herbicide chemicals would be used only as needed for maintenance purposes. All herbicide application would be conducted in a manner consistent with applicable federal, state, and local regulations and would be carried out by licensed personnel. No burning is anticipated to be needed for the maintenance of the right-of-way.

Various activities, including citrus farming, grazing, and agriculture, are typically allowed within the right-of-way as long as these activities do not interfere with the full use of the right-of-way as required to operate and maintain a transmission line. Specific uses within the right-of-way would be addressed individually with affected parties. Multiple use of the right-of-way may be restricted in certain areas, but in general, the compatible multiple uses listed above would be allowed.

It is Tampa Electric Company's policy to install locked gates at all points where the transmission line access road intersects previously fenced property. Therefore, with the exception of Tampa Electric Company's personnel performing routine maintenance, no increased vehicle access is anticipated. Since no significant increase in human traffic into formerly inaccessible habitats would result, there would be no subsequent increased disturbance to wildlife.

The proposed transmission lines would comply with Florida's EMF rule (Chapter 17-274, FAC), which requires 230-kV lines to not exceed 2.0 kilovolts per meter (kV/m) for electric fields and 150 milligauss (mG) for magnetic fields at the edge of the right-of-way. The electric field would also not exceed 8 kV/m anywhere on the right-of-way. EMF is not expected to affect wildlife in the area. Most wildlife would transit through the right-of-way and not remain in it for extended periods of time.

In summary, since the majority of the natural communities that occurred along both the northern and eastern corridors have been altered by mining or road construction, it is not anticipated that transmission line construction or maintenance would have any significant effects on vegetation, wildlife, or aquatic life. The absence of significant effects to important species is not coincidental as efforts were made during the corridor selection to avoid potentially sensitive habitats as much as possible. The avoidance of ecologically unique or valuable habitats was achieved primarily through location with SR 37 and/or crossing of lands that have been previously altered by mining.

4.5.2 Alternative: Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance)

Under the alternative proposal, use of a PC unit with an FGD system instead of the proposed IGCC unit would result in a significantly higher degree of effect to the terrestrial ecosystems of the site. The effects would result primarily from the increased land acreages required for product storage, increased cooling water requirements, and increased air emissions (Section 2.4.3.3). Technologies are similar for both processes because both involve the delivery, handling, and storage of coal and generate solid by-products that require development of on-site storage facilities. However, the PC technology has certain environmental disadvantages relative to the proposed IGCC unit.

As shown in Table 2.4.3-1, the PC unit would require more land area for the main power plant facilities than an equivalent IGCC unit, primarily due to the need for a larger coal and by-product storage areas. The PC unit would require almost twice as much land area for permanent storage of solid by-products (bottom and fly ash and gypsum) due primarily to its higher production volume of gypsum from the FGD system to control SO_2 emissions relative to the H_2SO_4 volumes from the IGCC unit syngas cleanup systems. A larger land area would be required to provide a similar period of storage for gypsum from the PC unit on a temporary basis relative to the H_2SO_4 from the IGCC unit, assuming that both by-products were marketable for off-site use. The PC unit with a FGD system would also require facilities for the delivery, handling, and storage of limestone that is not required for the proposed IGCC unit technology.

The air pollutant emission rates presented in Table 2.4.3-1 reflect modifications of the rates contained in the EPRI study. The modifications used similar sulfur removal efficiencies (95 percent) for SO_2 emissions for both technologies and more current assumed performance standards for NO_x emissions from PC units. Even with these modifications to reflect better efficiency and performance of the PC unit, the use of the PC technology would still result in higher SO_2 emissions and more than two times higher NO_x emissions than from the equivalent IGCC unit. Also, particulate emissions from the exhaust stack would occur from the PC unit, while particulate emissions from the IGCC unit are negligible.

Because of the requirement for a 500-MW PC unit compared to the 260-MW IGCC unit, the differences in effects of this alternative power resource at the Polk Power Station site would be proportionally greater than those discussed in the EPRI study.

For the PC with FGD alternative, effects associated with transmission line and pipeline corridors are not significantly different from those associated with the proposed facilities.

4.5.3 Alternative: No Action

The No-Action Alternative represents the situation in which the proposed Polk Power Station project would not be constructed and operated. If the proposed project was not constructed, all construction and operational environmental effects of the Polk Power Station project would be avoided. These potential effects involve both potentially adverse and beneficial effects.

If the Polk Power Station was not constructed on the site, land proposed for the power facilities would not be occupied by buildings, roads, storage areas, cooling reservoir, and other facilities. This land would be reclaimed according to FDER-approved reclamation plans.

4.5.4 Comparison of Impacts

Expected and anticipated adverse effects to terrestrial resources and species are more significant for the PC with FGD unit alternative proposal than for the proposed IGCC project. Use of a PC unit instead of the IGCC unit would result in the use of approximately 349 additional acres for product storage and increased cooling water storage as discussed in Section 2.4.3.3. This would represent additional loss of upland plant communities, wildlife habitat, and potential wetland areas. Air emissions would increase significantly for operation of a 500-MW PC unit compared to the proposed 260-MW IGCC unit and could result in potential effects to on-site vegetation (see Table 4.1.2-1).

The No-Action Alternative would result in both positive and negative effects to the site as discussed in Section 4.5.3. Land proposed for the power facilities would not be occupied by buildings, roads, storage areas, cooling reservoir, and other facilities. This land would be reclaimed according to FDEP-approved reclamation plans and could make more land available to wildlife and for reclaimed communities. However, this land would also be potentially used for agricultural purposes such as citrus groves or pasture which would decrease its wildlife usage.

If the Polk Power Station were not constructed and typical phosphate mining reclamation plans were implemented, less wetland and forested areas would be created than under Tampa Electric Company's proposed development/mitigation plan. Implementation of Tampa Electric Company's reclamation plan would result in 187 additional acres of on-site wetlands compared to premining conditions (see Table 5.2.3-1). This overall increase in wetland acres does not include the contribution of the cooling reservoir edge.

According to the previously approved mining reclamation plan for the site tract west of SR 37, the property was scheduled for a land-and-lakes type reclamation as indicated on Table 4.5.4-1. This reclamation process would result in the recontouring of overburden and mined-out areas for land-and-

Table 4.5.4-1. Estimated Premining, Disturbed, and Post-Reclamation Acreages and Percentages of Land Use/Cover on the Tampa Electric Company Polk Power Station

Code	Land Use/Cover*	Premining† Acres	Premining† Percent	Pre-1992 Disturbances from Mining** Acres	Pre-1992 Disturbances from Mining** Percent	Pre-1992 Disturbances from Power Line** Acres	Pre-1992 Disturbances from Power Line** Percent	Post-1992 Disturbances from Mining†† Acres	Post-1992 Disturbances from Mining†† Percent	Post-1992 Disturbances from Tampa Electric Company Polk Power Station†† Acres	Post-1992 Disturbances from Tampa Electric Company Polk Power Station†† Percent	Agrico's Current Post-Reclamation Plan Acres	Agrico's Current Post-Reclamation Plan Percent	Tampa Electric Company Polk Power Station Post-Reclamation Acres	Tampa Electric Company Polk Power Station Post-Reclamation Percent
140	Transportation	0	0	0	0	0	0	0	0	0	0	0	0	3	0.1
148	Gas transmission pipeline	14	0.3	0	0	0	0	0	0	0	0	14	0.3	14 †††	0.3
151	Electrical power facilities	0	0	0	0	0	0	0	0	0	0	0	0	261	6.0
152	Electrical transmission line	0	0	0	0	0	0	0	0	0	0	27	0.6	141 †††	3.3
210	Pastureland	885	20.3	381	13.8	11	40.7	36	7.2	60	36.6	972	22.4	635	14.6
230	Citrus grove	59	1.4	42	1.5	0	0	1	0.2	0	0	0	0	18	0.4
310	Grassland	20	0.4	20	0.7	0	0	0	0	0	0	49	1.1	0	0
320	Shrub and brushland	995	22.9	856	30.9	0	0	12	2.4	6	3.7	57	1.3	544	12.5
330	Mixed rangeland	159	3.7	159	5.7	0	0	0	0	0	0	1,067	24.5	6	0.1
410	Coniferous forest	439	10.1	355	12.8	0	0	65	12.9	0	0	59	1.4	0	0
420	Upland hardwood forest	53	1.2	85	3.1	3	11.1	24	4.8	9	5.5	38	0.9	55	1.3
430	Upland mixed forest	965	22.2	423	15.3	11	40.7	294	58.4	59	36.0	565	13.0	774	17.8
520	Lakes***	147	3.4	11	0.4	0	0	18	3.6	0	0	710	16.3	264	6.1
530	Reservoirs	0	0	0	0	0	0	0	0	0	0	0	0	834 ****	19.2
620	Wetland hardwood forest	68	1.6	0	0	2	7.4	17	3.4	5	3.0	59	1.4	61	1.4
630	Wetland mixed forest	267	6.1	267	9.6	0	0	0	0	0	0	264	6.1	310	7.1
640	Herbaceous wetland	277	6.4	170	6.1	0	0	36	7.2	25	15.2	467	10.7	428	9.8
	TOTAL	4,348	100	2,769	100	27	100	503	100	164	100	4,348	100	4,348	100

*The FLUCCS, 1976 was utilized for the land use and cover classification on the Tampa Electric Company Polk Power Station project. Level II FLUCCS is used for 200 to 600 series classifications, while urban or built-up (100) uses are classified at Level III.

†Refers to the land uses and cover present on the site prior to mining activities circa 1981.

**Pre-1992 disturbances refer to all disturbances from mining (Agrico, Inc.; IMC Fertilizer, Inc.; and American Cyanamid, Inc.) and power line (Tampa Electric Company Hardee-Pebbledale 230-kV) construction to premining land uses and cover prior to 1992.

††Post-1992 disturbances refer to all proposed disturbances from mining and power plant development to premining land uses and cover after 1992. An additional 926 acres of formerly altered land (154 acres of scraped-over areas and spoil piles and 772 acres of phosphate mined land) are also proposed to be used in the construction of the power plant facilities and cooling water reservoir (total acreage, 1,090 acres).

***The 520, Lakes classification refers to all man-made, open surface waters on the property other than the proposed cooling water reservoir.

†††Approximately 13 acres of the gas transmission pipeline (148) will remain in pasture; 141 acres of the electric transmission line rights-of-way (152) will also be maintained as pastureland.

****The approximate acreage of the proposed cooling reservoir including the inside portions of the surrounding berm and the area of the internal berms.

Sources: ECT, 1992; TEC, 1992a.

lakes. The resultant post-reclamation land would have less wetland and forested upland acreage than that proposed by Tampa Electric Company (approximately 170 acres less overall).

4.6 AQUATIC ECOLOGY IMPACTS

4.6.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

4.6.1.1 Construction-Related Impacts

The man-made aquatic systems that would be affected by construction of the proposed Polk Power Station are primarily waters in mine cuts. According to the USACOE 404 permit application Public Notice (see Appendix C) there are approximately 212 acres of jurisdictional mine cut wetlands on the proposed site. The filling of these surface waters would result in the loss of the resident fish and other aquatic biota. Although some of these mine cut lakes are used for limited amounts of recreational fishing, the loss of these habitats is unavoidable. If the proposed project is not constructed, the mine cut waters would still be filled under current FDEP reclamation regulations. If the project is approved, the loss of the mine cut lakes would be offset by the creation of additional aquatic habitat through construction of the cooling reservoir. This additional aquatic habitat would help restore local biodiversity. Tampa Electric Company has acquired the property and will prohibit fishing in surface waters within the site boundary. As discussed in Section 4.5.1.1, an additional approximately 41 acres of disturbed mixed herbaceous and early successional forested wetlands would be filled on the site for construction of the main power plant facilities (see Appendix C). No natural open water aquatic systems on or off site would be affected.

As discussed in Section 4.3, the water table level in the vicinity of the cooling water reservoir area would fluctuate due to dewatering activities during reservoir construction. Construction of the cooling reservoir would occur in stages with various portions of the site (subareas) being developed sequentially. As a subarea is dewatered, those manmade aquatic habitats would be lost. But as each subarea of the reservoir would be completed, it would receive waters from other portions of the site, thereby creating new aquatic habitats. The net effect of reservoir creation would be an increase in on-site aquatic habitats.

These dewatering activities could potentially decrease the amount of soil moisture or standing water in adjacent wetlands, depending upon the period of drawdown, the proximity of the wetlands to the dewatered area, and ambient rainfall. The dewatering effects could result in changes in plant biomass, species composition, and the proportion of aquatic plant species within wetlands. However, as discussed in Section 4.3.1, the effects to the surficial aquifer as a result of dewatering activities for the proposed project would be limited and short-term. Furthermore, these effects would be similar to those already experienced on site as a result of past and ongoing mining activities. Therefore, the proposed dewatering activities would have no significant effect on aquatic vegetation and wildlife habitats.

Proposed plant construction activities, such as habitat alteration, earth-moving, human presence, and noise, would force some species to be either permanently or temporarily displaced. Water birds and wading birds associated with the reclaimed and unreclaimed lakes on the eastern portion of the site could move elsewhere for feeding and roosting during construction, but should return and utilize these areas once construction is completed. No aquatic or terrestrial vertebrates associated with man-made surface waters would require translocation.

The proposed site development/reclamation plan would actually increase the wetland acreage on the site compared to premining conditions, thereby increasing habitat for water-dependent species. The old mine cut lake on the northeastern portion of the eastern tract, where the greatest water and wading bird activity was observed, would not be significantly disturbed by the proposed project activities. No effects to nesting of water-dependent bird species are expected since no nesting areas of these species were identified on site.

4.6.1.2 Operation-Related Impacts

Thermal Impacts

The proposed Polk Power Station cooling reservoir would discharge into the northwestern corner of the reclaimed lake located within the project boundaries on the east side of the site. Water would then drain from the lake through a swale on the southern edge of the lake into the Little Payne Creek drainage system. As discussed in Section 4.2, the predicted maximum average reservoir temperature on the cold side at the condenser intake is estimated to be 88.3°F in August. The maximum monthly discharge temperature (August) would be 88.7°F under plant full load conditions. At the point of discharge, these maximum discharge temperatures are within the acceptable water quality criteria for peninsular Florida streams. The thermal criteria for maximum discharge temperature in the project area is 92°F, while the predicted maximum discharge temperature is 88.7°F (TEC, 1992a).

Based on a natural water equilibrium temperature of 62.1°F in December and a maximum cooling reservoir discharge temperature of 66.2°F during winter, a maximum temperature differential of 4.1°F may occur. This temperature differential is less than the state standard of 5°F for receiving streams but slightly higher than the standard for receiving lakes (3°F above ambient). The greatest potential for thermal shock to aquatic organisms would be localized within 250 ft from the point of discharge (i.e., the mixing zone). In less than 250 ft from the point of discharge into the reclaimed lake, the thermal plume would be reduced to less than 3°F above ambient temperature.

The maximum summer temperature differential is estimated to be 2.6°F at the point of discharge. During summer, aquatic organisms would be acclimated to high temperatures and therefore, may be more tolerant to slight increases in ambient levels. At temperatures greater than their thermal preference, fish tend to avoid or move away from the heated waters (Talmage and Opresko, 1981). Because of the differences in thermal responses of different fish species, the seasonal changes in preference of species, and variation in temperatures across the mixing zone, fish would exhibit temporal and spatial variation near a thermal discharge. However, this seldom results in a permanent loss of species from the local population. Thus, based on the cases modeled for this project, no thermal effects to aquatic organisms are anticipated outside the mixing zone.

Water Quality Impacts

As shown in Table 2.3.6-2, all surface water quality parameters would meet state water quality standards when cooling water would be discharged from the cooling reservoir, except for temperature during certain winter months and under extended periods of full load operation. The temperature of the discharge water will meet the temperature standard within a mixing zone of less than 250 ft from the outfall. The water exiting the site at the southern edge of the lake would also meet all surface water quality standards.

An oxidizing agent (e.g., sodium hypochlorite or gaseous chlorine) would be used as a biocide for cooling system protection and would be introduced in conformance with the allowable residual chlorine discharge requirements as specified in 40 CFR 423.15 (i.e., 0.2 mg/L for 2-hour daily intervals). Based on the anticipated travel time for the cooling water to reach the point of discharge (greater than 9 days), mixing factors, and natural decay, the level of total residual oxidants near the reservoir outfall should be negligible.

The sanitary wastewater system and potable and process water treatment system would also use chemicals for their processes. Based on the proposed treatment prior to discharge to the cooling reservoir, these influents to the cooling reservoir are not expected to result in a toxicity issue. Chemical cleaning wastewater generated by the periodic cleaning of the HRSG boilers would be collected and temporarily stored in a chemical cleaning wastewater holding tank. A boiler cleaning contractor would transport the chemical cleaning waste off site for treatment and disposal.

Based on the above factors, no biological effects from the cooling reservoir discharges are anticipated outside the thermal mixing zone in the on-site reclaimed lake or in any off-site waters.

Physical Impacts

Cooling reservoir blowdown would be discharged at a rate of approximately 3.1 mgd. This relatively small amount would have two hydrological and ecological benefits to Little Payne Creek downstream of the site. First, the average volume of water entering the creek would be increased sightly over premining conditions, which would help maintain water in the creek on a more permanent basis. Second, the peak flood levels would be reduced in exchange for a more constant flow throughout the year. These two benefits would serve to maintain aquatic habitats year round, thereby maintaining use of the system by aquatic organisms. No adverse effects on the composition or diversity of fish in the creek is expected, and the more constant flow may benefit the community.

The increased volume and flow are not anticipated to be significant enough to cause scouring, bank erosion, or deposition of suspended solids in Little Payne Creek. Therefore, such negative effects on aquatic organisms are not anticipated from cooling reservoir discharges.

Impingement and entrainment are not considered potential sources of effects to aquatic organisms since natural surface waters from off site would not be used. Plant makeup water would be groundwater and waters from the cooling reservoir.

4.6.1.3 Transmission Line Corridor Impacts

The transmission line corridor would be 5.2 miles in length and consist of approximately 2,125 acres. Limited surface water and wetland environments are located within the proposed corridor as shown on Figure 3.5.6-1. The combined area for these aquatic systems would be 72 acres or 3.5 percent of the total corridor. This amounts to 12 acres for FLUCCS category 520 (surface water), 59 acres for 621 (freshwater swamp), and one acre for 641 (freshwater marsh). Tampa Electric Company has not made a final determination for the transmission line alignment, and therefore, effects to the exposed natural communities could only be assessed in a general manner.

Surface waters and wetlands within the corridor could be affected by construction activity of the proposed facility if the final alignment crosses such areas. Construction activities would produce temporary disturbance via potential siltation of surface waters. For example, the construction of the access road along the line would be a principal disturbance on natural communities. Tampa Electric Company would decrease the disturbance by use of siltation barriers and appropriate measures to reduce suspended solids volume from storm water runoff. Also, Tampa Electric Company will attempt to avoid wetland and surface water areas in its selection of the final right-of-way alignment.

The construction of a road to access the transmission line would reduce the acreage of any affected natural community. It may also act as a barrier to wildlife species if there is no provision for crossing. The necessary installation of culverts would lessen this probable effect. Since the off-site portion of the proposed corridor parallels SR 37 for the majority of its length, the need for transmission line access roads is expected to be minimal.

The long-term effects would be loss of some natural habitat due to the construction of the road. Quantitative limits would be available when the alignment is known. At that time assessments can be made in coordination with the State of Florida for determinations on wildlife effects and also cultural resources.

4.6.2 Alternative: Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance)

The alternative PC technology would require 60-percent more water for condenser cooling purposes than the equivalent IGCC unit since PC unit electricity generation is totally based on STs, whereas only the HRSG/ST component of the IGCC unit requires cooling water. Therefore, if a PC unit was used instead of the proposed IGCC unit or the CC units for the proposed Polk Power Station, the proposed cooling reservoir area would need to be increased, and the proposed cooling water makeup from the Floridan aquifer and discharge volumes would be significantly increased. The PC unit would require less process/service water than an equivalent IGCC unit and would require the treatment of significantly less wastewater than the typical IGCC unit, primarily due to water uses in the CG process. However, since the proposed IGCC unit would involve reuse and treatment of CG process water with no liquid discharges, the amount of treated process wastewater discharge to the cooling reservoir similar for the proposed project and alternative proposal.

No significant increase in effects to off-site aquatic systems are expected with the alternative proposal compared to the proposed project.

4.6.3 Alternative: No Action

Under the No-Action Alternative, aquatic systems on the site would be developed/reclaimed under approved mining reclamation plans. Fewer acres of aquatic and wetland habitat would result than under Tampa Electric Company's proposed plan.

4.6.4 Comparison of Impacts

As a result of Tampa Electric Company's proposed project, the aquatic systems that would be affected by construction of the Polk Power Station are primarily waters in mine cuts. An additional 41 acres of disturbed mixed herbaceous and early successional forested wetlands would be filled on the site for construction of the main power plant facilities. The proposed site development/reclamation plan would actually increase the wetland acreage on the site compared to premining conditions, thereby increasing habitat for water-dependent species. The old mine cut lake on the northeastern portion of the eastern tract, where the greatest water and wading bird activity was observed would not be significantly disturbed by the proposed project activities. No natural aquatic systems on or off site would be affected.

Development of the alternative power resource proposal would require 60-percent more water for condenser cooling purposes than an equivalent IGCC unit since PC unit electricity generation is totally based on STs, whereas only the HRSG/ST component of the IGCC unit requires cooling water. Therefore, if a PC unit was used for the Polk Power Station, the proposed cooling reservoir area would need to be increased, and the proposed cooling water makeup from the Floridan aquifer would be significantly increased.

The No-Action Alternative would result in fewer acres of aquatic and wetland habitat than under either alternative development/reclamation plan, as discussed in Section 4.5.4.

4.7 SOCIOECONOMIC IMPACTS

4.7.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

4.7.1.1 Population Impacts

Population impacts from the proposed project on housing, schools, and other public services and facilities in the regional study area would be minimal. Construction, operation, and maintenance personnel requirements from 1994 to 2010 are shown in Table 4.7.1-1. Since the projected workforce would primarily commute from existing residences with few relocations, project-associated increases in spending would benefit the local and regional economies, while not significantly increasing demand for public services and facilities.

Construction-Related Impacts

As shown in Table 4.7.1-1, employment would be highest during the initial project phases (i.e., 1994 to mid-1996, when the IGCC unit is built) because of the construction activities associated with overall site reclamation, CG facilities, and ancillary facilities that will be constructed for ultimate build-out. Construction employment would average approximately 650 workers over the 27-month initial construction phase, peaking for a 7-month period in 1995 at approximately 1,400 workers. Beyond this initial construction timeframe, an average of 73 and peak of 109 construction workers would be employed for 6 to 9 months for the free-standing CT units, and an average of 83 and peak of 111 construction workers would be employed for 12 to 18 months for the CC units (TEC, 1992a).

Based on experience provided by construction of the Hardee Power Station, approximately 60 percent of the construction workforce would be drawn from Polk County, 30 percent from Hillsborough County, 5 percent total combined from both Manatee and Hardee Counties, and 5 percent from outside the region or state (TEC, 1992a). The geographic distribution of this construction workforce is shown in Table 4.7.1-2. Construction employees moving to the area from outside the region would range from a peak of 70 persons during the initial (through IGCC unit) construction phase to a peak of five persons during subsequent construction of the CT and CC units. The potential effects on housing, schools, and other public facilities and services would be minimal. Construction would occur during daylight hours, with the majority of the construction workers on site between 7 a.m. and 4 p.m.

Operation-Related Impacts

As shown in Table 4.7.1-1, the operational workforce would be 130 total employees at the completion of the IGCC unit in 1996. At project build-out, employment would reach 210 persons. This employment figure includes plant operators, internal maintenance personnel, and supervisory and administrative staff.

The majority of the operational workforce (e.g., plant workers) would be drawn from the local labor pool in Mulberry, Bartow, Lakeland/Winter Haven, Plant City, and Tampa, with most of the senior plant management staff drawn from existing Tampa Electric Company operations in Hillsborough and

Table 4.7.1-1. Annual Construction Workforce and Operational Workforce to Build-Out in 2010 at Proposed Polk Power Station

Year	Total Nominal Station Capacity (MW)	Construction Personnel (Average)	Construction Personnel (Peak)	Operational Personnel	Maintenance Personnel	Total Maximum Employment	Unit Addition
1994	0	100	400	0	0	400	
1995	0	1,200	1,400	0	0	1,400	
1996	260	600	1,200	130	0	1,330	260 MG IGCC
1997	260	0	0	130	6	136	
1998	260	73	109	130	66	305	
1999	335	73	109	140	0	249	75 MW CT
2000	410	64	96	147	75	318	75 MW CT
2001	480	137	184	162	5	351	CC Conversion of two 75 MW CTs
2002	555	83	111	167	80	358	75 MW CT
2003	775	0	0	182	21	203	220 MW CT
2004	775	0	0	182	95	277	
2005	775	73	109	182	17	308	
2006	850	73	109	187	94	390	75 MW CT
2007	925	73	109	192	26	327	75 MW CT
2008	1,000	73	109	197	89	395	75 MW CT
2009	1,075	73	109	202	39	350	75 MW CT
2010	1,150	0	0	210	100	310	75 MW CT

Sources: UE&C, 1992.
ECT, 1992.
Bechtel, 1993.
TEC, 1992a.

Table 4.7.1-2. Estimated Distribution of Construction Workforce During Construction of the IGCC

County	Average IGCC Construction Workforce	Peak IGCC Construction Workforce	Peak CT Construction Employment	Peak CC Construction Employment
Polk (60 percent)	390	840	65	67
Hillsborough (30 percent)	195	420	33	33
Hardee and Manatee (5 percent)	32	70	6	6
Outside region/state (5 percent)	33	70	5	5
TOTAL	650	1,400	109	111

Sources: UE&C, 1992.
ECT, 1992.
TEC, 1992a.

Polk Counties. The geographic distribution of the operational workforce, as shown in Table 4.7.1-3, would consist of the following: 60 percent from Polk County; 25 percent from Hillsborough County; 5 percent from Manatee County; 5 percent from Hardee County; and 5 percent from outside the region or state. Because the major regional population centers would be within a 30-mile distance to the Polk Power Station, and based on typical commuting patterns of power plant employees (EPRI, 1982), it is estimated that 95 percent of the total operational workforce would commute from their existing residences. Only 5 percent of the operational workforce (11 persons) would permanently relocate to the region (TEC, 1992a). This number of potential relocations would not significantly impact regional housing, transportation facilities, or public services and facilities.

The operational workforce would also include those employees hired on an annual basis for contract maintenance. All of the contract maintenance workers would commute from their existing residences, with no permanent relocation anticipated (TEC, 1992a). The total number of annual contract maintenance workers would range from 6 in 1997 to 100 workers at build-out in 2010, as shown in Table 4.7.1-1. The number of contract maintenance workers would vary from year to year due to the maintenance schedules for the power units, which generally require maintenance every other year.

4.7.1.2 Environmental Justice

EPA is committed to promoting and supporting equitable environmental protection regardless of race, ethnicity, economic status, or community. This focus is to assure that no segment of the population bears a disproportionate share of the consequences of environmental pollution.

It has been asserted that communities consisting of poor people and/or minorities bear a disproportionate burden of this nation's air, water, and waste problems. It has been observed that poor people and/or minorities are more likely than their counterparts to live near freeways, sewage treatment plants, municipal and hazardous waste landfills, incinerators, and other noxious facilities. Such facilities may also be more likely to be sited near poor people and/or minorities. Disparate siting and land-use patterns can result in elevated health risks to nearby inhabitants. As a result of these concerns, EPA and DOE are developing policies to begin addressing environmental inequities that exist in working class and low-income communities. Federal decision-makers using this EIS as a decision-making document must consider whether this proposed project causes one segment of society to bear a disparate burden for the rest of society's problems.

As discussed in Section 2.5, Tampa Electric Company conducted a Power Plant Site Selection Assessment program to identify a suitable site for constructing and operating proposed power plant facilities. An integral aspect of this site selection program by Tampa Electric Company was the formation and participation of a Siting Task Force. The Siting Task Force was comprised of 17 private citizens from environmental groups, businesses, and universities in the Tampa Electric Company service area and throughout Florida. The DEIS (Appendix J) lists the Siting Task Force members and highlights the diversity of the group. Tampa Electric Company's objective in forming

Table 4.7.1-3. Estimated Distribution of Operational Workforce*

County	1996	2010
Polk (60 percent)	78	126
Hillsborough (25 percent)	33	53
Hardee (5 percent)	6	10
Manatee (5 percent)	6	10
Outside region/state (5 percent)	7	11
TOTAL	130	210

* Rounded to the next whole position.

Sources: UE&C, 1992.
ECT, 1992.
TEC, 1992a.

and committing to the Siting Task Force participation in the siting program was to ensure that local and statewide public issues and concerns relative to new power plant development were adequately and accurately considered in the process of selecting a site for the new power plant.

The Task Force members met monthly from September 1989 through September 1990 to review and guide the progress of the siting program. Among the Siting Task Force membership was Mr. Henry Carley, an educator at Hillsborough Community College (HCC) and coordinator of minority student outreach programs at HCC. Mr. Carley was also president of the Tampa branch of the National Association for Advancement of Colored People (NAACP) during the time the Siting Task Force was meeting. Members with expertise in socioeconomic issues related to power plant siting were Dr. David Denslow, interim director of the Bureau of Economic and Business Research and professor in the Department of Economics at the University of Florida (UF) and Dr. Sanford Berg, also a professor of Economics at UF and the executive director of the Public Utility Research Center at the university.

The power plant site selection process involved systematic analyses and comparisons to evaluate the advantages and disadvantages of various areas. This process attempted to locate potential sites which had the most suitable or acceptable balance of trade-offs among the environmental, social, and engineering/ economic siting factors. The Siting Task Force members unanimously recommended that the proposed Tampa Electric Company power facility should be located at one of the three preferred sites in southwestern Polk County, one of which included the proposed Polk Power Station site (see Section 2.5.4.7).

Tampa Electric Company conducted extensive coordination efforts during the 18-month period of the licensing efforts prior to submission of the SCA to ensure that the general public and public organizations were informed of the proposed project. Public meetings, advertised in local newspapers, were held in the communities of Bartow, Mulberry, Fort Meade, and Chicora in August and May of 1992. The Chicora meeting is noteworthy because it was held with the proposed power plant's nearest neighbors, residents living along Bethlehem, Albritton and Mills Roads. Chicora is the place-name for the small rural settlement located nearest the proposed site, approximately two miles to the west. Tampa Electric Company attempted to contact and invite to these public meetings leaders from the local communities. Two newsletters were distributed during this period that discussed the location of the project, technology to be used, potential jobs, and schedule. In addition, duly noticed and advertised public hearings in area newspapers were held for the Polk County Zoning Advisory Board meetings and Polk County Board of County Commissioners meetings on the Conditional Use Permit application. A public scoping meeting was held by DOE in Fort Meade on August 12, 1992. Two public hearings were held as part of the site certification process in Bartow, Florida, on October 29, 1992 and October 13, 1993.

The Siting Task Force recommended the project be located in the southwestern corner of Polk County. This area is one of the more rural areas of Polk County. The primary study area, as well as additional land area to the north and east, are encompassed by Census Tract 161.98. Tract 161.98 is bordered by Hillsborough County to the west, Hardee County to the south, CR 555 to the east, and CR 640 to the north. The tract has two block groups: Block Group 1, which includes much of the rural area within the tract, including the area around the proposed Polk Power Station; and Block Group 2, which includes much of the unincorporated community of Bradley Junction. Figure 4.7.1-1 shows the relationship between Census Tract 161.98 (including Block Group 1 and Block Group 2) and the proposed Polk Power Station.

The community of Bradley Junction is the only area within the five-mile study area that approaches urban type development. Bradley Junction is predominantly a residential area with medium density residential uses (2 to 6 units per acre), a few scattered commercial uses (i.e., convenience store and gas stations), a few institutional uses (i.e., post office, fire station, and churches), and a park (Bradley Junction Recreational Park). There are no known schools, hospitals, or other sensitive uses located in Bradley Junction. As discussed in Table 3.7.3-2, the nearest schools to the proposed project are located in the cities of Fort Meade and Mulberry, 11 and 13 miles respectively from the proposed site. Since the community of Bradley Junction is unincorporated, the boundaries of Block Group 2 will be used to delimit the area of Bradley Junction for this analysis.

The 1990 Census reported a population of 1,627 for Tract 161.98. The overall density in the approximate 130-mi^2 area was 12 persons/mi^2. Block Group 1, which covers an area of 129 mi^2, had a population of 744 and a population density of 5.8 persons/mi^2 in 1990. Block Group 2, which covers an area of 1.15 mi^2, had a population of 883 and a population density of 768 persons/mi^2. The average density of Polk County was 222 persons/mi^2 in 1990 (BEBR, 1991).

Tract 161.98 has a higher percentage of blacks (43.2 percent) than Polk County or surrounding tracts in Polk, Hillsborough, Manatee, and Hardee Counties. Block Group 2, which includes Bradley Junction, has the nearest division of black to white citizens with 50.1 percent black and 49.0 percent white. Block Group 1 has 35.1 percent black and 64.9 percent white. In all of Polk County, blacks make up 13.4 percent of the population, while 84.4 percent of the population is white. Other tracts in the vicinity exhibit ratios of black to white population more similar to Polk County than to Tract 161.98. Florida's black population comprises 13.6 percent of the total population. Overall in Florida, the percentage of blacks in urban areas is higher than the percentage in rural areas (14.4 percent versus 9.0 percent); however, the percentage of blacks in rural areas with less than 1,000 persons or with between 1,000 and 2,500 persons is notably larger with percentages of 19.0 percent and 15.5 percent, respectively (Table 4.7.1-4). The data for Tract 161.98 in Table 4.7.1-4 indicates that the site selection appears to impact a higher percentage of blacks in comparison to the total black percentage data for Polk County and Florida.

The black population density in Tract 161.98 is comparable to the other tracts and lower than the county densities (Table 4.7.1-5).

Table 4.7.1-4. Comparison of 1990 Population Characteristics of Polk County Tract 161.98 with Polk County, the State of Florida, and Rural Tracts in the Vicinity of the Proposed Polk Power Station.

Location	Total Population	White Population	Percent of Population	Black Population	Percent of Population
Polk County	405,382	342,316	84.4%	54,318	13.4%
Tract 161.98	1,627	916	56.3%	703	43.2%
BG1	744	483	64.9%	261	35.1%
BG2	883	433	49.0%	442	50.1%
Tract 160	6,368	4,402	69.1%	1,302	20.4%
Tract 159	1,772	1,584	89.4%	40	2.3%
Tract 158	3,128	2,657	84.9%	285	9.1%
Tract 157	5,666	4,364	77.0%	1,001	17.7%
Manatee Co.- Tract 19.01	4,764	4,276	89.8%	175	3.7%
Hillsborough Co.- Tract 139.03	2,963	2,945	99.4%	0	0.0%
Hardee Co.- BNA 9702	3,939	3,283	83.3%	292	7.4%
Florida	12,937,926	10,755,698	83.1%	1,755,958	13.6%
Florida Urban	10,970,445	9,012,863	82.2%	1,578,357	14.4%
Florida Rural	1,967,481	1,742,835	88.6%	177,601	9.0%
Florida Rural (1,000 to 2,499)	159,740	131,406	82.3%	24,731	15.5%
Florida Rural (less than 1,000)	39,461	31,133	78.9%	7,504	19.0%

Source: U.S. Bureau of the Census, 1991.

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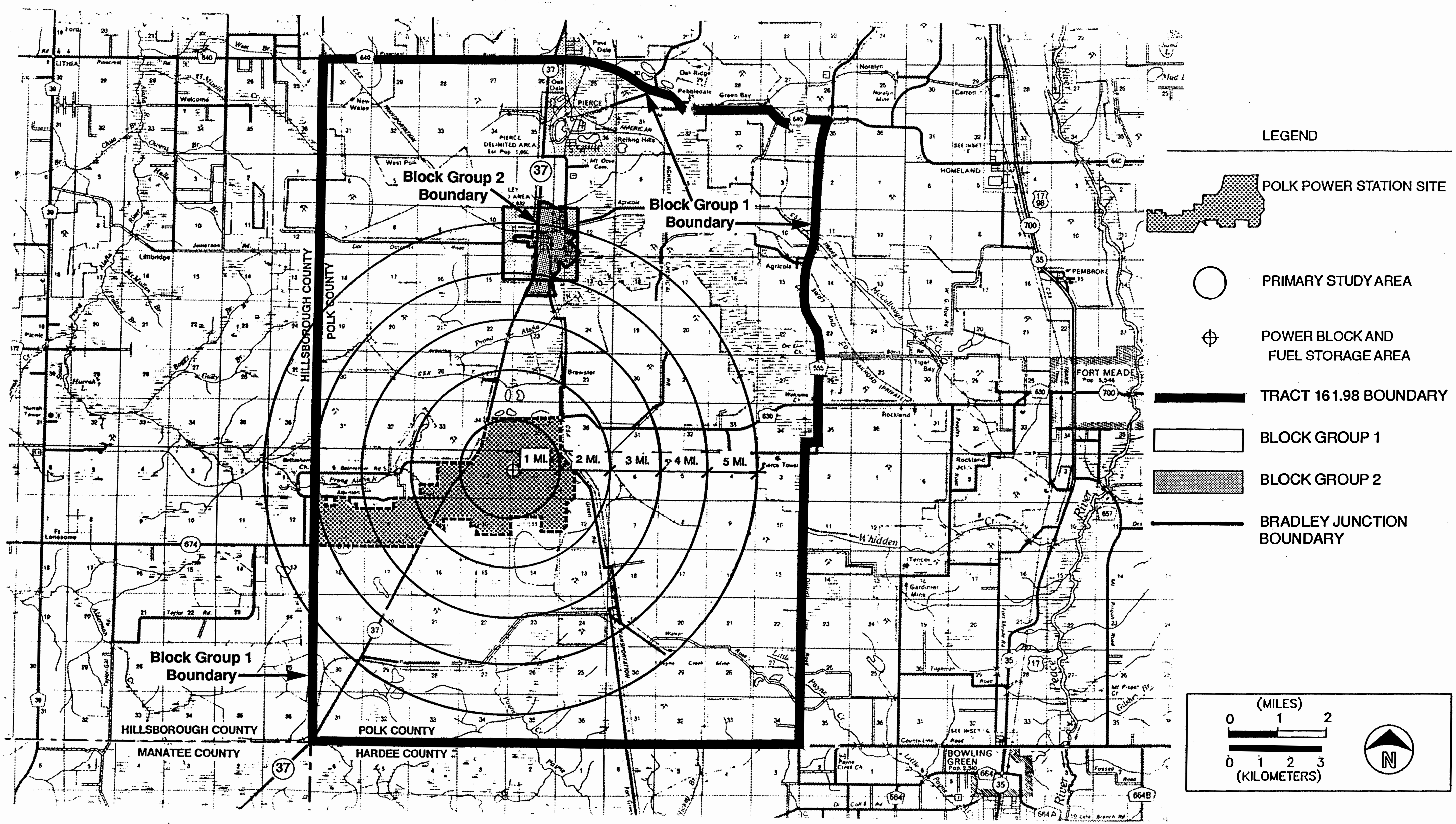

FIGURE 4.7.1-1.
Location of U.S. Census Block Groups 1 and 2.

SOURCE: U.S. Bureau of the Census 1991.

NOTE: Block Group 2 envelops the community of Bradley Junction.

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Polk County, Florida

Table 4.7.1-5. Comparison of 1990 Population Density in Polk, Hillsborough, Manatee, and Hardee Counties

County/Tract	1990 Population	1990 Black Population	Square Miles	Population Density (sq. mi)	Black Population Density (sq. mi)
Tract 161.98	1,627	703	130	12	5
Tract 160	6,368	1,302	91	70	14
Tract 159	1,772	40	66	27	1
Tract 158	3,128	285	63	49	5
Tract 157	5,666	1,001	207	27	5
Tract 19.01 (Manatee)	4,764	175	294	16	1
Tract 139.03 (Hillsborough)	2,963	0	89	33	0
Tract 9702 (Hardee)	3,939	292	65	60	4
Polk	405,382	54,318	1,875	216	29
Hillsborough	834,054	110,283	1,051	794	105
Manatee	211,707	16,400	741	286	22
Hardee	19,499	1,034	637	31	2
Florida	12,937,926	1,755,958	53,997	240	33

Sources: BEBR 1993
Bureau of the Census 1991

Median household income in Tract 161.98 is 79.8 percent of the median household income in Polk County. There is a large difference in median household income between Block Group 1 and Block Group 2. The median household income for Block Group 2 is $14,583, or 57.8 percent of Polk County's median household income of $25,216. Block Group 1 has a median household income of $23,661, which is 93.8 percent of Polk County's median household income. The median household income for Block Group 1 is higher than five of the eight rural tracts examined in the vicinity of the proposed power station. Block Group 2 has the lowest median household income in the area. The pattern holds true for median family income in the area as well, with Block Group 1 near the top of the eight areas examined, and Block Group 2 the lowest (Table 4.7.1-6). Bradley Junction is a qualified community to receive Community Development Block Grant (CDBG) funding (Deardorf, 1994). The median household income for Bradley Junction is considerably less than the Florida Urban and Rural median household income (48 and 44 percent, respectively).

In Florida, generally, rural places of less than 1,000 persons have median family incomes of $23,689 as compared to the state average of $32,212. With increased environmental regulation and the difficulties associated with siting a new power plant in an urban area in general, power facilities are drawn to rural areas. Regardless of the specific rural area, there is a higher probability that the area would have significantly lower incomes (73 percent) than the state average in Florida.

The economic impacts of the proposed project on Polk and surrounding counties are discussed in Section 4.7.2.2. The proposed project would have a positive impact on the local economy through increased employment (both construction and operations), tax revenues (property tax and sales tax), and expenditures for construction and operation of the proposed project. It is anticipated that approximately 60 percent of the construction and operational workforce, and 50 percent of the maintenance workforce would be drawn from Polk County.

In order to help ensure that economic benefits of the proposed power station are realized locally, Tampa Electric Company has proposed a cooperative training program in the power generating and process industry be developed as a joint venture between power producers in the area and Polk Community College and South Florida Community College. Upon implementation, the program will be publicly announced in local newspapers, and persons residing in the local area, including Bradley Junction, would have the opportunity to attend.

The proposed power plant is located in an area that is characterized as sparsely settled by personnel from the Polk County Property Appraiser's Office. Dwellings in the area are a mix of single family and mobile homes, mostly on larger parcels, and many built in the 1950s and 1960s.

Table 4.7.1-6. Comparison of 1990 Income Characteristics of Polk County Census Tract 161.98 with Polk County, the State of Florida, and Rural Census Tracts in the Vicinity of the Proposed Polk Power Station.

Location	Median Household Income	Median Family Income	Per Capita Income	Persons Below Poverty Level	Percent of Persons Below Poverty Level
Polk County	25,216	28,965	12,392	51,201	12.9
Tract 161.98	20,116	25,212	7,703	313	19.2
BG1	23,661	26,761	8,851	72	9.7
BG2	14,583	19,135	6,735	241	27.3
Tract 160	22,745	25,252	9,321	293	9.9
Tract 159	22,878	24,706	9,865	1,483	23.3
Tract 158	19,022	20,536	8,497	589	19
Tract 157	20,850	24,369	11,025	903	23.1
Manatee Co.- Tract 19.01	32,112	36,326	15,588	776	19
Hillsborough Co.- Tract 139.03	25,792	28,800	10,028	589	17.6
Hardee Co.- BNA 9702	20,185	23,703	8,544	903	23.1
Florida	27,483	32,212	14,698		
Florida Urban	27,789	32,792	14,997		
Florida Rural	26,039	29,495	13,029		
Florida Rural (1,000 to 2,499)	21,970	25,845	12,099		
Florida Rural (less than 1,000)	19,748	23,689	12,221		

Source: U.S. Bureau of the Census, 1991.

Personnel from the Polk County Planning Division office noted that power-generating companies have been attracted to the area because of environmental reasons and not because of income or racial makeup of the local population (Anders, 1994; Deardorf, 1994).

Based on aerial photographic interpretations within a 5-mile radius of the power station site proposed by Tampa Electric Company, approximately 85 homes are located in areas west of SR 37 north of the proposed site along Albritton and Bethlehem Roads. The Alafia Bible Camp is located along Bethlehem Road, and Bethlehem Primitive Baptist Church and Cemetery are located at the western edge of Bethlehem Road. Approximately 14 additional homes are located 1.5 miles southeast of the proposed site, along Mills Road, and approximately 30 other homes are located west of the proposed site adjacent to SR 674. The proposed facility is located on a large property, which would isolate it from its neighbors to some extent.

Existing land use adjacent to the proposed Polk Power Station site boundaries primarily includes areas currently utilized for phosphate mining, unreclaimed phosphate mining areas, and reclaimed phosphate mining areas. From a land-use perspective, the reclaimed areas currently function as agricultural land.

The proposed northern transmission line corridor connecting the proposed Polk Power Station to the existing Mines-Pebbledale 230-kV transmission line would traverse along SR 37 and then turn northwest at a point south of Bradley Junction in order to connect to the existing circuit while avoiding this community. The corridor width along SR 37 is 0.5 mile wide and is increased to 1.0 mile in width southwest of Bradley Junction to allow flexibility in routing the line around mined areas and phosphate clay settling ponds and to avoid the existing community. The existing Mines-Pebbledale 230-kV transmission line runs in a southwest to northeast direction through the northern area of Bradley Junction. The EMF associated with the proposed transmission lines and the transmission lines that would be interconnected would comply with the State of Florida EMF Rule (Chapter 17-274, FAC), which requires 230-kV lines to not exceed 2.0 kV/m for electric fields and 150 mG for magnetic fields at the edge of the right-of-way. Both the proposed lines and the lines that would be interconnected would be 230-kV lines.

Average noise levels for the construction and operation of the proposed Polk Power Station would be similar to existing levels and would be at relatively low noise levels (see Section 3.11 and 4.11). For example, based on the literature, the averaged hourly noise measurements $L_{eq(1)}$ during construction at the nearest residence (1.6 miles from the proposed power block) can be expected to be between 40 and 35 dB, which is below the existing $L_{eq(24)}$ of 51.7 dB measured near the residence. The $L_{eq(24)}$ noise level at the nearest residence during full build-out operation (scheduled by Tampa Electric Company for 2010) is predicted to be 51 dB $L_{eq(24)}$ compared to 51.7 dB $L_{eq(24)}$. However, intermittent maximum instantaneous noise levels would be significant during construction and operation noise single events. For example, steam line blow out cleaning during construction is predicted to result in a significant 85 to 80 dB level at the nearest residence and flare stack operation is predicted to result in a significant

77 to 75 dB at the two nearest residential areas. Such single events could produce a "startle effect" for nearby human and wildlife receptors. These single events are not expected to be frequent, with steam cleaning being associated with the construction phase with such events to be announced in local newspapers, and flare stack operation occurring during project start-up, maintenance, and emergencies totalling some 24 hours per year.

Maximum instantaneous noise levels for coal trains are not predicted to be significant (54 dB at nearest residence from the power block compared to 51.7 dB $L_{eq(24)}$ for existing levels), although single events such as whistles could be intrusive and pass-by noise levels can be expected to be significant (97 dB at 50 ft for diesel locomotives). In regard to project coal and other truck noise, peak-hour $L_{eq(1)}$ (noise level during peak traffic hour) noise levels at full build-out at the nearest residence from the edge of the proposed delivery route (85 ft away) is predicted to be 57.5 dB $L_{eq(1)}$ compared to the existing peak-hour traffic noise level of 64 dB $L_{eq(1)}$. The addition of the project truck traffic would increase the peak-hour overall traffic by approximately 1 dB, which is typically not a detectable increase. The predicted and overall resultant noise levels are also below the FHWA peak-hour $L_{eq(1)}$ guidelines of 67 dB for residential areas and 72 dB for commercial areas (although FHWA guidelines additionally consider background noise contributions not considered here). However, coal truck noise during pass-bys are calculated to be a significant 86 dB at the nearest residences and 77 dB at the most distant (250 ft away) residences considered. At full build-out, 302 truck trips (i.e., 151 trips entering the site and 151 trips exiting the site) are expected per day (24 hour) for coal and other trucks (excluding approximately 100 total trips per year for general consumables). It should be noted that the population along the considered 250 ft zone along the proposed coal delivery route within the 5-mile project radius route is relatively sparse (five residences), truck traffic is not a new noise along the proposed route due to existing phosphate mining, and Tampa Electric Company will also provide a special toll-free telephone number (1-800-282-4667) to consider public comments related to plant construction and operation. Further minimization of further truck noise would be difficult since the truck delivery route is off site. However, truck delivery scheduling may be one option for Tampa Electric Company to consider to minimize nighttime disturbance.

The proposed power station is industrial in nature. Construction and operation of the facility would result in environmental impacts (Section 4.0), including unavoidable adverse impacts (Section 5.3), cumulative impacts (Section 4.13), and human health impacts (Section 4.12). However, methods intended to reasonably avoid, minimize, and mitigate impacts are documented in this EIS (Section 5.2). While impacts/risk of impacts would necessarily be greatest near the source, populations near the proposed power station are relatively sparse (which was one of the site selection criteria used by Tampa Electric Company), and human health risk concerns (i.e., direct human inhalation) are not expected to be significant, since the total individual cancer risk is at the 1.8×10^{-6} level and the noncarcinogen exposure level is below the Florida No-Threat Level, given the assumptions and models used in this EIS (Section 4.1). As previously discussed, the proposed project is expected to have a positive impact on the local economy.

4.7.1.3 Economic Impacts

Tampa Electric Company's investment in the Polk Power Station project would have a significant economic effect on Polk and surrounding counties. Economic changes would be created by new sources of construction and operation employment and generation of public revenues. This section is organized into a discussion of construction-related and operation-related payroll sources, and a discussion of the public revenues generated by the combined construction and operation employment positions.

<u>Construction-Related Impacts</u>

As previously discussed, during the initial construction phase (1994-1996), an average of 650 workers would be employed for a 27-month construction period, with a 7-month peak of 1,400 construction workers. An average of approximately 65 to 140 workers would be employed during other construction phases of the project between 1998 and 2010. As shown in Table 4.7.1-7, construction payroll wages would exceed $118 million from the initiation of construction to project build-out in 2010. Based on the distribution of construction employees, Polk and Hillsborough County employees would receive approximately $71 million and $35 million, respectively, in construction wages. These payroll estimates are held constant in 1992 dollars through build-out.

<u>Operation-Related Impacts</u>

As previously stated in Section 4.7.1.1, the Polk Power Station would employ 210 operational workers at project build-out. In addition, annual contracted maintenance workers hired for periodic routine services would range from 6 persons in 1997 to 100 persons at build-out in 2010. The total combined annual operational payroll is presented in Table 4.7.1-8, and is estimated in 1992 dollars to be cumulatively $107 million from 1996 to 2010. The annual wage figure represents the expected 1992 salary average for Tampa Electric Company power plant employees and maintenance workers. As with construction employment, employees residing in Polk and Hillsborough Counties would capture a major percentage of the operational payroll. Cumulatively, Polk and Hillsborough County employees would receive $64.5 million and $26.9 million, respectively, in wages between 1996 and 2010. At build-out, annual payroll for employees residing in Polk County would exceed $5.97 million.

With the downturn of the phosphate mining industry in the area in recent years, there is a local labor force of skilled workers that could be available to work at the proposed facility. If the proposed project is implemented, there will be local opportunities for employment for qualified people. To ensure that qualified personnel are available in the future, Tampa Electric Company has proposed a cooperative training program in the power generation and process industry to develop a workforce in the central Florida area that can meet the changing needs of these industries. The program proposed by Tampa Electric Company would be a joint venture between Tampa Electric Company Energy Corporation, Seminole Electric, Florida Municipal Electric Association members, Polk Community College, and South Florida Community College (TEC, 1993d).

Table 4.7.1-7. Annual Construction Workforce Payroll to Build-Out in 2010 (1992 dollars)

Year	Total Nominal Station Capacity (MW)	Construction Personnel		Construction Wages ($)
		Average	Peak	
1994	0	100	400	4,400,000
1995	0	1,200	1,400	52,700,000
1996	260	600	1,200	26,400,000
1998	260	73	109	3,207,000
1999	335	73	109	3,207,000
2000	410	64	96	2,812,000
2001	480	137	184	6,019,000
2002	555	83	111	3,647,000
2005	775	73	109	3,207,000
2006	850	73	109	3,207,000
2007	925	73	109	3,207,000
2008	1,000	73	109	3,207,000
2009	1,075	73	109	3,207,000
2010	1,150	0	0	0
TOTAL				118,427,000

Sources: UE&C, 1992.
ECT, 1992.
TEC, 1992a.
Bechtel, 1993.

Table 4.7.1-8. Annual Operational Workforce Payroll to Build-Out in 2010 (1992 dollars)

Year	Total Nominal Station Capacity (MW)	Total Personnel Operational	Total Personnel Maintenance	Wages ($) Operational*	Wages ($) Maintenance†	Total ($)
1996	260	130	0	4,550,000	0	4,550,000
1997	260	130	6	4,550,000	156,000	4,706,000
1998	260	130	66	4,550,000	1,716,000	6,266,000
1999	335	140	0	4,900,000	0	4,900,000
2000	410	147	75	5,145,000	1,950,000	7,095,000
2001	480	162	5	5,670,000	130,000	5,800,000
2002	555	167	80	5,845,000	2,080,000	7,925,000
2003	775	182	21	6,370,000	546,000	6,916,000
2004	775	182	95	6,370,000	2,470,000	8,840,000
2005	775	182	17	6,370,000	442,000	6,812,000
2006	850	187	94	6,545,000	2,444,000	8,989,000
2007	925	192	26	6,720,000	676,000	7,396,000
2008	1,000	197	89	6,895,000	2,314,000	9,209,000
2009	1,075	202	39	7,070,000	1,014,000	8,084,000
2010	1,150	210	100	7,350,000	2,600,000	9,950,000
TOTAL				**88,900,000**	**18,538,000**	**107,438,000**

* Average annual wage of $35,000 plus benefits.
† Average annual wage of $26,000 plus benefits.

Sources: UE&C, 1992; ECT, 1992; TEC, 1992a.

Tax Revenues

The construction and operation of the Polk Power Station would result in direct and indirect tax benefits. Local revenues would be generated from property taxes levied on the plant site and facilities and along areas where the off-site transmission line and future natural gas pipelines would be sited. Polk County would be the primary beneficiary of these revenues. As shown in Table 4.7.1-9, the estimated ad valorem taxes to be generated by the Polk Power Station would increase from $7.6 million in 1997 to $19.6 million in 2011. Sales taxes generated from construction of the IGCC unit are estimated to be approximately $2 million and sales tax revenues for each of the remaining units are estimated to be approximately $100,000 (TEC, 1992a). Indirect economic benefits in the form of state and local tax revenues would result from spending by both the construction and operational workforce.

4.7.1.4 Community Service Impacts

Water

Water to supply the potable, process, and cooling reservoir makeup needs for the operations of the Polk Power Station would be provided from groundwater withdrawn from the Floridan aquifer through on-site wells. The total estimated groundwater withdrawals for potable, process, and cooling water makeup uses after full build-out would be approximately 9.3 mgd on a maximum daily basis and approximately 6.6 mgd under average annual operating conditions. The average annual water demand for the IGCC unit is estimated to be 5.2 mgd. These estimated withdrawals include the use of water injection for NO_x control for the stand-alone CC and CT units when fired on the backup fuel oil.

The computer modeling efforts for the surficial and Floridan aquifer systems indicate there will be no adverse effects to potable water supplies. There are no municipal wells within a 5-mile radius of the site. Most of the residential wells, located primarily to the west of the site along Bethlehem and Albritton Roads, use one of the two water-bearing units within the intermediate aquifer. Additionally, the modeling results indicate the drawdown effects in this area would be approximately 2.5 ft or less in the Floridan aquifer. Anticipated drawdowns in the overlying intermediate aquifer system would be minimal because of the confining unit that separates this system from the Floridan aquifer. Much of the surficial aquifer surrounding the Tampa Electric Company Polk Power Station site has been impacted by mining activities. Much of the land surrounding the site to the northeast, northwest, east, and south is presently clay settling ponds. Thus, the surficial aquifer is not used as a significant potable water source and is not expected to be adversely affected by the Floridan aquifer withdrawals or the operation of the cooling reservoir.

Wastewater

Since wastewater would be treated on site, there would be no significant effects to community wastewater treatment systems in the region. Wastewater treatment systems are discussed in Sections 2.3.8, 4.2, and 4.3. On site, no adverse changes to the cooling reservoir or off-site water quality are expected from sanitary wastewater discharges. Detectable amounts of residual chlorine and

Table 4.7.1-9. Estimate of Ad Valorem Taxes for Realty and Tangible Personal Property Generated by the Polk Power Station Project, 1997 through 2011

Tax Year	Estimated Tangible Personal Property ($)	Estimated Realty ($)	Estimated Net Taxes* ($)
1997	7,396,200	206,600	7,602,800
1998	7,297,500	212,800	7,510,300
1999	7,186,100	228,000	7,414,100
2000	7,851,100	234,800	8,085,900
2001	8,554,600	241,800	8,796,400
2002	10,250,600	258,700	10,509,300
2003	11,025,500	266,400	11,291,900
2004	13,980,600	274,400	14,255,000
2005	14,817,800	282,700	15,100,500
2006	15,700,200	291,100	15,991,300
2007	16,630,400	299,900	16,930,300
2008	17,610,400	308,900	17,919,300
2009	17,073,600	318,100	17,391,700
2010	18,184,300	327,700	18,512,000
2011	19,357,400	337,500	19,694,900
TOTAL	192,916,300	4,089,400	197,005,700

Note: Assumed actual 1991 millages and increased 3 percent per year. 1991 millage rates for Polk County were 15.609. The assessment ratio for real property is 85 percent; assessments for tangible property are based on original cost.

* Net taxes implies a reduction for an early payment discount has been taken.

Source: TEC, 1992a.

other constituents within the effluent would be rapidly mixed and dissipated upon entering the cooling reservoir.

Domestic Waste Treatment System

Discharges from domestic water uses, such as from showers, wash basins, bathrooms, and drinking fountains would result in approximately 10,500 gpd of combined sanitary wastewater flow on an average daily basis. This wastewater flow would be treated in an extended aeration-type package unit, which will be constructed on the site.

Industrial Wastewater Treatment System

There would be two major sources of industrial wastewater streams: the CC/CT process wastewater and the CG process wastewater. Table 2.3.8-1 lists the monthly anticipated average wastewater flow (gpd) from these wastewater stream sources for the IGCC unit only and at full build-out.

Solid and Hazardous Waste

Nonhazardous solid wastes and by-products generated by the Polk Power Station project include the following:

- Sanitary wastewater treatment sludge
- IWT solids
- CG wastewater treatment brine solids
- Slag
- Waste oils
- Water treatment media
- HGCU system wastes
- General solid wastes

Hazardous wastes (as defined under RCRA) would be generated primarily as a result of painting, degreasing, and other maintenance activities at the Polk Power Station site. Material and by-products with potentially hazardous properties to be generated by the project include the following:

- Worn gasifier refractory
- Refractory backup brick
- Spent H_2SO_4 plant catalysts
- Rich acid gas removal solvent
- Acid gas removal solvent filters
- De-activated carbon filter media
- H_2SO_4 by-product
- Miscellaneous wastes

Construction-Related Waste Impacts

Construction waste materials would be collected, managed, and disposed in accordance with applicable rules and regulations. Combustible construction wastes (e.g., wood and paper) would be burned on site in accordance with applicable state and local requirements. General waste materials would be collected in waste collection containers and periodically transported off site for disposal at an approved facility. Other construction wastes (e.g., metal, wire, and piping) would be stockpiled for salvage, to the extent possible, and then also removed from the site for disposal at an approved facility.

Waste oil from construction vehicles and equipment would be collected in appropriate containers and transported off site for recycling or disposal at an approved, permitted facility.

Under contractual arrangements with Tampa Electric Company, individual contractors would be responsible for handling any potential hazardous materials and wastes resulting from their on-site activities, including the appropriate off-site disposal of any wastes.

Solid waste generated from right-of-way preparation and line construction would typically contain trash and cleared vegetation. Any combustible trash and cleared vegetation from right-of-way preparation and line construction would be burned on site in accordance with any applicable burning ordinances. If or when burning is not allowed, material would be hauled off and disposed of in a locally approved landfill.

Operation-Related Solid Waste Impacts (On-site Disposal)

The effects of on-site disposal of solid wastes, in addition to the potential surface water and groundwater effects discussed previously, would be limited to topographic and associated changes in runoff patterns in the immediate vicinity of the solid waste disposal areas. The net land requirement for the brine and HGCU waste and slag management units, including storm water basins, would be approximately 50 acres. The land affected by the construction of these units has previously been altered by phosphate mining activities.

The by-product slag storage area would be located west of the main plant facilities and would have pile heights of approximately 35 ft each. This area would encompass approximately 10 acres.

Brine concentrator and certain HGCU solids would be stored in a secure, on-site disposal area consisting of storage cells with a leachate collection system and liner designed per the requirements of Chapter 17-701, FAC. The cells would be divided into two categories: inactive and active. Inactive cells would be those in which brine concentrator and HGCU solids have been placed and covered in accordance with Chapter 17-701, FAC requirements. The material would be vegetated to prevent erosion. The active cells would be the cells in which brine and HGCU solids are currently being deposited.

Design measures have been taken to minimize the potential for groundwater contamination due to leachate or runoff from the brine and HGCU solids storage areas. Runoff from the active cells would be prevented by the use of temporary enclosures covering the active cells. Runoff from the permanently capped cells would be routed to the storm water detention basin. As mentioned previously, there would be a leachate collection system and liner designed per the requirements of Chapter 17-701, FAC. A groundwater monitoring system is also a requirement of Chapter 17-701, FAC. Sampling and testing of groundwater to provide an indication of leaking liner systems would be in accordance with Sections 17-3.401, 17-28.700, 17-4.246, and 17-22, Part III and IV, FAC.

The brine and HGCU solids storage area would be located in the eastern portion of the site adjacent to the cooling reservoir and would have a pile height of approximately 10 to 15 ft. The area would encompass approximately 40 acres. The active cell of the brine solids storage area would be approximately 0.12 acres, while the active cell for the HGCU solids would be approximately 0.31 acres.

The rainfall runoff that may come in contact with the by-product slag would be collected and treated in the IWT system. Leachate from the active cell of brine and HGCU solids storage areas would be routed to the inlet of the brine concentrator unit.

No adverse environmental disturbances would result from the runoff and leachate from the solid waste, brine solids, and slag storage areas, except for the need for land area to store these solids.

Operation-Related Solid Waste Impacts (Off-Site Disposal)

Materials and by-products with potentially hazardous properties would be managed on site and shipped off site to a permitted waste disposal or recycle facility in accordance with local, state, and federal hazardous waste requirements. Some locations where hazardous wastes would be stored are expected to be fixed (e.g., maintenance shop and paint shop), while other locations may vary according to the need (e.g., pump requiring degreasing and repair). Satellite storage areas would be selected near the most common hazardous waste generation points, which would be used to store up to 55 gallons of hazardous wastes in a designated drum. When the drum is full, the waste would be transferred to the hazardous waste storage facility and shipped to a permitted RCRA facility within 90 days. The hazardous waste storage facility would be located near a site roadway to provide easy access to both off-site waste transporters and emergency response personnel. The facility would be equipped with fire extinguisher, spill absorbent material, and spill containment features to ensure that the environment is adequately protected from a chemical release.

These hazardous wastes would be managed on site and transported off site to a permitted waste disposal or recycle facility in accordance with local, state, and federal hazardous waste requirements for generators. The amount of hazardous waste would be minimized through the use of source reduction techniques, such as product substitution, and waste reduction techniques, such as recycling and waste segregation.

Wastes would be collected in designated containers located in satellite storage areas. When a container becomes full, it would be transferred to the central hazardous waste storage facility for temporary storage. Hazardous wastes would not be stored on site longer than 90 days (or 180 days for small quantities); therefore, the facility would not require a storage facility permit. However, the storage facility would be designed and managed in accordance with applicable emergency prevention and preparedness measures specified in 40 CFR Part 264, Subparts C and D. Such measures would include an available fire extinguisher, spill absorbent material, and spill containment features. Hazardous wastes would be stored in a manner to minimize the potential for an incident, and a preliminary RCRA contingency plan would provide immediate response in the unlikely event of a fire, spill, or explosion involving hazardous wastes. As a result, any potential effects associated with the on-site storage of hazardous waste would be minimized through emergency prevention and response.

Public Safety, Education, Health Care Facilities, and Housing

Most of the Polk Power Station operational workforce would be recruited from the regional workforce, with minimal relocations. Because this population is currently served by existing public services and facilities in place relative to their residences, no significant effects to public safety, education, health care facilities, or housing would be expected.

The fire protection system on site would use a 6,000-gpm flow. Main piping loops would be located around the gasification area, fuel oil area, fuel unloading areas, and coal storage areas, at a minimum. The fire protection water loops would extend in phases as the additional CC and CT units were added so that an adequate level of coverage and protection would be provided at all times.

4.7.2 Alternative: Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance)

4.7.2.1 Population Impacts

Potential population effects resulting from the alternative power resource proposal are presented in Table 4.7.2-1. These would be similar to the effects resulting from the proposed project. A workforce population comparison between the proposed project and the alternative proposal is presented in Table 4.7.2-1. Construction of the alternate proposal would require 900 employees during the peak of construction. The alternative proposal and proposed project would employ approximately the same number of employees during construction of the CC and CT units.

The estimated operational workforce associated with the alternative proposal would be similar to the operational workforce associated with the proposed project. As with the proposed project, population effects from the alternative proposal on housing, schools, and other public service and facilities would be minimal.

Table 4.7.2-1. Comparison of Construction and Operation Employment at the Polk Power Station Proposed Project and Alternative Project

	Polk Power Station Proposed Project							Polk Power Station Alternative Power Resource Proposal						
				Construction Personnel		Operational Personnel					Construction Personnel		Operational Personnel	
Year	Unit Add.	Type	Total Nominal Station Capacity	Avg	Peak	Annual	Cum.	Unit Add.	Type	Total Nominal Station Capacity	Avg	Peak	Annual	Cum.
1994	0		0	100	400						80	116	0	0
1995	0		0	1,200	1,400			75	CT	75	45	63	10	10
1996	260	IGCC*	260	600	1,200	130	130	75	CT	150	20	25	4	14
1997			260	0	0		130	220	CC†	220	40	60	15	29
1998			260	73	109		130	75	CT	295	15	20	5	34
1999	75	CT	335	73	109	10	140	75	CT	370	230	400	3	37
2000	75	CT	410	64	96	7	147	220	CC†	440	635	900	15	52
2001	220	CC†	480	137	184	15	162	75	CT	515	785	880	55	107
2002	75	CT	555	83	111	5	167	500	PC	1015	345	580	88	195
2003	220	CC	775	0	0	15	182			1015	0	0		195
2004			775	0	0		182			1015	0	0		195
2005			775	73	109		182			1015	0	0		195
2006	75	CT	850	73	109	5	187			1015	0	0		195
2007	75	CT	925	73	109	5	192			1015	0	0		195
2008	75	CT	1000	73	109	5	197	75	CT	1090	15	20	5	200
2009	75	CT	1075	73	109	5	202	75	CT	1165	15	20	5	205
2010	75	CT	1150	0	0	8	210	75	CT	1240	15	20	5	210

* Replaces 150- MW CT
† Replaces 2 75-MW CTs

Source: TEC, 1992a.

TECO.4[WP]4-7\T472-1.TAB 050294

4.7.2.2 Economic Impacts

Projected wages generated by positions created by the construction and operation of the alternative proposal at the Polk Power Station project site parallel the projected employment described in Section 4.7.2.1. Overall, slightly more construction workers would be required for the proposed project. Accordingly, a slightly higher level of construction wages would be generated within the region.

The number of employees required for the operation of alternative proposal would be similar to the proposed project.

The amount of capital investment in the alternative proposal would be comparable to investment required for the IGCC unit. Therefore, the associated tax base with the PC unit would be comparable to the IGCC unit.

4.7.2.3 Community Service Impacts

As above, most of the Polk Power Station operational workforce would be recruited from the regional workforce, with minimal relocations. Therefore, no significant changes to water and wastewater treatment facilities, public safety, education, health care facilities, or housing would be expected.

4.7.3 Alternative: No Action

The No-Action alternative would result in reduced employment opportunities and no additional capital investment or growth to the tax base.

4.7.4 Comparison of Impacts

The construction and operation of the Polk Power Station project should have primarily positive effects on the socioeconomic character of the community and regional area. Some of the positive benefits would include increased employment opportunities, increased payrolls, and increased tax base.

As previously discussed, the workforce would be drawn primarily from the existing population in the regional study area. Only a small percentage of the construction and operational workforce would relocate from outside the region. Therefore, while the project would create positive benefits in terms of employment, payroll, and tax base, increased demands on community services and housing should be minimal.

Construction of the alternative proposal at the site would result in a slightly lower number of construction workers and a similar number of permanent operational workers. No population effects would occur as a result of the No-Action alternative.

The alternative proposal would generate lower construction and wages, and similar long-term operational wages. Comparable capital investment would be expected regardless of the action alternative, and a comparable addition to the local tax base and sources of revenue would result. The No-Action alternative would maintain economic conditions as they currently exist, and would preclude the significant positive economic effects associated with employment, capital investment, and revenues.

4.8 LAND USE, RECREATION, AND AESTHETIC IMPACTS

Much of the information in the following section was taken from the SCA (TEC, 1992a).

4.8.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

This section discusses the effects upon the land use, recreation, and aesthetic qualities of the project site and adjacent area caused by the construction and operation of the proposed Polk Power Station project.

4.8.1.1 Land-Use Impacts

Construction-Related Impacts

The proposed site layout and post-reclamation plan for the entire 4,348-acre Polk Power Station site is presented in Figure 2.3.2-1. This figure shows the locations of the proposed electric generating units and associated facilities on the site after full build-out as well as the proposed land-use/land-cover classifications of the site areas that would be reclaimed by Tampa Electric Company, or would not be changed from existing conditions and would not include power plant facilities. These reclaimed, undeveloped areas would provide a combination of buffer, water management, and wildlife habitat/corridor functions on the site. Table 2.3.2-1 provides a summary of the approximate areas of the proposed power plant facilities and other land-use/land-cover classifications on the site after full build-out of the project.

As shown in Figure 2.3.2-1, the main power plant facilities would be located in the central area of the portion of the site east of SR 37. This plant site area was not mined for phosphate, but has been disturbed by the surrounding mining activities. The main power plant facilities (i.e., power blocks and fuel, and by-product storage areas) would be located more than 2,500 ft from off-site properties, more than 1.5 miles from residential areas to the west along Bethlehem Road, and 2.8 miles from residential areas to the southeast along Mills Road. Also, as shown in the figure, a vegetated buffer area would be provided along public roadways surrounding the eastern site tract.

The proposed cooling reservoir would be constructed in mined-out areas located to the east and south of the main facility site. The other mined-out portions of the eastern site tract to the west and north of the main facilities would be reclaimed/developed into a series of wetlands and uplands, which will be used for management of storm water runoff from the plant site and to restore premining drainage conditions for the Little Payne Creek system. The remaining areas of the eastern tract (i.e., the southwest and southeast corners, the 775-acre area north of the main plant site and cooling reservoir extending to CR 30, and the reclaimed lake to the east of the reservoir) would not be significantly altered by the proposed project. The two proposed transmission line corridors would run through the northern site area.

The 1,511-acre portion of the site west of SR 37 would be reclaimed to a wildlife habitat/corridor system composed of an integrated series of forested and nonforested wetlands and uplands. No power plant facilities would be located on this tract and, after reclamation, the area would develop into a wildlife corridor between the headwater areas of the Little Manatee River, Payne Creek, and South Prong Alafia River systems. The implementation of this proposed plan for the property west of SR 37 would allow Tampa Electric Company to meet the requirements for wetland reclamation and would provide additional buffer to the power block area.

Figure 1.1.3-2 presents the proposed arrangement of the power plant and associated facilities on the eastern portion of the site at a more detailed scale. Figure 4.8.1-1 presents the same proposed arrangement on an aerial photograph showing the current conditions on the site. As indicated in Table 2.3.2-1, approximately 261 acres (approximately 6 percent) of the entire site, excluding the cooling reservoir, would be classified for power plant facilities after full build-out of the proposed Polk Power Station. Of these 261 acres, approximately 150 acres would actually be used for the main power plant facilities and structures, including the coal, fuel oil, by-product, and brine storage areas, and IWT systems. The remaining acreage classified for power plant facilities would include land within the main road system and vacant areas between the main power facilities and structures.

On-Site Construction-Related Impacts

Approximately 94 percent of the 4,348-acre Polk Power Station site has been or will be disturbed by phosphate mining activities prior to Tampa Electric Company's use of the site for the proposed project. Also, more than 3,280 acres (more than 75 percent) of the site that has been recently, or will be mined or disturbed, would be subject to further disturbance by reclamation activities required under FDEP regulations, even without the proposed Polk Power Station project. These required reclamation activities would essentially involve earthmoving and dewatering activities similar to those needed for the proposed project. Therefore, the general site preparation and construction activities for the Polk Power Station would have minimal additional effects on land resources on and in the vicinity of the site. Lands left unmined were not considered to be economically viable to mine or had sensitive environmental resources.

The main power block, fuel storage, and associated facilities would occupy approximately 150 acres (3 percent) of the entire 4,348-acre site. These facilities would be constructed in the central portion of the site property east of SR 37. The mined-out lands surrounding the eastern and southern sides of the site for the main facilities would be developed into an approximately 860-acre cooling reservoir, including berm areas, that would be primarily below the premining elevations after development/reclamation of the site. The development of the Polk Power Station main power plant facilities would not adversely effect existing conditions and land uses on site.

Off-Site Construction-Related Impacts

Projected construction disturbance to the surrounding land uses would be minimal based on the predominance of phosphate mining activities in the area. The nearest single-family residence to the planned location of the Polk Power Station power block and fuel storage area is located approximately 7,000 ft (1.3 miles) east, along Fort Green Road. Approximately 85 homes are located west of SR 37 and north of the Polk Power Station site along Bethlehem and Albritton Roads, with the closest residence in this grouping being approximately 8,000 ft (1.5 miles) west of the power block and fuel storage area. Another 30 homes are located west of the Polk Power Station site boundary in Hillsborough County along and near SR 674, approximately 20,500 ft (3.9 miles) west of the power block and fuel storage area. Further, 14 homes are located along Mills Road off Fort Green Road, approximately 14,700 ft (2.8 miles) southeast of the power block and fuel storage area.

The power block and fuel storage facilities would be located approximately 2,600 ft from the nearest roadway, SR 37, or to off-site properties that are located northwest of the facility location. In all other directions, the power block and fuel storage areas would be located at least 1 mile from off-site properties. Tampa Electric Company would provide vegetative visual buffers along SR 37 and Fort Green Road so that only the tallest structures on site (i.e., CG facilities and exhaust stacks) would be potentially visible from roadways or off-site property. The combination of significant setback distances and vegetative visual buffers would minimize any adverse off-site visual and land-use effects. Potential noise impacts resulting from the project construction activities are discussed in Section 4.11.

After completion of current phosphate mining activities, the approximately 1,511-acre portion of the site west of SR 37 would be reclaimed in accordance with the proposed reclamation plans, as approved by FDEP and Polk County. The proposed conceptual plans for this tract would provide for reclaiming the mined-out lands into a natural system of forested and nonforested wetlands and uplands. No active power plant-related activities are planned on this tract. After reclamation, the tract would be allowed to evolve into a natural wildlife habitat system. Access to this 1,511-acre tract would be controlled, which would allow the property to develop into a significant wildlife habitat resource in southwestern Polk County. The scattered areas of single-family residential uses located to the north of this western tract along Albritton and Bethlehem Roads and to the west in Hillsborough County would not be affected by the proposed reclamation and use of the western tract.

Transmission Corridor Construction Impacts

The proposed northern transmission line corridor primarily crosses disturbed lands currently or previously utilized for phosphate mining. The corridor route was selected based in part on the ability to minimize potential effects to human populations. For the most part, the corridor avoids residences and the populated areas of Bradley Junction. Approximately 13 homes are located within the northern corridor along its length off the Polk Power Station site. An abandoned commercial structure is located approximately 0.5 mile north of CR 630 east of SR 37. No schools or other sensitive

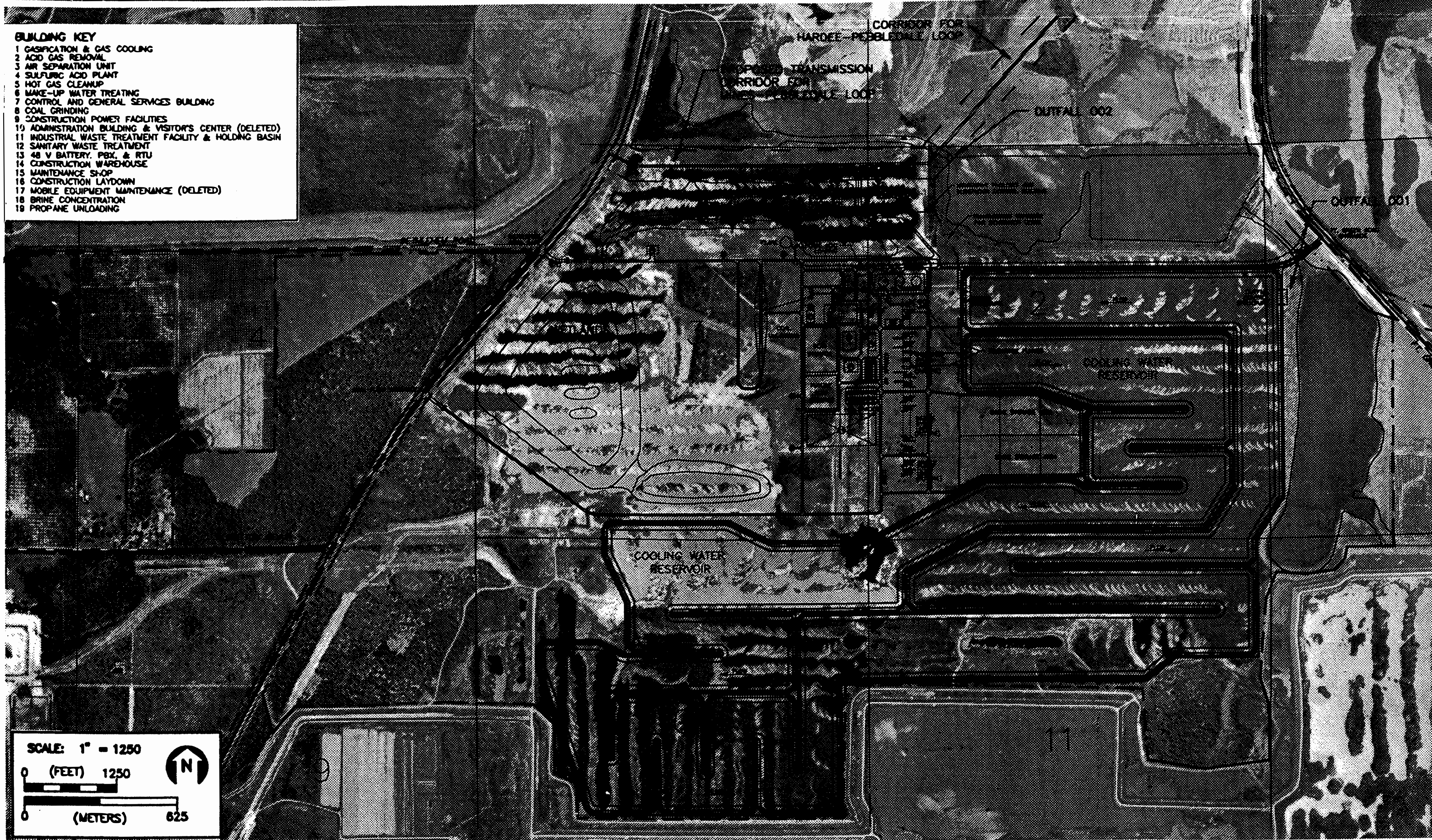

FIGURE 4.8.1-1.
Aerial Photograph with Proposed Facility Arrangement.

SOURCES: SRMC, 1992; UEC, 1992; ECT, 1992; TEC 1992a.

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institutional uses or structures are contained within this corridor. Since this corridor would be located along existing linear facilities, would avoid populated areas, and would traverse existing mined lands, the proposed transmission line is not expected to have significant effects on adjacent areas and land uses.

For those residents near the actual right-of-way, construction effects should be minor and temporary. Typically transmission construction is a phased activity, consisting of such phases as right-of-way preparation, foundation placement, pole erection, conductor stringing, and right-of-way restoration. Each of these activities is short in duration. Depending on the structure used, the right-of-way would generally be 150 ft wide for the off-site portion of the northern corridor. The right-of-way for the on-site northern and eastern corridors would generally be 400 ft wide.

Minor inconveniences, such as noise, dust, and increased traffic, would be short-term and localized. Activities would typically be scheduled for daylight hours to further minimize potential effects to residents.

Various activities, including citrus farming, grazing, and agriculture, are typically allowed within the right-of-way as long as these activities do not interfere with the full use of the right-of-way as required to operate and maintain a transmission line. Specific uses within the right-of-way would be addressed individually with affected parties. Multiple use of the right-of-way may be restricted in certain areas, but in general, compatible multiple uses would be allowed.

The proposed on-site eastern transmission line corridor would traverse lands that were previously mined for phosphate ore. Therefore, no residential, commercial, or institutional structures are located within this corridor. This on-site corridor would have no effect on land uses in the area.

Comprehensive Plan and Zoning Ordinance Impacts

The development of the Polk Power Station would be consistent with, or would further several goals, objectives, and policies of the Polk County Comprehensive Plan, the Central Florida Comprehensive Regional Policy Plan, and the State Comprehensive Plan. Table 4.8.1-1 provides a listing of the applicable goals, objectives, and policies according to each plan.

Polk County Comprehensive Plan Impacts

As a Certified Electric-Power Generating Facility, the Polk Power Station would be an allowed use within the phosphate mining future land-use category designated for the Polk Power Station site, according to the Future Land Use Element of the Polk County Comprehensive Plan. The Comprehensive Plan allows for the development of Certified Electric Power Generating Facilities in the phosphate mining future land-use category when such proposed development is reviewed and approved by Polk County and a CUP is issued. The Polk Power Station power block site would also satisfy locational, environmental, and development approval of Section 2.114-C of the Polk County

Table 4.8.1-1. Listing of Goals, Objectives, and Policies of Planning Documents

---

- State Comprehensive Plan (Section 187, F.S.):
  - -- Energy, Policy 6
  - -- Land Use, Policy 1
  - -- Public Facilities, Policies 1 and 6
- Central Florida Comprehensive Regional Policy Plan:
  - -- Energy, Regional Issue (2), Regional Goal (a), Regional Policy (4)
  - -- Mining, Regional Issue (1), Regional Goal (a), Regional Policy (2)
  - -- Land Use, Regional Issue (1), Regional Goal (a), Regional Policy (2)
  - -- Public Facilities, Regional Issue (1), Regional Goal (a), Regional Policies (1) and (2)
  - -- Transportation, Regional Issue (2), Regional Goal (1), Regional Policy (2)
- Polk County Comprehensive Plan
- Future Land Use Element:

  Objective 2.102-A
  - -- Policy 2.102-A1(a), Compatibility (of land uses)
  - -- Policy 2.102-A2, Distribution (of land uses)
  - -- Policy 2.125-D1(b), Utilities Permitted Uses
- Conservation Element:

  Objective 2.302-A, Air Quality
  - -- Policy 2.304-A4, Mineral Resources
  - -- Policy 2.307-A3, Floodplains
  - -- Policy 2.308-A3, Wetlands
  - -- Policy 2.310-A2, Hazardous Waste/Materials
- Economic Element:
  - -- Policy 2.402-A1, Economic Base Maintenance
  - -- Policy 2.402-A5, Economic Base Maintenance
  - -- Policy 2.403-A2, Economic Base Diversification
  - -- Policy 2.404-A4, Economic Development Integrated with Planning
- Infrastructure Element:
  - -- Policy 3.102-A1, Sanitary Sewer
  - -- Policy 3.102-A2, Sanitary Sewer
  - -- Policy 3.102-A3, Sanitary Sewer
  - -- Policy 3.102-B4, Sanitary Sewer
  - -- Policy 3.102-C1, Sanitary Sewer
  - -- Policy 3.104-A5, Drainage
  - -- Policy 3.104-A7, Drainage
  - -- Policy 3.105-A1, Potable Water
  - -- Policy 3.105-A2(d)(e), Potable Water
  - -- Policy 3.105-A3, Potable Water
  - -- Policy 3.105-C1, Potable Water
- Traffic Circulation Element:

  Policy 3.205-A1, Protection of Rights-of-Way

Sources: ECT, 1992; TEC, 1992a.

Comprehensive Plan. Adjacent future land-use categories would be compatible with the power station and associated storm water management areas. The suitability of the Polk Power Station site for the development of an electric-power generating facility would also supported by statements contained within Appendix B2.100 of the Future Land Use Support Document (Polk County Department of Planning, 1991).

Polk County Zoning Ordinance Impacts

The Polk Power Station is considered a Class III Essential Service, which is an allowed conditional use for the RC zoning district designated for the Polk Power Station site. Therefore, a CUP was required for compliance with the Polk County Zoning Code. Under the county's zoning ordinance, CUPs are established to allow the approval of specific uses in addition to the permitted uses in each zoning district, and a CUP may be issued for the Polk Power Station site based on the recommendations of the Polk County Zoning Advisory Board and approval of the Board of County Commissioners. A CUP application was filed with Polk County on January 24, 1992, and provided the information required by the Polk County Zoning Ordinance to demonstrate that the Tampa Electric Company Polk Power Station complies with the applicable standards for approval of the CUP. The CUP application for the entire proposed Polk Power Station was approved by the Polk County Zoning Advisory Board on May 13, 1992, and by the Board of County Commissioners on June 2, 1992. One of the determinations made by the Board of County Commissioners of Polk County was "Tampa Electric Company's project will be evaluated further during proceedings under the PPSA, Chapter 403, Part II, F.S., in which Polk County may participate fully as a party and may raise questions or objections to the proposed plan of development. Certification issued under the PPSA for Tampa Electric Company's Polk Power Station constitutes the necessary approval for construction and operation of the Project (Development plan)" (Polk County, 1992).

Polk County Concurrency Management Impacts

The proposed Polk Power Station would comply with the Polk County Concurrency Management Ordinance. As part of the concurrency determination, capacity would be reserved for transportation and solid waste and drainage standards will need to be met. Based on projected traffic disturbances and existing and projected traffic volumes, construction-related traffic is not expected to lower the LOS on roadway links and intersections to unacceptable levels in their current geometries. Sufficient capacity exists on roadways serving the Polk Power Station site. Adequate capacity also exists in county landfills to meet the solid waste disposal needs of the project. Drainage standards would be met through the appropriate design of drainage features and facilities. Capacity for potable water and wastewater would not have to be reserved because connections to municipal services are not required. Concurrency provisions for recreation and open space are not required as the Polk Power Station would contain no residential element.

State and Regional Plans

The development of the Polk Power Station project would be consistent with, or would further several goals, policies in the State Comprehensive Plan and the Central Florida Regional Policy Plan. Some of these goals include the following:

- Reclaiming and putting disturbed lands to productive use
- Requiring the concurrent provision of adequate transportation facilities
- Restoring degraded natural conditions to a functional condition
- Complying with all national air quality standards
- Ensuring that disturbed areas are reclaimed or restored to beneficial use as soon as reasonably possible
- Planning and financing new facilities to serve residents in a timely manner

Land-Use and Zoning Plans in the Transmission Line Corridor

The development of the transmission lines associated with the Polk Power Station are currently permitted uses according to the Polk County Comprehensive Plan and Zoning Ordinance. According to Policy 2.125-D1(b) of the Comprehensive Plan, electric transmission lines are permitted as specialized uses in all future land-use categories, in conjunction with the county approval of the CUP for the Certified Electric-Power Generating Facilities. Electric transmission lines are defined as Class I Essential Services according to the Polk County Zoning Ordinance. Class I Essential Services are permitted uses in all zoning districts. Construction of the Polk Power Station and associated facilities would be consistent with future land use and comprehensive planning programs in Polk County and should not significantly effect the future use of lands adjacent to the Polk Power Station site and transmission line right-of-way.

4.8.1.2 Recreation Impacts

No changes to recreational uses on or off site would result from development of the site and associated facilities. Recreational use of the site is currently limited and controlled. Recreational species (game birds, mammals, and fish) occurring on the site are expected to continue to be present after construction is completed. Off site, the nearest recreation area is the 1.5-acre Bradley Junction Recreational Park located approximately 5 miles from the proposed power plant.

4.8.1.3 Aesthetic Impacts

Construction-Related Impacts

Construction-related alterations in site topography and soils would have no adverse effects on aesthetics and visual qualities in the site vicinity, especially relative to currently existing condition on the site. As shown on Figure 2.3.2-1, the proposed site development/reclamation activities would include the creation of planted vegetation buffer areas along public roadways surrounding the main plant facility and cooling reservoir areas on the site tract to the east of SR 37. In addition, the main plant structures are set back from the nearest public viewsheds by at least 2,500 ft and more than

1 mile from the nearest resident. Therefore, after construction, only the relatively taller plant structures (e.g., CG facilities and certain exhaust stacks) would be potentially visible from nearby public viewpoints. The tallest structures would be associated with gasification facilities and certain exhaust stacks that range from 150 to 300 ft in height above ground level. Vegetative buffers would be provided along SR 37 and other potential viewpoints. Based on setback distances, and proposed vegetative buffering and the currently disturbed nature of adjacent land, the proposed Polk Power Station would not create significant visual disturbance to the immediate area. Other plant operational facilities would be expected to be three stories or less in height. Further, since the property tract to the west of SR 37 would not contain power plant facilities and would develop as a wildlife habitat/corridor area, the proposed site development activities for this area would enhance aesthetic and visual qualities in the vicinity of the Polk Power Station site.

Transmission Line

The four 230-kV transmission circuits (two per transmission line corridor) would undergo a transmission line design process that would include considerations for the cost of construction and future maintenance and aesthetic compatibility. The transmission lines may be constructed using H-frame or single-pole structures. The poles may be of wood, steel, or concrete and may range in height from 65 to 110 ft. Unguyed structures would be used where the lines turn shallow angles. Guys and anchors would be used where the lines turn sharp angles. Depending on structure type used, the right-of-way would generally be a maximum of 150 ft wide for the off-site portion of the northern corridor. The right-of-way for the on-site eastern corridor, and the on-site portion of the northern corridor would be 400 ft wide.

Span lengths between structures would average between 500 to 700 ft. Individual span lengths would be determined by the topography of the route and width of the right-of-way. The entire line would meet National Electrical Safety Code (NESC) standards for clearance to ground and obstructions. Additionally, the minimum clearance from any energized conductor to ground would be 23.5 ft, which exceeds NESC standards by 1 ft.

Existing roadways would be used for access to the off-site portions of the northern transmission line wherever possible. If adequate road access does not exist for the on-site or off-site corridors, new roads would be constructed, which would typically be unpaved and have a prepared driving area width of 16 to 20 ft.

Structure pads would typically be constructed adjacent to the access roads. The pads could be up to 150 ft in width with the length varying as a function of the distance between the structure and the access road.

Multiple structure configurations and construction materials would be used throughout the length of the transmission lines from the Polk Power Station to the end points. The type of structure used in any particular area would be a function of the characteristics of the right-of-way and surrounding areas. Currently, seven different structure scenarios are being considered for the two proposed corridors. Single-pole construction would be used where right-of-way or other constraints limit the use of H-frame construction. Single-pole structures would also be used in areas where the width of the right-of-way prohibits the use of an H-frame structure, and in areas where visual effects would be significant. Single-pole structures could be directly imbedded with native soil, crushed rock, or concrete backfill. Single-pole structures could be used for line angles and could be designed to be self-supporting, but may also use guys to support angle loads.

4.8.2 Alternative: Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance)

The potential land use, recreational, and aesthetic effects from construction of the alternative power resource proposal at the site would not differ significantly because the project would be located on the same site and would fall under the same land use and zoning classification. The alternative power resource proposal does require the use of more land area within the site (approximately 36 percent greater for equivalent size plants) for the power plant and fuel handling/storage facilities and for by-product or solid waste storage. The alternative power resource proposal would require additional acreage for the cooling reservoir and for by-product storage. The stack for the PC plant under the alternative power resource proposal would be 100 to 200 ft higher than the highest structures in the proposed project.

4.8.3 Alternative: No Action

With the No-Action Alternative, the proposed Polk Power Station project would not be constructed and operated, and different FDEP-approved reclamation plans for the site would be implemented. The No-Action Alternative would result in no effects to land use, recreation, and aesthetic character of the area. However, disturbances from phosphate mining would still occur. More than 3,330 acres (more than 76 percent) of the site that has been recently, or will be mined or disturbed, would be subject to further disturbance by reclamation activities required under FDEP regulations, even without the proposed Polk Power Station project.

4.8.4 Comparison of Impacts

Projected construction effects to the surrounding land uses from the proposed Polk Power Station are expected to be minimal based on the predominance of phosphate mining activities in the area. The proposed project would be isolated and well buffered from residential or other sensitive land uses.

As a Certified Electric Power Generating Facility, the Polk Power Station is an allowed use within the phosphate mining future land-use category designated for the Polk Power Station site, according to the Future Land Use Element of the Polk County Comprehensive Plan. The Comprehensive Plan allows for the development of Certified Electric Power Generating Facilities in the phosphate mining future land-use category when such proposed development is reviewed and approved by Polk County by a

CUP. The CUP application was approved by the Polk County Zoning Advisory Board on May 13, 1992, and by the Board of County Commissioners on June 2, 1992.

No effects to the recreational uses on or off site would occur as a result of power plant development. The nearest recreation area is the 1.5-acre Bradley Junction Recreational Park located approximately 5 miles from the central area of the proposed power plant.

Construction-related alterations in site topography and soils would have no adverse effects on aesthetics and visual qualities in the site vicinity, especially relative to currently existing conditions on the site. After construction, only the relatively taller plant structures (e.g., CG facilities and certain exhaust stacks) would be potentially visible from nearby public viewpoints. The transmission line circuits would undergo a transmission line design process that includes considerations for the cost of construction and future maintenance and aesthetic compatibility.

Construction and operation of the alternative power resource proposal at the site would not cause additional significant disturbances to land use, recreational, and aesthetic qualities in comparison to the proposed project. The No-Action Alternative would result in no changes to the land use, recreation and aesthetic character of the area associated with the proposed project, however, effects from phosphate mining would still occur and mined portions of the site would still need to be reclaimed in accordance with FDEP-approved reclamation plans.

4.9 TRANSPORTATION IMPACTS

4.9.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

4.9.1.1 Roadway Traffic Impacts

A Land Development Traffic Assessment was conducted for the proposed project as required by Polk County Planning Division. This analysis was performed in accordance with the draft Polk County Traffic Impact Study Methodology and Procedures dated October 18, 1991, the Traffic Methodology Statement for the project, and criteria established during the pre-application conference held with Polk County on April 3, 1992.

A traffic impact area was defined in the draft Polk County Traffic Impact Study Methodology and Procedures dated October 18, 1991, as including any roadway segment on the Concurrency Determination Network on which the project traffic consumes 5 percent or more of the peak hour LOS C FDOT generalized planning capacity. The determination of the traffic impact area for the Polk Power Station project was based on the trip ends to the site during the morning peak hour for the operational phase of the project (Lincks, 1992). Figure 4.9.1-1 illustrates the traffic impact area for this project and includes the following roadway links:

- SR 37 from SR 674 to project driveway B
- SR 37 from project driveway B to project driveway A
- SR 37 from project driveway A to CR 630
- SR 37 from CR 630 to CR 640
- SR 37 from CR 640 to Cameron Street
- 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 98

In addition, Fort Green Road from project driveway C to CR 630 was also included in the link analysis since construction workers would access the site either by project driveway A or C (see Figure 4.9.1-1).

The draft Polk County Traffic Study Methodology and Procedures also requires that intersection analysis be conducted on each major intersection within the traffic impact area where the total traffic consumes 80 percent or more of the generalized planning LOS C peak hour capacity of the approach link (Lincks, 1992). The only approach link where this occurs is SR 37 from CR 640 to Cameron Street. However, the intersections of SR 37 - CR 630 and CR 630 - Fort Green Road were also analyzed since they are adjacent to the site and the majority of the project traffic would be is from the north and east.

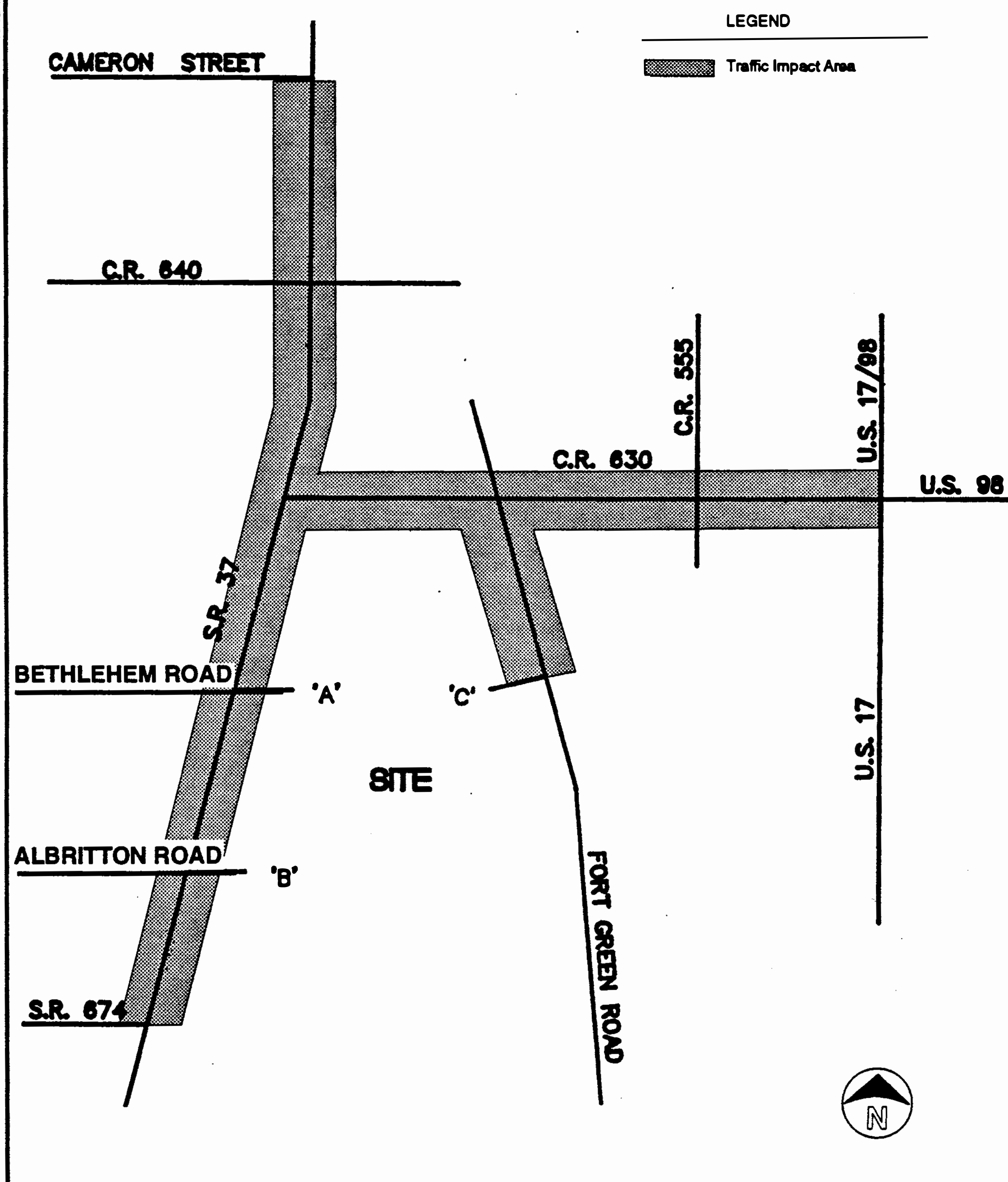

FIGURE 4.9.1-1.
Traffic Impact Area.

SOURCES: Lincks, 1992; TEC 1992a.

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For the operational phase analysis, it was assumed that all turbines but the IGCC unit were burning natural gas rather than fuel oil and that any by-products (e.g., slag) were hauled away from the site in the same trucks that delivered the coal. Thus, traffic effects were included only for employees and coal-truck deliveries.

Construction-Related Traffic Impacts

Some construction-related transportation effects would result from the movement of construction workers, machines, and equipment to and from the Polk Power Station site. The initial construction phase would last approximately 27 months, during which the average construction employment would be 650 workers and the peak employment during the construction phase would be approximately 1,400 workers for a period of about seven months. This peak construction employment period was analyzed for traffic impacts within the traffic impact area. Construction employment during construction phases for future generating units through 2009 would involve significantly less workers and related, potential traffic impacts even with operational workers and activities at the site than the initial construction phase. Therefore, the analysis of the initial phase construction-related traffic impacts represented the period of greatest potential traffic impacts during the phased build-out of the proposed project. The analysis for the initial phase indicates that effects to the area would be temporary and would not have significant adverse effects on the LOS ratings of roadway links and intersections in the vicinity of the site (TEC, 1992a; Lincks, 1993).

Based on the analysis for Florida Power & Light CG/CC facility in Martin County, Florida, a construction-related trip generation rate of 2.0 and a vehicle occupancy rate of 1.33 was used to calculate construction phase traffic impacts (Kimley-Horn, 1989). Table 4.9.1-1(a-c) summarizes the estimated projected average daily traffic and the a.m. and p.m. peak hour trip ends associated with the construction phase of the facility, and Figure 4.9.1-2 illustrates the predicted distribution of these trips within the traffic impact area. Table 4.9.1-2 contains the background LOS conditions, adopted LOS performance standards, and the a.m. and p.m. LOSs expected on the analyzed links and intersections for two scenarios. In scenario 1, 75 percent of the construction employees would use project driveway A, and 25 percent would use project driveway C. In scenario 2, 55 percent of the construction employees would use project driveway A and 45 percent would use project driveway C. As the table indicates, none of the links and intersections would fall below adopted Polk County LOS performance standards (Lincks, 1993).

During the initial phase of the project, three access roads or project driveways would be constructed. These are shown as A, B, and C on Figure 4.9.1-1. The main plant entrance roadway would be used for operational employees and visitors, and would connect with SR 37 at a point approximately 2,500 ft to the north of the Albritton Road intersection with SR 37 (i.e., approximately halfway between the Albritton Road and Bethlehem Road intersections on SR 37). The other entrance road on SR 37 would be located opposite to the Bethlehem Road intersection and would primarily provide access for contracted construction labor and construction and operational deliveries. The third

Table 4.9.1-1a. Estimated Project Average Daily Traffic During the Peak Construction Phase

Land Use	Size	Vehicle Occupancy	Trip Generation Rate	Trip Ends
Power Plant	1,400 construction employees	1.33 employees/ vehicle	2 trip ends/ employee	2,106

Table 4.9.1-1b. Estimated Project a.m. Peak Hour Trip Ends During the Peak Construction Phase

Land Use	Size	Vehicle Occupancy	Trip Generation Rate			Trip Ends		
			In	Out	Total	In	Out	Total
Power Plant	1,400 construction employees	1.33 employees/ vehicle	1.0	0	1.0	1,053	0	1,053

Table 4.9.1-1c. Estimated Project p.m. Peak Hour Trip Ends During the Peak Construction Phase

Land Use	Size	Vehicle Occupancy	Trip Generation Rate			Trip Ends		
			In	Out	Total	In	Out	Total
Power Plant	1,400 construction employees	1.33 employees/ vehicle	0	1.0	1.0	0	1,053	1,053

Note: Trip ends refer to the total of all trips entering plus all trips exiting the site during the designed time.

Sources: TEC, 1992a.
Lincks and Associates, 1993.

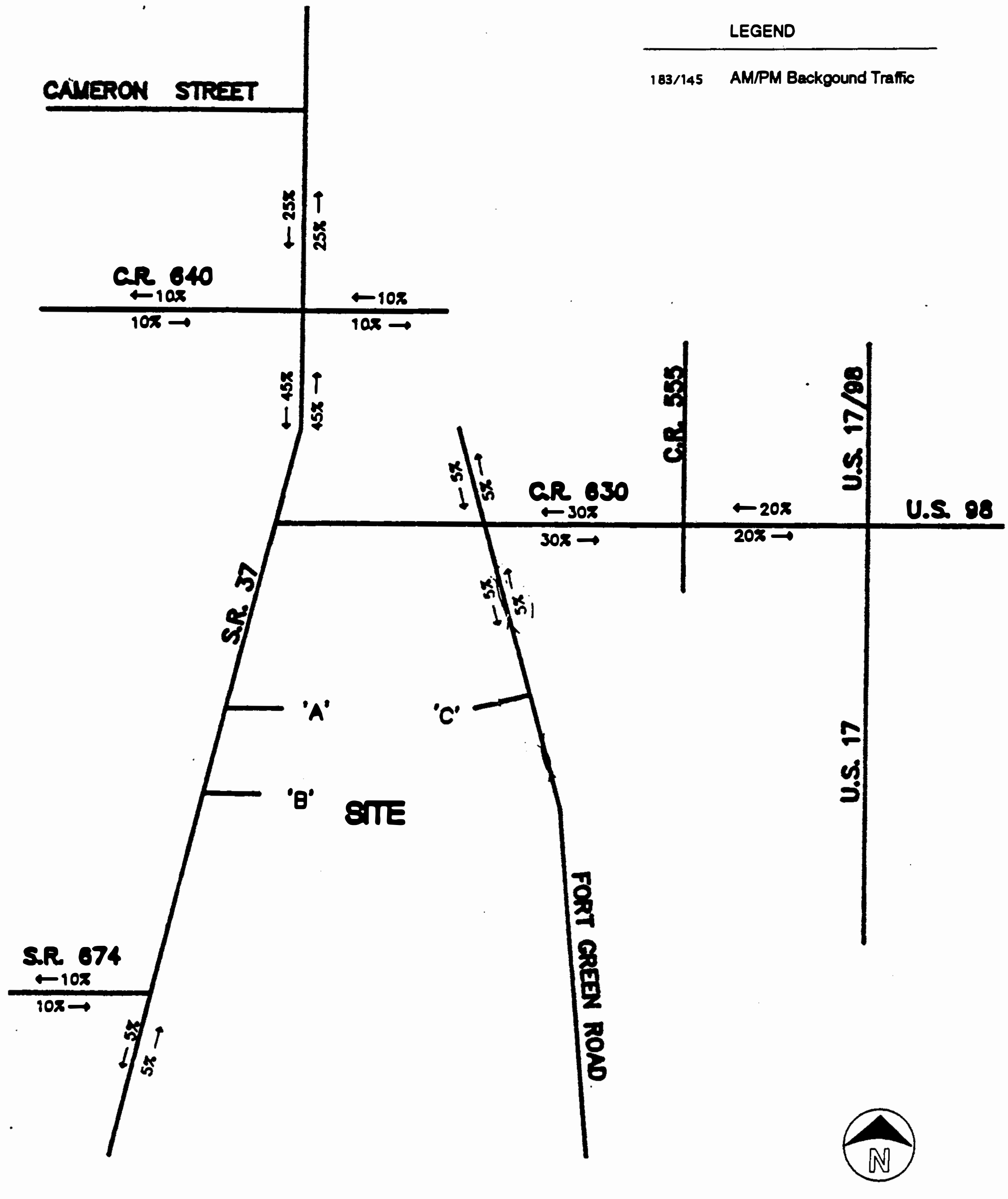

FIGURE 4.9.1-2.
Predicted Distribution of Construction Traffic in the Traffic Impact Area.

SOURCES: Uncks, 1992; TEC 1992a.

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Table 4.9.1-2. Predicted Levels of Service for Links and Intersections -- Construction Project Conditions

Roadway Segment	Direction	Background Conditions LOS (peak hour)	Adopted Performance LOS Standard	Predicted LOS Scenario 1	Predicted LOS Scenario 2
SR 37		a.m. p.m.		a.m. p.m.	a.m. p.m.
SR 674 - Project Drive B	NB	B B	D	C B	C B
	SB	B B	D	B B	B C
Proj. Drive B to Proj. Drive A	NB	B B	D	C B	C B
	SB	B B	D	B B	B C
Proj. Drive A to CR 630	NB	B B	D	B D	B D
	SB	B B	D	D B	D B
CR 630 to CR 640	NB	B B	D	B D	B D
	SB	B B	D	D B	D B
CR 640 to Cameron Street	NB	C C	D	C D	C D
	SB	C C	D	D C	D C
CR 630					
SR 37 to Fort Green Road	EB	A A	D	B C	C C
	WB	A A	D	C B	C C
Fort Green Road to CR 555	EB	A A	D	A C	A C
	WB	A A	D	C A	C A
CR 555 to US 98	EB	A B	D	A B	A C
	WB	B A	D	C B	C A
Fort Green Road					
Proj. Drive C to CR 630	NB	A A	D	A A	A C
	SB	A A	D	A A	C A
Intersection	a.m./p.m.				
SR 37 and CR 640	AM	B	D	B	B
	PM	B	D	D	D
SR 37 and CR 630	AM	B	D	C	D
	PM	A	D	C	B
CR 630 and Fort Green Road	AM	B	D	C	D
	PM	B	D	B	D

NB = northbound. EB = eastbound.
SB = southbound. WB = westbound.

Sources: TEC, 1992a.
Lincks, 1993.

entrance, the Fort Green Road entrance, would also provide access for the construction work force and construction and operational deliveries. All entrances would be gated and access to the plant site would be controlled.

Tampa Electric Company would construct certain geometric improvements at all site entrances to accommodate the projected construction and operational work forces. In 1995, 1996, and 1997, Tampa Electric Company would begin a traffic monitoring program at SR 37 and CR 630 and at CR 630 and Fort Green Road. Should the traffic monitoring program show the need for improvements as a result of traffic to the Polk Power Station site, Tampa Electric Company would install traffic signals or make geometric improvements. The site entrances would be designed with appropriate deceleration, acceleration, and turn lanes, based on FDOT standards, to accommodate construction and operational traffic so that roadway volumes are not lowered to an unacceptable LOS (TEC, 1992a).

It is possible for vehicles accessing the Polk Power Station site to degrade the paving surfaces (e.g, by pot-holes) of those roadways closest to the site. Two factors should minimize such potential degradation. First, certain heavy power plant components would be delivered via rail. Second, access improvements mentioned above would facilitate construction worker and machinery access to the site. Tampa Electric Company would repair and maintain these entrances as necessary.

Tampa Electric Company would encourage transportation demand management techniques to reduce the number of temporary construction-related vehicle trips on the road networks. These techniques would include placing a bulletin board on site that may be used by construction contractors to place car-pooling advertisements. All construction contractors would be requested to inform their employees that this service is available (TEC, 1992a).

During the peak construction activities, construction vehicles (e.g., graders, bulldozers, and dump trucks) would also access the site. However, the majority of these heavy construction vehicles are anticipated to remain on site for the duration of the initial construction activities, entering at initiation and exiting at completion. Since the majority of these vehicles would not make daily trips to and from the site, the potential traffic effects would be expected to be minimal to the regional road network (TEC, 1992a).

One additional construction-related traffic impact would result from transport of a large piece of equipment, the Radiant Syngas Cooler (RSC), to the site. The RSC would be transported by ship to either Port Manatee or the Port of Tampa and then transported to the site. It is expected that the RSC would be transported to the site by road. The RSC would be delivered in two large sections. The outer shell section dimensions would be about 130 ft long and 23 ft in diameter, weighing 625 tons. The internal section would be about 110 ft long and 17 ft in diameter, weighing about 235 tons (TEC, 1993e).

Each of these large sections of equipment would be transported separately to the site. Part of each move would involve crossing Interstate 75 (I-75). Tampa Electric has been coordinating with FDOT to determine whether going over or under the overpass of I-75 is preferred. Going over I-75 would involve some roadwork and closure of the interstate for several minutes for each move. Going under I-75 would involve significant excavation under the overpass due to clearance problems (about 5 ft of road would need to be taken out under the overpass). These types of roadwork are common in movement of large pieces of equipment. Tampa Electric expects to be able to obtain the necessary approvals to accomplish the RSC transport to the site (TEC, 1993e).

The impacts from construction-related traffic would be partly offset by the drop in traffic associated with the cessation of mining activities at the Polk Power Station site.

Operation-Related Traffic Impacts

While the proposed project would have some operation-related effects, all existing roadway links and intersections within the area are expected to operate at a LOS C or better with the existing traffic in addition to traffic associated with the proposed project operation and with the existing geometry. Therefore, no additional roadway improvements other than the ones previously identified at the entrance roads to the site, would be required due to the project. There are no known load-limited bridges, pavement segments, or overpasses or underpasses that would need to be improved to accommodate truck traffic. Trucks going both to and from the site would comply with all maximum weight restrictions required by FDOT.

The traffic analysis of the operational phase of the project is based on the anticipated employment in 2010 with 310 employees (which includes contract maintenance personnel). The trip generation rate of 2.35 trip ends per employee was based on a traffic analysis for a Florida Power and Light facility in Martin County, Florida (Kimley-Horn, 1989). For this analysis, it was assumed that all coal delivery would be by truck. Coal deliveries by truck were estimated to require 80 trucks per day, 56 fuel oil trucks per day, and 17 by-product and slag trucks per day. Even if both coal and fuel oil were delivered by truck, the percentage of truck traffic as a percentage of all trips on adjacent roadways, would remain below 13 percent of total 1992 average annual daily traffic. Table 4.9.1-3 summarizes the trip ends associated with the operational phase of the facility, and Figure 4.9.1-3 illustrates the predicted distribution of these trips within the traffic impact area. The distribution of the operational work force is based on distribution of Tampa Electric Company's existing employees and the anticipated distribution of the work force in the region. Table 4.9.1-4 contains the LOS expected on these links as well as at the analyzed intersections.

The impacts from operation-related traffic would be partly offset by the decrease in traffic associated with the cessation of mining activities at the Polk Power Station site, and other phosphate mines in the area as reserves are depleted during the life of the Polk Power Station.

Table 4.9.1-3. Estimated Daily Trip Ends -- Operation Phase of the Project

Land Use	Size	Trip Rates	Daily Trip Ends
Power Plant	310 Employees*	2.35/employee†	729
	153 Trucks‡	2/truck	306
	Total		1,035

* Total operational and maintenance employees projected for 2010 operations.
† Trip generation rate based on Kimley-Horn Report for FPL in Martin County, Florida.
‡ Estimated number of coal, fuel oil, and by-product trucks.

Source: TEC, 1992a.

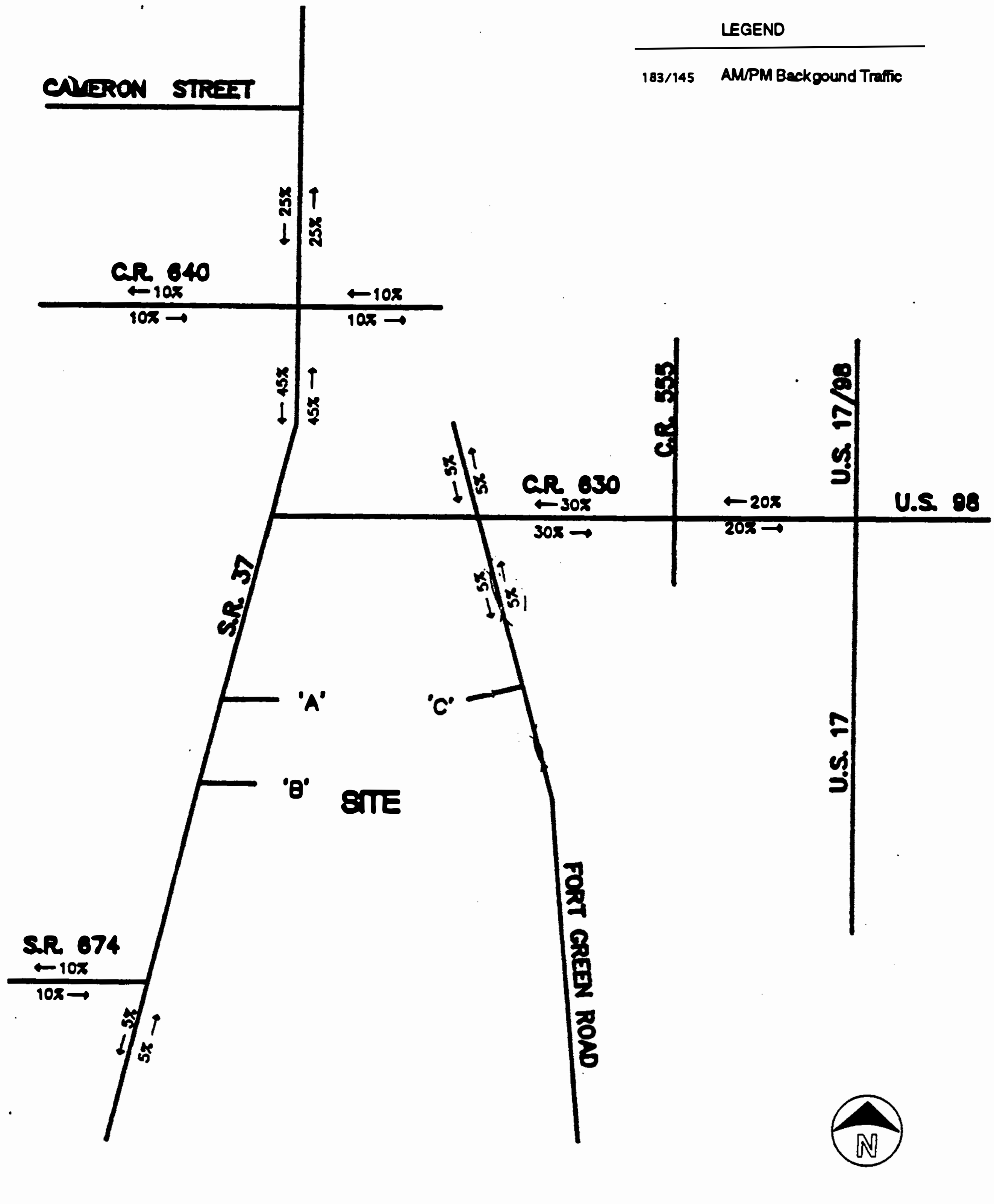

FIGURE 4.9.1-3.
Predicted Distribution of Operation Traffic in the Traffic Impact Area.

SOURCES: Lincks, 1992; TEC 1992a.

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Table 4.9.1-4. Predicted Levels of Service for Links and Intersections -- Operation Project Conditions

Roadway Segment	Direction	Background Condition LOS (peak hour)		Adopted Performance LOS Standard	Predicted LOS	
SR 37		a.m.	p.m.		a.m.	p.m.
SR 674 - Project Drive B	NB	B	B	D	B	B
	SB	B	B	D	B	B
Proj. Drive B to Proj. Drive A	NB	B	B	D	B	B
	SB	B	B	D	B	B
Proj. Drive A to CR 630	NB	B	B	D	B	B
	SB	B	B	D	C	B
CR 630 to CR 640	NB	B	B	D	B	B
	SB	B	B	D	B	B
CR 640 to Cameron Street	NB	C	C	D	C	C
	SB	C	C	D	C	C
CR 630						
SR 37 to Fort Green Road	EB	A	A	D	B	B
	WB	A	A	D	B	B
Fort Green Road to CR 555	EB	A	A	D	B	B
	WB	A	A	D	B	B
CR 555 to US 98	EB	A	A	D	B	B
	WB	B	B	D	B	B
Fort Green Road						
Proj. Drive C to CR 630	NB	A	A	D	A	A
	SB	A	A	D	A	A
Intersection	a.m./p.m.					
SR 37 and CR 640	AM	B		D	B	
	PM	B		D	B	
SR 37 and CR 630	AM	B		D	B	
	PM	A		D	A	
CR 630 and Fort Green Road	AM	B		D	B	
	PM	B		D	B	

NB = northbound.
SB = southbound.
EB = eastbound.
WB = westbound.

Source: TEC, 1992a.

Additional operational-related traffic impacts would result along the route for transport of coal to the site, if coal was delivered by truck. The proposed coal delivery route is shown in Figure 4.9.1-4. The route would proceed along the following road segments:

- East on Big Bend Road to US 301
- South on U.S. 301 to SR 672
- East on S.R. 672 to SR 39
- South on S.R. 39 to SR 674
- East on S.R. 674 to SR 37
- North on S.R. 37 to Polk Power Station entrance at Bethlehem Road

No major municipalities exist along this route. Within the 5-mile radius study area, only seven houses lie within 300 ft of the proposed route, based on recent (1987 to 1993) aerial photographs.

Transmission Line Service Roads

Two transmission line service roads would be constructed for the project. One service road for the northern transmission line corridor would access SR 37 at a point approximately 1,500 ft to the north of the Bethlehem Road entrance, and the other service road for the eastern transmission line corridor would access Fort Green Road at a point approximately 1,300 ft south of CR 630. These service roads would be constructed in the right-of-way and would only be used for periodic transmission line and corridor maintenance and inspection purposes, and would have locked gates to control access from the existing roadways. Therefore, only a limited number of vehicles would occasionally use these service roads and their construction, and use would have no effects on existing roadways.

The use of fill would be minimized in the construction of transmission line access roads, and wherever possible, roads would be constructed by blading natural soil from both sides of the intended road. Where fill is required, it would be trucked in and spread, compacted, and shaped to the desired elevation. Access roads would be constructed to have a maximum surface width of 16 to 20 ft. Dump trucks could be used for hauling, and bulldozers and graders may be used for spreading and compacting.

The crossing of the South Prong Alafia River by the transmission lines is unavoidable, but the potential effects could be minimized by crossing along-side the existing SR 37 crossing. Currently, the wetland area is only about 200 ft wide and has been cleared previously for construction of SR 37. No structures or fill would be placed in the water. If fill is required in any water crossings, use of filtration devices, such as fabric fences or staked straw bales would be used to maintain water quality.

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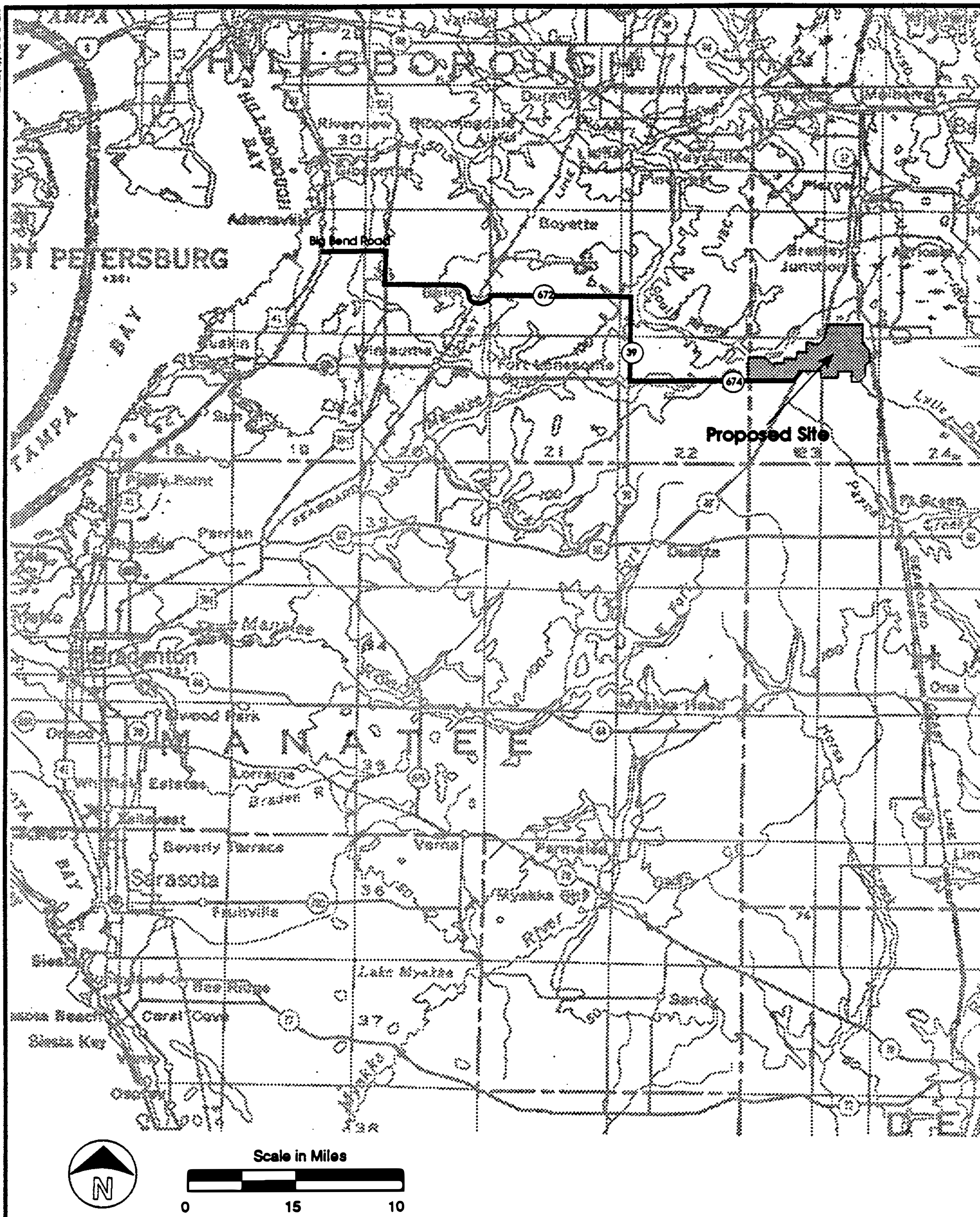

FIGURE 4.9.1-4.
Proposed Coal Delivery Route.

SOURCE: Modified from ECT, 1992; TEC 1992a.

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4.9.1.2 Air, Rail, and Navigational Impacts

Air

No effects to air facilities in the area would be expected. As stated in Section 3.9, no public or private aviation facilities are located within a 5-mile radius of the Polk Power Station. No deliveries to the plant would be made by air.

Rail

Railroad access to the Polk Power Station would be provided by construction of a rail spur from the existing CSX Railroad line that runs along the east side of Fort Green Road adjacent to the eastern boundary of the site. This rail spur would be used for delivery of coal, fuel oil, and certain equipment and materials to the site. The spur would also be used to transport process by-products from the site. Two unit trains per week would be needed for delivery of coal to the site by rail. It is estimated that current phosphate operations in the site area require four unit trains per day on this rail line. Therefore, should coal be delivered by rail to the site, the increase in rail traffic at the site would be minor compared to current levels.

Except for a short segment (approximately 200 ft) of the rail spur to cross Fort Green Road, the spur and associated material loading and unloading facilities would be located within the boundaries of the Polk Power Station site. Therefore, any off-site effects associated with the construction and operation of this rail spur would be insignificant. On the site, the rail spur would be approximately 1.5 miles. The impacts of the rail spur and a potential rail loop constructed at the end to provide for turning and storage of rail cars have been assessed. Descriptions of the environmental characteristics (e.g., land use, vegetation, and wildlife) along the on-site route for the rail spur were provided in Section 3.0. There are five at-grade railroad crossings in the area currently operating at LOS A. The proposed project would not significantly effect LOS at these crossings (Polk County Department of Planning, 1993).

Navigation

No bridges would be required for any water crossings so no restrictions to navigation would occur due to the proposed project. Adequate clearances would be provided in the transmission line design so as not to impede any boat traffic at any water crossings.

4.9.1.3 Programmed Transportation Improvements

The FDOT District I, which has jurisdiction over the roads in the project area, currently has one project planned within a 5-mile radius of the site. This project consists of widening and resurfacing SR 37 from SR 630 north to Mulberry resulting in two 12-ft lanes with a 2-ft shoulder and extended drainage structures (FDOT, 1993). Polk County has no improvements planned in this area (Polk County Department of Planning, 1993).

4.9.1.4 Transportation-Related Economic Impacts

Transportation-related economic effects are not predicted to affect Polk County or the four-county region. Because no significant residential relocations are predicted due to the new power station, no additional transportation infrastructure (as opposed to project-specific roadway improvements) would be required.

4.9.2 Alternative: Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance)

No significant additional traffic effects would be expected if the proposed IGCC unit were to be replaced by a PC unit under the alternative proposal. Operational and construction employment traffic would be similar to the proposed plan, although an increase in coal deliveries would be expected under the alternative proposal. In addition, during construction and operation of the proposed project, all roadways and intersections are expected to operate at or above the adopted Performance Standard of D according to the Polk County Roadway Inventory, dated March 1992. It is unlikely that traffic under the alternative proposal would push the capacities of these roadways beyond an LOS D.

4.9.3 Alternative: No Action

Under the No-Action Alternative, traffic levels would be expected to stay at existing levels at all roadway links and intersections, which is currently at LOS C or better.

4.9.4 Comparison of Impacts

Because the proposed project would have few effects on LOS on area roads, there would be little difference between the alternatives presented above with respect to traffic. No effects would result under the No-Action alternative. Under the proposed project and the alternative proposal, LOS on area roads would not be expected to decrease to unacceptable levels.

4.10 CULTURAL RESOURCE IMPACTS

4.10.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

4.10.1.1 Construction-Related Impacts

As previously discussed in Section 3.10, one prehistoric site had previously been recorded in the project area, although this site is not listed or eligible for listing for the *National Register for Historic Places* and is not considered significant on a regional or local level. Based on a cultural resource assessment conducted on the proposed project site by Tampa Electric Company and confirmed by the Florida SHPO of the FDHR (see Appendix B), the construction of the proposed Polk Power Station is not expected to affect any known archaeological or historical resources listed or eligible for listing. SHPO has stated on June 1, 1993, that FDHR has ". . .no concerns regarding historic properties at the site submitted for the Site Certification Application." Therefore, no mitigation is anticipated. In the event that buried unlisted resources are discovered during construction, construction would be halted until coordination with FDHR, and a certified archaeologist evaluated the site or find and determined its significance. If the find is significant, Tampa Electric Company would take the appropriate measures to preserve or mitigate the effect to the resource in coordination with FDHR.

At this time, a cultural resource assessment has not been conducted for the portion of the proposed northern transmission line corridor outside of the proposed Polk Power Station site. Although the corridor has been selected, the alignment within the corridor has not been finalized by Tampa Electric Company. Once finalized, Tampa Electric Company would coordinate the location of the proposed alignment with FDHR, as appropriate.

In regard to a potential natural gas pipeline interconnection to serve the proposed Polk Power Station that would interconnect with a potential new regional natural gas pipeline, a proposed alignment would also need to be coordinated with FDHR. This may or may not occur during this EIS NEPA process, depending on the availability of the regional gas pipeline and the status of the Tampa Electric Company interconnection. If the interconnection occurs during the EIS process, EPA would coordinate the alignment proposed by Tampa Electric Company with FDHR for cultural resource effects; however, if it occurs after the EIS NEPA process, Tampa Electric Company would need to coordinate with FDHR at that time.

4.10.1.2 Operation-Related Impacts

No cultural resource effects are expected during operation of the proposed Polk Power Station at the proposed site since operation activities should not involve excavations to uncover any potential unlisted cultural resources on site. As indicated, coordination with FDHR regarding potential effects to cultural resources along the alignments of project off-site linear facilities (transmission line and natural gas pipeline) is pending.

4.10.2 Alternative: Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance)

As discussed previously, no effects to archaeologic or historic resources would result from construction and operation of the Polk Power Station. Accordingly, as the alternative power resource proposal would use the same site, no effects to cultural resources would be expected.

4.10.3 Alternative: No Action

With the No-Action Alternative, phosphate mining and reclamation activities, as well as other existing land use, would continue on the proposed project site. Based on the cultural resources assessment and concurrence by SHPO of FDHR, these activities would have no effect since no significant cultural resources were found, listed or eligible for listing on the site. However, buried unlisted resources could potentially be discovered during mining excavations.

Existing land-use activities at the off-site areas of the project (transmission line, rail spur, and natural gas pipeline corridors) would continue under the No-Action Alternative.

4.10.4 Comparison of Impacts

The Tampa Electric Company's proposed project and the alternate power resource proposal should not differ in effects on cultural resources since the same land areas would be used.

4.11 NOISE IMPACTS

4.11.1 Tampa Electric Company's Proposed Project (Preferred Alternative With DOE Financial Assistance)

4.11.1.1 Construction-Related Impacts

The major construction activities for the proposed Polk Power Station project would involve the construction of one IGCC, two CC units, and six simple-cycle CT units. Overall site reclamation for phosphate mining impacts is also required by FDEP if the proposed project is constructed or not. For purposes of assessing potential noise exposures and effects, the construction activities can be divided into four stages:

- Site preparation and excavation
- Foundation preparation and pouring
- Steel erection and equipment installation
- Site cleanup and plant start-up

The first stage is scheduled to last for approximately 27 months. Stages 2, 3, and 4 would also occur during approximately the same period with start-up of the 260-MW IGCC unit scheduled at the end of the 27-month period. This period encompasses the bulk of the construction-related noise. Construction of additional units would continue until approximately January 2010. This would be a much smaller-scale construction, and site preparation would have already been completed.

During the initial stage, heavy diesel-powered earthmoving equipment would be the major source of noise. This equipment would include bulldozers, graders, backhoes, front-end loaders, dump trucks, scraper pans, sheepsfoot rollers, and dewatering pumps. Typical noise levels for such equipment produce could approach 91 dB at 50 ft (UE&C, 1992). Noise levels for each piece of equipment are listed in Table 4.11.1-1. By comparison, EPA (1971) has published noise levels at 50 ft for similar construction equipment including: front-end loaders (79 dB), trucks (91 dB), bulldozers (80 dB), graders (85 dB), and pile drivers (101 dB). The location of activity in this stage would include reclamation of the site, in general, heavy activity at the plant site and the cooling reservoir, and activities near the site boundaries such as access roads and gates and the rail spur (UE&C, 1992).

For the proposed addition of the CC and CT units in the later phases of construction, site preparation and excavation activities would be limited to the immediate power block areas and the circulating water lines for the CC units.

Equipment used during second stage activities would include concrete trucks, cranes, pile drivers, air compressors, concrete pumps, and some earthmoving equipment. Typical maximum noise levels for such equipment could reach 95 dB at 50 ft (UE&C, 1992). A list of this equipment is given in Table 4.11.1-1. The heaviest activity for all phases would be at the power block and gasifier. Pile driving may be required for the air separation unit, CT units, and ST generators.

Table 4.11.1-1. Construction Equipment and Noise Levels

Equipment	Maximum Noise Level at 50 ft (dB)
Site Preparation and Excavation Stage	
Bulldozers	90
Graders	83
Backhoes	84
Front-end loaders	90
Dump trucks	89
Scraper pans	91
Sheepsfoot rollers	83
Dewatering pumps	78
Foundation Preparation and Pouring Stage	
Pile drivers	95
Concrete pouring/trucks	87
Cranes	86
Air compressors	89
Concrete pumps	84
Excavation equipment	90
Trucks	87
Steel Erection and Equipment Installation Stage	
Cranes	86
Air compressors	89
Welders	73
Delivery trucks	87
Diesel locomotives (12 to 30 infrequent rail deliveries)	97
Asphalt paver	89
Dump trucks	87

Sources: Modified from UE&C, 1992; TEC, 1992a.

Cranes, air compressors, welders, asphalt pavers, dump trucks, and delivery trucks would be required during the third stage of construction. There would also be 12 to 30 rail deliveries (or a total of 24 to 60 trips to and from the site) of equipment and materials on an infrequent basis during the IGCC unit construction activities. An additional 6 to 12 rail deliveries (or a total of 12 to 24 trips to and from the site) would be needed for the construction of the CC and CT units. Based on UE&C information, noise levels produced during equipment installation and erection should be in the range of 78 to 89 dB at 50 ft. Diesel locomotives would be expected to produce a maximum of 97 dB at 50 ft (UE&C, 1992). Table 4.11.1-1 lists this equipment and their respective noise levels.

The final stage, site cleanup and plant start-up, should be approximately 10 dB quieter than the other stages (BBN, 1977), except during the short periods of time when the steam lines are being cleaned. During steam line cleaning, high-pressure steam would be blown through the steam piping between the HRSGs and the ST generators to remove scale or welding debris that could damage the ST blades. The steam is vented directly to the atmosphere through a temporary by-pass line constructed specifically for that purpose. Cleaning of the steam lines would require approximately 3 to 10 blows of 1 to 15 minutes per blow over a 2- to 5-day period. A significant peak sound pressure level of 131 dB can be expected at 50 ft (UE&C, 1992). This sound level exceeds the Occupational Safety and Health Administration (OSHA) maximum noise exposure limits, which would require evacuation and/or hearing protection for workers in the vicinity of the source (TEC, 1992a). The temporary steam line blow-out activity would produce a significant maximum instantaneous noise level of between 85 and 80 dB at the nearest residence (Figure 4.11.1-1). This level represents a noticeable increase from background levels, but the effect can be minimized. If the proposed project is implemented, Tampa Electric Company will attempt to minimize potential public inconvenience caused by noise impacts for steam blow-out activities by publishing advance notices in the local newspapers of such scheduled events. The earthmoving equipment will be operated according to design specifications and only during daytime working hours, which could include weekend and holiday periods.

Figure 4.11.1-1 shows the composite construction noise-level contours overlain on the power block portion of the project site. These noise contours are based on time-integrated averaged noise data measured during the construction of several power plants (BBN, 1977). These data represent average-hour $L_{eq(1)}$ noise levels during daytime construction activities, which is more realistic than a 24-hour ($L_{eq(24)}$) average that would incorporate night-time noise levels that have no construction activity noise. The site preparation and steel erection stages produce the highest levels of continuous daytime noise. However, due to the large separation between the plant site and the nearest residence, the construction noise levels would be reduced to an average-hour $L_{eq(1)}$ noise level between 40 and 35 dB (Figure 4.11.1-1). This level is significantly below the existing $L_{eq(24)}$ of 51.7 dB measured near the residence (see Table 3.11-3, Monitoring Station NS-3; Figure 3.11-1, Residential Area 3).

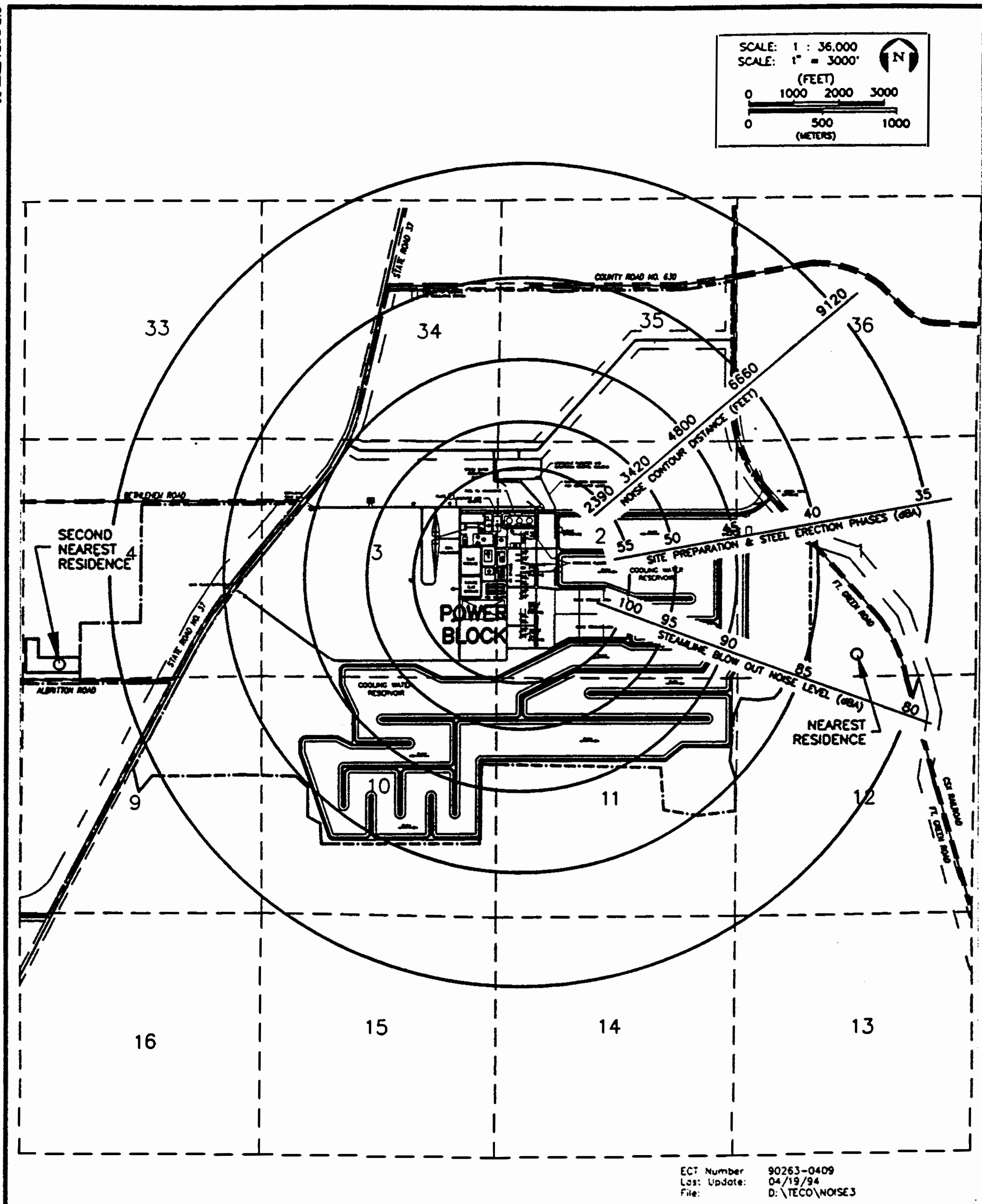

FIGURE 4.11.1-1.
Composite Construction Noise-Level Contours.

SOURCES: Modified from BBN, 1977; UEC, 1992; ECT, 1992; TEC 1992a.

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Noise related to roadway truck traffic would be minimized since most heavy trucks and earthmoving equipment would remain on site during the first year or two of construction activities, rather than make daily trips. Truck deliveries would be variable, probably not to exceed 40 to 50 trips per day (i.e., total trips to and from the site). However, this source of noise would be temporary since the majority of construction-related traffic would occur during the first two years of construction, with less frequent traffic for the remaining 14 years of construction. Truck traffic related to the phosphate industry is already common in the project area.

Construction trucks generate noise levels of approximately 91 dB at 50 ft (EPA, 1971). This level would attenuate to approximately 86 dB at 85 ft, the approximate distance to the nearest roadside residence to the site along SR 674. The construction-related level of truck traffic is much lower than the maximum potential level predicted during operation for full build-out (see Section 4.11.1.2 and Table 4.11.1-3). Therefore, peak-hour $L_{eq(1)}$ (highest hourly noise level during peak traffic) construction-related truck traffic should not cause or significantly contribute to exceedances of the FHWA peak-hour $L_{eq(1)}$ guidelines of 67 dB for residential areas, or of 72 dB for commercial areas.

4.11.1.2 Operation-Related Impacts

Potential operational noise effects were assessed for the three closest groups of residential receptors around the project site (Residential Areas 1, 2, and 3) from both continuous and intermittent sources of noise resulting from the proposed Polk Power Station together with the existing sources. The NOISECALC noise model (version 1.02, 1984) developed by the New York State Department of Public Service was the primary analytical tool employed in the assessment. Noise level input data were obtained from vendors, constructing engineers, and literature (TEC, 1992a). The NOISECALC model only predicts noise levels contributed by the modeled sources; therefore, existing background noise levels must be separately considered in the assessment of potential noise impacts.

Figure 3.11-1 shows the locations of residential area receptors assessed in the noise modeling. The receptors were located at the three groups of residential areas (designated as 1, 2, 3), which were typically low density, single-family homes, closest to the project site. The following list provides the distances between each receptor location and the power block center, as well as the approximate number of residences and estimated number of persons (2.52 persons per residence [BEBR, 1992a]) at each location.

Residential Area	Distance from Power Block Center		Number of Residences	Estimated Number of Persons
	Feet	Miles		
1	22,250	4.2	53	134
2	10,125	1.9	45	113
3	8,250	1.6	1	2-3

Each of the receptor locations would be shielded to some extent from lower elevation noise sources by existing features or features that would be developed as part of the project, including an approximately 200-ft wide vegetative buffer area (mixed evergreens and hardwoods) that would be established along the public roadways (SR 37, CR 630, and Fort Green Road). In addition to its significant distance from the facilities (over 4 miles), Residential Area 1, southwest of the power block, would receive some shielding from the wetlands and uplands after reclamation. Currently, there are trees shielding Residential Area 2 which is located west of the site. After reclamation, there would be wetlands and uplands that may provide some shielding. Residential Area 3, located east of the plant, may receive some shielding from an orange grove between it and the plant. However, unless the vegetation is dense and wide enough, it will not significantly attenuate the noise between the plant and the residences (FHWA, 1980a). Since the proposed vegetative buffer area surrounding the main plant site boundaries would take some time to mature after development of the project, a conservative approach was used for the noise analysis in that no credit was taken for vegetative noise attenuation in the modeling.

Table 4.11.1-2 presents the results of the noise modeling at each of the three residential area locations for three different timeframes in the overall project development and operation schedule (i.e., proposed IGCC unit only, IGCC and CC units, and full build-out). In the analyses, flare stack, and coal delivery train noise sources were modeled separately. For the IGCC unit only, the highest $L_{eq(24)}$ of 51 dB occurred at Residential Area 2 west of the site. The highest $L_{eq(24)}$ of 51 dB for the other two development timeframes occurred at Residential Area 2 and Residential Area 3, east of the site. In addition, the sparse population near the power block would reduce the extent of noise disturbances to residents.

Infrequent operation of the flare stack would temporarily increase noise levels to maximum instantaneous levels of 63, 77, and 75 dB at Residential Areas 1, 2, and 3, respectively. Tampa Electric Company does not expect flare stack operations for full load trips to occur more than 24 hours per year (TEC, 1992a). The flare stack would operate only during IGCC start-up and shut-down and during unforeseen emergencies, so the actual frequency or duration of usage cannot be accurately determined, but it is expected to be infrequent. Project-related coal delivery trains on the CSX Railroad would consist of approximately 2 in-bound and 2 out-bound trains per week (i.e., 104 in-bound and 104 out-bound train trips per year). This should not cause significant increases in the

Table 4.11.1-2. Operation Noise Modeling Results ($L_{eq(24)}$) for the Proposed Polk Power Station Compared to Existing Noise Levels

	Sound Level (dB)					
Residential Area	Existing Noise Level $L_{eq(24)}$	IGCC Unit Only $L_{eq(24)}$	IGCC and CC Units $L_{eq(24)}$	Full Build-Out $L_{eq(24)}$	Maximum Instantaneous Flare Stack Level	Maximum Instantaneous Coal Train Level
1	50.4	39	39	40	63	30
2	55.4	51	51	51	77	37
3	51.7	50	51	51	75	54

Sources: ECT, 1992; TEC, 1992a.

maximum noise levels at the residences since approximately four phosphate-related trains per day use the same railroad line. Although trains produce 97 dB at 50 ft (UE&C, 1992), at Residential Area 3, the residence closest to the railroad, the modeled maximum instantaneous noise level produced by a train entering the site is predicted to be 54 dB. However, some annoyance noise levels could be produced by single-event noise such as train whistles.

Tampa Electric Company would consider additional noise reduction measures as it evaluates equipment and prepares the detailed design of the proposed power station. In addition to the proposed mixed forest vegetative buffer, mitigative options could include a requirement that vehicles on the plant site travel at slow speeds, and silencers for the CT air intakes. These proposed measures would reduce the noise levels at Residential Areas 2 and 3, particularly as vegetative attenuation increases with the growth and maturity of the proposed buffers. Tampa Electric Company would also consider reasonable public noise comments related to plant construction and operation and will provide a special toll free telephone number (1-800-282-4667, Extension 34269) for such comments.

An analysis of the noise associated with maximum potential daily truck traffic for plant operation at full build-out was performed, which included truck trips (total of all trips entering and all trips exiting the site) for coal delivery (160 trips/day), fuel oil delivery (112 trips/day), by-product hauling (12 trips/day), and slag hauling (18 trips/day). These would result in a total of 151 round trips or a total 302 trips per day (24 hr) of truck traffic to and from the site. This results in an overestimate of the actual trips because the by-product and slag hauling trips will likely be performed partly or entirely by the same trucks that have delivered the coal, whose return trips are already accounted for in the total of 302 trips per day. General consumables also delivered by trucks are predicted to peak at approximately 100 total trips per year (or approximately one round trip per day), so they were not included in the analysis. These predicted traffic volumes for coal deliveries, fuel oil deliveries, by-product hauling, and slag hauling are for full build-out conditions scheduled by Tampa Electric Company for 2010.

The FDOT noise model (117/144-Interactive (PPLENV24) (FLAMOD) 1979 version) was used to estimate peak-hour $L_{eq(1)}$ effects (i.e., average noise level for the peak hour of traffic) due to operational truck traffic and along SR 674, the proposed coal delivery route. A conservative modeling scenario was used, which assumed that there was no shielding, that there was a daily traffic volume of 302 vehicles, and that 100 percent of traffic is heavy trucks. The peak hour of traffic was assumed to comprise 10 percent (30.2 trips) of the daily total trucks, although deliveries could occur at any time (approximately 4 percent in any given hour). These assumptions, coupled with the maximum potential truck volume and the assumption that all trucks follow the same route, should result in a conservative estimate of noise associated with plant operation during full build-out operation.

The L_{10} value (a noise level that would only be exceeded 10 percent of the time) produced by the FDOT model was converted to a peak-hour $L_{eq(1)}$ by subtracting 3 dB (FHWA, 1982; EPA, 1974).

For project-related truck traffic along SR 674, the model predicted a peak-hour $L_{eq(1)}$ of 57 dB at a reference distance of 100 ft. For residences farther than 100 ft from the highway, the noise would be reduced as a function of distance (approximately 3 to 4 dB per doubling of distance, [Salvato, 1982]).

Because actual site-specific data on current truck traffic noise are not available, the FDOT FLAMOD traffic noise model was used to estimate existing traffic noise for comparison to the project-related noise. Existing traffic along SR 674 is approximately 3,600 trips/day (Lincks, 1992). Assuming 10 percent of the daily volume occurs in the peak hour (Lincks, 1992) and 13 percent are heavy trucks (Kimley-Horn, 1989), the peak-hour $L_{eq(1)}$ at 100 ft is 63 dB, 6 dB higher than the project-related truck traffic contribution along SR 674.

Potential noise impacts to specific residences within the 5-mile diameter study area around the proposed plant site were determined by identifying the residences along the proposed coal delivery route (SR 674 east to SR 37 north and to the Polk Power Station main entrance) (see Figure 4.9.1-4) and determining their distance from the closest edge of the highway to a maximum considered distance of 250 ft. Five residences were located by aerial photography within the 250 ft corridor along the proposed coal delivery route. The modeled peak-hour $L_{eq(1)}$ due to the estimated trip numbers, and the calculated maximum noise levels generated by individual trucks were determined for project-related truck traffic at each individual residence. The instantaneous maximum and peak-hour $L_{eq(1)}$ noise levels at the five residences along the proposed coal delivery route within five miles of the Polk Power Station are presented in Table 4.11.1-3 (excluding existing traffic noise levels along the roadway).

The closest residence to the proposed coal delivery route is 85 ft from the edge of the SR 674 (see Table 4.11.1-3). The estimated peak-hour $L_{eq(1)}$ from project truck traffic at full project build-out at that location is approximately 57.5 dB compared to a peak-hour $L_{eq(1)}$ of 64 dB from existing traffic. The addition of the project truck traffic would increase the peak-hour overall traffic noise by approximately 1 dB, which is typically not a detectable increase. The next closest residence is approximately 140 ft from the roadway, which attenuates the noise level to 55.5 dB. At 250 ft, the noise level is reduced to 53 dB. These predicted and overall resultant noise levels, even at the nearest residence along SR 674, would not exceed to FHWA peak-hour $L_{eq(1)}$ guidelines of 67 dB for residential areas and 72 dB for commercial areas (although the FHWA guidelines additionally consider background noise contributions not considered here). It should be clarified that these noise levels refer to outdoor exposure; within a closed residence the noise would be attenuated considerably (10 to 30 dB).

Instantaneous maximum noise levels from individual trucks hauling coal or other operation-related materials can be approximated by a maximum level of 91 dB at 50 ft (EPA, 1971). This maximum would only be observed for that time when the truck reaches the closest point to the observer during a pass-by event. Since a single truck produces noise as a point source (as opposed to a line source, such

Table 4.11.1-3. Noise Levels Produced by Project-Related Truck Traffic at the Five Closest Residences along the Proposed Coal Delivery Route within Five Miles of the Polk Power Station

Residence Number	Highway	Distance from Edge (ft)*	Project Truck Noise Level (dB)	
			Maximum†	$L_{eq(1)}$‡
1	SR 674	85	86	57.5§
2	SR 674	140	82	55.5
3	SR 674	170	80.5	55
4	SR 674	205	79	54
5	SR 37	250	77	53

Notes: * Residences beyond 250 ft from the road edge were not included.
† Maximum is a calculation based on single truck passage, 91 dB at 50 ft.
‡ Peak-hour $L_{eq(1)}$ is a prediction based on FLAMOD traffic noise modeling, 302 total trips (i.e., total to and from site) per day of truck traffic, with a peak hour of 30 trips, 57 dB at 100 ft without consideration of background noise levels.
§ The peak-hour $L_{eq(1)}$ noise level for existing traffic noise at Residence 1 was predicted (FLAMOD) to be 64 dB $L_{eq(1)}$.

as long-term or continuous traffic), its noise would attenuate approximately 6 dB for each doubling of distance. This would result in levels of approximately 85 dB at 100 ft, and 79 dB at 200 ft.

The instantaneous maximum noise level during a truck pass-by event at the closest residence (85 ft from the edge of SR 674) would be approximately 86 dB. The next closest residence (140 ft from SR 674) would experience a maximum of approximately 82 dB. The level is attenuated to approximately 79 dB at 205 ft, and 77 dB at 250 ft (see Table 4.11.1-3).

Projected $L_{eq(24)}$ noise levels from normal power plant operation (excluding flare stack) should not significantly affect wildlife resources. Although present in the area, wildlife communities (e.g., active eagle nests or wading bird rookeries) do not exist within one mile of the power block area. At one mile from the power block, the predicted $L_{eq(24)}$ for plant operation is approximately 56 dB at full build-out. This value is within the range of measured existing ambient $L_{eq(24)}$ (see Section 3.11) near the site so it would essentially be masked by existing environmental sounds one mile from the power block and beyond. Wildlife on site and in the region have been exposed to similar noise levels for years from phosphate mining.

Operation of the flare stack would have the greatest potential for environmental effect due to its intermittent nature and the higher sound levels produced. Intermittent sounds could produce a "startle effect", which is a short-term physiological stress reaction to sudden noises that lasts 5 to 20 seconds. The startle effect would affect both humans and wildlife, and would be most pronounced when instantaneous levels are loud (90 dB and above). This level would only be found adjacent (generally within approximately 2,000 to 2,500 ft) to the source. A startle effect could be produced in wildlife and humans at the distances of the Residential Area 1 (63 dB), Residential Area 2 (77 dB), and Residential Area 3 (75 dB) locations. Studies have shown that habituation to this type of noise (such as aircraft noise) usually occurs over time and would lessen the startle effect further (Kryter, 1984). However, the magnitude of such effects is species specific, with more sensitive species being more affected and possibly displaced.

Busnel and Briot (1980) observed that birds, such as gulls, pigeons, jays and various other forms of wildlife, were abundant in land areas adjacent to some airport runways. Bird and animal populations had to be thinned by hunting parties to reduce the danger to air traffic. They concluded, based on the relationship between aircraft flights and the numbers of birds and animals bagged per year, that animal populations grew independently of the amount of air traffic. Other observations showed that migratory birds do not hesitate to utilize airport environs as resting places during migration and do not necessarily attempt to move even in the presence of noise levels up to 120 dB. These reports indicate that habituation to this type of noise can occur quickly, and long-term exposure is not necessarily detrimental to the health of bird and animal populations near airports. Busnel and Briot (1980) reported nest building on runway shoulders. However, no specific bird species were identified in their report.

Perhaps a more comparable type of noise is sonic booms from aircraft. Espmark *et al.* (1974) exposed cattle and sheep to sonic booms for four days and concluded that the effects of the noises were not unusual and that the animals returned quickly to grazing or other normal activities when interrupted.

As previously indicated, the flare stack would operate only during start-up and shut-down of the CG facilities and unforeseen emergencies. Besides initial start-up and maintenance of the CG facilities every few years, no use of the flare stack is planned. The frequency of unforeseen emergencies and shut-down/start-ups cannot be predicted, but should be quite low. There are no regulatory guidelines for levels of intermittent environmental noise.

In summary, the normal plant operations would not cause significant noise disturbance in the area surrounding the Polk Power Station site although some intrusive single-event noise levels would occur.

4.11.2 Alternative: Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance)

The use of a 500-MW PC unit instead the proposed 260-MW IGCC Polk Unit 1 would not significantly change the noise produced by the proposed construction, reclamation, and operation of the power plant.

The PC alternative would require more coal than the IGCC alternative. The increased coal consumption would result in a proportionally larger number of rail and/or truck deliveries. There would also be more solid waste by-products, such as gypsum and ash, that would require hauling by truck. The overall result would probably be an increase in rail deliveries and truck traffic.

Normal operation of the PC alternative would produce noise levels similar to the IGCC plant except that it would not require a flare stack, so this source of intermittent noise would not be added for this alternative.

4.11.3 Alternative: No Action

The No-Action Alternative would result in no construction or operation of the proposed Polk Power Station. The No-Action Alternative would have similar construction-related noise as the proposed project due to the reclamation of the land surface to premining conditions that is required for all alternatives. Noise sources directly related to construction of the power plant facilities, such as pile drivers, would not be added and duration of construction/reclamation activities would be shortened.

After reclamation, the noise would be at roughly the measured ambient levels.

4.11.4 Comparison of Impacts

None of the three alternatives would result in significant noise to the environment of the proposed Polk Power Station site and surrounding area. All three alternatives would have similar noise from machinery during the reclamation of the land surface. The No-Action Alternative would generate the least construction noise since no facilities would be constructed, and there would be no long-term noise from plant operation.

The PC and IGCC alternatives would have similar levels of operation noise, which would not result in a significant increase in environmental noise levels since the predicted increase in $L_{eq(1)}$ levels at the nearest residences to the site is only 1 to 4 dB. The IGCC facility would require a flare stack that would operate infrequently. The flare stack single-event noise would be noticeable to residents within approximately 1 to 2 miles from the power block area. The PC alternative would not require a flare stack.

4.12 HUMAN HEALTH IMPACTS AND RISK TO WILDLIFE

4.12.1 <u>Health and Safety Procedures During Construction</u>

Tampa Electric Company would implement a health and safety plan specifically for phase one during the construction of the project. The Project Safety and Health Plan would be written to promote accident prevention through voluntary compliance with OSHA standards, Tampa Electric Company requirements, environmental regulations, and other statutes that apply to the scope of work to be performed at the work site (Bechtel, 1993b).

The following regulations and procedures, as a minimum, apply to the project:

- American National Standards Institute (ANSI) Guidelines
- NFPA Codes
- National Electric Code (NEC)
- All other codes and regulations which are applicable to construction activities within Florida
- EPA and DOE statutes and regulations such as SARA, RCRA, CERCLA, etc.
- Federal OSHA codes and regulations
- All Tampa Electric Company regulatory procedures and standards, including:
    * Safety procedures
    * Contractor safety standards
    * Emergency action plan
    * General work rules and procedures
    * Environmental and health regulations
    * Hazard communication and process safety standards
    * Contractor orientation/training procedures
    * Project site environmental requirements

The Project Safety and Health Plan would include these key components:

- Training and education
- Industrial hygiene
- Communications
- Accident reporting and investigation
- Safety and health inspections
- Safe work practices
- Controlled substance program
- Emergency program

All of these individual sections of the plan would be designed to minimize accidents and to maximize the health and safety of workers during the construction phase.

4.12.1.1 Management of Hazardous Waste

Any mismanagement of hazardous wastes could potentially result in the accidental contamination of surface water and groundwater in the area and thus, could present a threat to public health. Air emissions created from the spill of volatile hazardous wastes could also pose a threat to human health. A plan to handle and dispose of hazardous waste would be established by the on-site Environmental Coordinator and Construction Management. The specific plans and procedures would be developed per RCRA requirements and would be taught during the on-site environmental awareness training. Thus, the potential for mismanagement of hazardous wastes would be minimized. All efforts would be made to minimize the generation of hazardous wastes and to promote the awareness of proper handling methods in order to prevent accidental spills.

4.12.1.2 Proper Storage of Hazardous Materials

Access to material storage areas would be controlled to prevent accidental misuse or release of hazardous materials. The inventory of all supplies, equipment, and materials would be controlled and monitored by inventory and warehouse personnel. Liquid solvents, cleaners, fuels, lubricants, acids, caustics, etc., would be stored on pallets or above the ground, so that leaks in the containers could be detected. Hazardous materials would be stored on concrete slabs, lined cells, or other impervious surfaces to prevent contamination of the soil, groundwater, or surface water. The on-site Environmental Coordinator would be made aware of any activities involving the use of hazardous substances to facilitate prompt responses in the event of an accidental spill or release.

4.12.1.3 Air Emissions from Construction Operations

Fugitive emissions created by vehicular traffic or construction activities are not expected to have significant effects in the off-site community. Emissions are expected to be temporary, and would vary depending on the levels of activity, specified operations, and prevailing weather. Any burning of grasses or underbrush would be done with the approval of the appropriate state and local governing agencies, fire control agency, and public safety agencies. As such, no threats to human health are expected.

4.12.2 Assessment of Impacts During Operation

4.12.2.1 Air Toxic Emissions Study

The overall goal of the air toxic emissions study was to assess the potential effects on human health associated with the direct inhalation of air toxic constituents potentially present in emissions from the proposed Polk Power Station.

This assessment involved the following five steps:

1. The development of an air toxic emissions list for review
2. The development of emission estimates of the air toxic emissions chosen for review
3. The determination of the maximum possible concentrations of selected air toxic emissions
4. The assessment of systemic toxic effects (noncarcinogenic effects)
5. The assessment of individual carcinogenic risk and total population risk

The following sections describe in detail the methodology and assumptions involved in each step of the analysis.

Step 1

The air toxic emissions chosen for review (Tables 4.12.2-1 through 4.12.2-3) were selected on the following basis:

- Reported to EPA as potential emissions for a similar project, or data were available (EPA, 1989b and EPA 1990b) to suggest potential emissions (Table 4.1.2-3 illustrates a comparison of reported air toxic emission rates from coal fired plants to those predicted for the Polk Power Station)
- Included on the Florida Air Toxics List
- Included on the list of Hazardous Air Pollutants contained in the amendments to the CAA in 1990

Step 2

Following the development of the list of air toxic emissions for review, Tampa Electric Company was requested to develop emission estimates for these chemicals based on vendor information or available literature. Any emission factors not vendor-specified were reviewed to assure their consistency with available literature, or, in the absence of source specific emissions data in the literature, that they were reasonably conservative estimates. Because of the location of the site in the phosphate district of Florida, hydrogen fluoride is of special concern, although it is primarily associated with phosphate chemical plants. All fluoride in the fuel was conservatively assumed to be emitted as hydrogen fluoride. Neither vendor specified data nor source specific emissions data were available in the literature to better predict the emission rate of hydrogen fluoride from the specific combustion sources.

An emission factor summary (in $lb/10^{12}$ Btu) rate of each air toxic emission is provided in Tables 4.12.2-1 through 4.12.2-3. The maximum possible annual and 24-hour emission (in tpy and g/sec) per unit type are provided in Tables 4.12.2-4 through 4.12.2-7. It should be noted that these values were the input emission rates used in the ISC2 modeling. For each air toxic emission, the maximum possible 24-hour emission rate was estimated using the emission factor corresponding to the fuel that produced the greatest emission rate. The maximum possible annualized emission rate was determined by using the operating scenario that produced the greatest emissions. The two operating

Table 4.12.2-1. Metallic Pollutant Emission Factors for the Proposed Polk Power Station Sources (lb/10^{12} Btu)

Pollutant	Period	7F CT Syngas[a]	7F CT or 7EA CT Oil-Fired[b]	7EA CT Gas-Fired[c]
Antimony (Sb)	Annual	0.44[1]	22[2]	0[2]
Arsenic (As)	Annual	0.26[3]	20[3]	0[3]
Beryllium (Be)	Annual	0.044[3]	2.5[3]	0[3]
Cadmium (Cd)	Annual	0.39[3]	11[3]	0[3]
Chromium (Cr) (Total)	Annual and 24-Hour	0.18[1]	90[3]	0[3]
Chromium (+VI)	Annual and 24-Hour	0.008[4]	1.8[4]	0[3]
Cobalt (Co)	24-Hour	0.22[1]	9.1[2]	0[2]
Lead (Pb)	Annual	1.5[3]	53[3]	0[3]
Manganese (Mn)	Annual	0.22[1]	340[2]	0[2]
Mercury (Hg)	Annual	1.5[3]	3[3]	11[3]
Nickel (Ni) (Total)	Annual and 24-Hour	0.22[1]	1,200[2]	0[2]
Selenium (Se)	24-Hour	0.31[1]	4.4[2]	0[2]
Vanadium (V)	Annual	0.18[1]	4.4[2]	0[2]

Notes:
[a]7F CT at 2280 x 10^6 Btu/hr on coal gas (syngas)
7F CT at 1907 x 10^6 Btu/hr on No. 2 fuel oil
[b]7EA CT at 1115 x 10^6 Btu/hr on No. 2 fuel oil
[c]7EA CT at 1072 x 10^6 Btu/hr on natural gas
lb = pound
Btu = British thermal units
hr = hour

Sources:
[1] Converted from factor listed in GE, 1992.
[2] Converted from factor listed in EPA, 1993b.
[3] Converted from factor listed in TEC, 1992a.
[4] Based on hexavalent chromium being 2 percent of total chromium for distillate oil and 0.5 percent of total for syngas (Radian 1992)

Table 4.12.2-2. Inorganic Pollutant Emission Factors for the Proposed Polk Power Station Sources (lb/10^{12} Btu)

Pollutant	Period	7F CT Syngas	7F CT 7EA CT Oil-Fired	7EA CT Gas-Fired
Ammonia (NH_3)	Annual	0	0	0
Fluorides (F)	24-Hour	92.1	32.5	0
Hydrogen sulfide (H_2S)	Annual	0	0	0
Hydrogen fluoride (HF)	24-Hour	92.1*	32.5*	0*
Uranium 238	Annual and 24-Hour	0.41[1]	0	0
Sulfuric acid (H_2SO_4) mist	Annual	20,000	10,000	0

* Assumes all fluoride is emitted as hydrogen fluoride.

Notes: 7F CT at 2280 x 10^6 Btu/hr on coal gas (syngas)
7F CT at 1907 x 10^6 Btu/hr on No. 2 fuel oil
7EA CT at 1115 x 10^6 Btu/hr on No. 2 fuel oil
7EA CT at 1072 x 10^6 Btu/hr on natural gas

Sources: TEC, 1992a, unless otherwise noted.
[1]Converted from factor listed in EPA, 1990b.

Table 4.12.2-3. Organic Pollutant Emission Factors for the Proposed Polk Power Station Sources ($lb/10^{12}$ Btu)

Pollutant	Period	7F CT Syngas	7F CT 7EA CT Oil-Fired	7EA CT Gas-Fired
Benzene	Annual	2.0[1]	2.0[1]	2.0[2]
Benzo-a-pyrene	Annual	2.0[1]	22.5[2]	2.0[2]
Formaldehyde	Annual	2.0[1]	240[2]	2.0[2]
Naphthalene	24-Hour	2.0[1]	22.5[2]	2.0[2]
Acetaldehyde	Annual	2.0[1]	22.5[2]	2.0[2]

Notes: 7F CT at 2280 x 10^6 Btu/hr on coal gas (syngas)
7F CT at 1907 x 10^6 Btu/hr on No. 2 fuel oil
7EA CT at 1115 x 10^6 Btu/hr on No. 2 fuel oil
7EA CT at 1072 x 10^6 Btu/hr on natural gas

Sources: [1] ECT 1993 data derived from 25 ng/20 L detection limit
[2] EPA, 1989b.

Table 4.12.2-4. Maximum Metallic Pollutant Emission Rates for the Auxiliary Boiler, H_2SO_4 Plant, and HGCU Thermal Oxidizer

Pollutant	Period	Auxiliary Boiler tpy	Auxiliary Boiler g/sec	H_2SO_4 Plant and HGCU Thermal Oxidizer tpy	H_2SO_4 Plant and HGCU Thermal Oxidizer g/sec
Antimony (Sb)	Annual	0.0044	1.4×10^{-4}	0.0016	4.5×10^{-5}
Arsenic (As)	Annual	0.0009	2.6×10^{-5}	0.004	0.0001
Beryllium (Be)	Annual	0.0005	1.6×10^{-5}	0.004	0.0001
Cadmium (Cd)	Annual	0.0008	3.0×10^{-4}	0.004	0.0001
Chromium (Cr) (Total)	Annual	0.0104	3.0×10^{-4}	0.46	0.0132
Chromium (Total)	24-Hour	0.005 (lb/hr)	6.3×10^{-4}	0.105 (lb/hr)	0.0132
Chromium (+VI)	Annual	0.0002	5.9×10^{-6}	0.0092	0.0003
Chromium (+VI)	24-Hour	9.6×10^{-5} (lb/hr)	1.2×10^{-5}	0.002 (lb/hr)	2.6×10^{-4}
Cobalt (Co)	24-Hour	0.0012 (lb/hr)	1.5×10^{-4}	0.0001 (lb/hr)	1.9×10^{-5}
Lead (Pb)	Annual	0.0137	3.7×10^{-4}	0.018	0.0003
Manganese (Mn)	Annual	0.0696	0.0017	0.035	0.0010
Mercury (Hg)	Annual	0.0006	1.8×10^{-5}	0.0009	0.0003
Nickel (Ni) (Total)	Annual	0.2610	0.0074	0.307	0.0087
Nickel (Total)	24-Hour	0.1426 (lb/hr)	0.0180	0.070 (lb/hr)	0.0087
Selenium (Se)	24-Hour	0.0007 (lb/hr)	8.8×10^{-5}	8.6×10^{-5} (lb/hr)	1.1×10^{-5}
Vanadium (V)	Annual	0.0009	2.7×10^{-5}	0.0003	9.0×10^{-6}

Source: Bechtel, 1994.

Table 4.12.2-5. Maximum Inorganic Pollutant Emission Rates for the Proposed Polk Power Station Sources (Per Unit)

Pollutant	7F CT Syngas		7EA CT Oil-Fired		7EA CT Gas-Fired	
	(tpy)	(g/sec)	(tpy)	(g/sec)	(tpy)	(g/sec)
Ammonia (NH_3)	0	0	0	0	0	0
Fluorides (F)	0.92	0.0265	0.042	0.0012	0.017	0.0005
Hydrogen sulfide (H_2S)	0	0	0	0	0	0
Hydrogen fluoride (HF)	0.92*	0.0265*	0.042*	0.0012*	0.017*	0.0005*
Uranium 238	0.004	.000116	0	0	0	0
Sulfuric acid (H_2SO_4)	241	6.94	20	0.58	12	0.035

* Assumes all fluoride is emitted as hydrogen fluoride.

Source: ECT, 1993.

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Table 4.12.2-6. Maximum Organic Pollutant Emission Rates for the Proposed Polk Power Station CT (Per Unit)

		7F CT		7EA CC		7EA SC	
Pollutant	Period	tpy	g/sec	tpy	g/sec	tpy	g/sec
Benzene	Annual	0.020	0.0006	0.012	0.0004	0.006	0.0002
Benzo-a-pyrene	Annual	0.042	0.0012	0.038	0.0011	0.017	0.0005
Formaldehyde	Annual	0.262	0.0075	0.391	0.0092	0.129	0.0037
Naphthalene	24-Hour	0.043 (lb/hr)	0.0054	0.025 (lb/hr)	0.0032	0.025 (lb/hr)	0.0032
Acetaldehyde	Annual	0.042	0.012	0.038	0.0011	0.017	0.0005

Source: ECT, 1993.

Table 4.12.2-7. Maximum Organic Pollutant Emission Rates for the Auxiliary Boiler, H_2SO_4 Plant, and HGCU Thermal Oxidizer

Thermal Oxidizer		Auxiliary Boiler		H_2SO_4 Plant and HGCU	
Pollutant	Period	tpy	g/sec	tpy	g/sec
Benzene	Annual	0.0070	2.0×10^{-4}	0.0023	6.7×10^{-5}
Benzo-a-pyrene	Annual	0.0035	1.4×10^{-4}	0.0016	4.6×10^{-5}
Formaldehyde	Annual	0.0052	1.5×10^{-4}	0.0005	0.0005
Naphthalene	24-Hour	0.0026 (lb/hr)	0.0003	0.0004 (lb/hr)	4.6×10^{-5}
Acetaldehyde	Annual	0.0035	1.4×10^{-4}	0.0016	4.6×10^{-5}

Source: ECT, 1993.

scenarios considered were: (1) operating at 100-percent capacity on primary fuel, or (2) operating for the maximum allowable capacity on backup fuel and the rest of the capacity on primary fuel. Vent and fugitive emission information for H_2S and NH_3 was taken from the PSD Application in Volume IV of the SCA (TEC, 1992a).

While emission factors were easily acquired for the metals and inorganics under review, limited information was available in the literature for the organic air toxic emissions. Also, the data available corresponded to emission sources that are fundamentally different in design from the combustion turbines at the proposed plant. The formation and emission rates of organic compounds depend on combustion zone temperature, residence time in the combustion zones, air/fuel ratios, mixing efficiency between air and fuel, and fuel-feed size. Therefore, it was difficult to justify using emission factors from different source types for purposes of this analysis. Instead, it was determined that an emission factor derived from a minimum detection limit of 25 nanograms/10 liters (ng/10L) would be used for all organic pollutants (unless specific data were available in the literature), since some of the sources reviewed indicated that the organics were "less than detectable." This detection limit was arrived at by multiplying an instrument detection limit for polynuclear aromatic hydrocarbons (PAHs) by a safety factor of 2.5. The safety factor was incorporated to ensure that the emission rate used in the human health analysis was conservative. The instrument detection limit was provided by Environmental Science and Engineering, Inc., and represents an instrument detection limit for PAHs (in general) for a gas chromatograph-mass spectrometer (GC-MS) using EPA Method 8270. It is reasonable to assume that the emission rate of organic compounds would be minimal because the destruction of many polycyclic organic compounds occurs at temperatures below the operating temperatures of the combustion turbines under consideration.

<u>Step 3</u>

Following the compilation of emission factors, Tampa Electric Company performed air modeling analyses to determine the maximum possible concentrations for the air toxic chemicals using meteorological data for the period 1982 through 1986.

Dispersion modeling was performed using the ISC2 models. ISCLT2, version 93109 was used to perform modeling for annual averaging. ISCST2, version 93109 was used to perform dispersion modeling for 24-hour averaging. The modeling was performed using a polar grid centered on the IGCC HRSG stack. The grid extended out 10,000 meters in 10° radial increments, with the 360° (or 0°) radial line being the north axis. Annual and 24-hour maximum concentration summaries and locations are provided in Tables 4.12.2-8 and 4.12.2-9.

As discussed in Section 4.1.1.2, this detailed air quality modeling analysis did not change from the DEIS analysis since relevant project design changes were minor and would not significantly affect the detailed dispersion modeling.

Table 4.12.2-8. ISC2 Modeled Maximum Annual Concentration due to Polk Power Station Sources ($\mu g/m^3$) (Page 1 of 2)

Pollutant	1982	1983	1984	1985	1986
Antimony (Sb)	6.4×10^{-5} 2500 m; 260°	5.6×10^{-5} 2000 m; 140°	6.6×10^{-5} 2000 m; 260°	6.2×10^{-5} 2500 m; 260°	7.1×10^{-5} 2000 m; 90°
Arsenic (As)	5.3×10^{-5} 3000 m; 260°	4.8×10^{-5} 2000 m; 140°	5.3×10^{-5} 2000 m; 260°	5.4×10^{-5} 2000 m; 90°	6.2×10^{-5} 2000 m; 90°
Beryllium (Be)	1.0×10^{-5} 2000 m; 250°	8.0×10^{-6} 2000 m; 250°	1.0×10^{-5} 2000 m; 250°	1.0×10^{-5} 2000 m; 260°	1.2×10^{-5} 2000 m; 90°
Cadmium (Cd)	3.5×10^{-5} 2500 m; 260°	2.9×10^{-5} 2500 m; 260°	3.6×10^{-5} 2500 m; 260°	3.4×10^{-5} 2000 m; 90°	3.9×10^{-5} 2000 m; 90°
Chromium (Cr) (total)	6.23×10^{-4} 2000 m; 40°	6.05×10^{-4} 2000 m; 40°	5.82×10^{-4} 2500 m; 270°	6.68×10^{-4} 2000 m; 40°	6.73×10^{-4} 1980 m; 90°
Chromium VI	1.4×10^{-5} 2000 m; 40°	1.3×10^{-5} 2000 m; 40°	1.3×10^{-5} 2000 m; 40°	1.5×10^{-5} 2000 m; 40°	1.5×10^{-5} 2000 m; 40°
Lead (Pb)	1.68×10^{-4} 2500 m; 250°	1.44×10^{-4} 2000 m; 140°	1.74×10^{-4} 2500 m; 260°	1.63×10^{-4} 2000 m; 90°	1.87×10^{-4} 2000 m; 90°
Manganese (Mn)	9.92×10^{-4} 2500 m; 260°	8.84×10^{-4} 2000 m; 140°	1.02×10^{-3} 2500 m; 260°	9.77×10^{-4} 2000 m; 90°	1.12×10^{-3} 2000 m; 90°
Mercury (Hg)	1.46×10^{-4} 3000 m; 260°	1.21×10^{-4} 3500 m; 270°	1.47×10^{-4} 3000 m; 260°	1.53×10^{-4} 2500 m; 90°	1.77×10^{-4} 2000 m; 90°
Nickel (Ni) (total)	3.70×10^{-3} 2500 m; 260°	3.18×10^{-3} 2000 m; 140°	3.82×10^{-3} 2500 m; 260°	3.61×10^{-3} 2000 m; 90°	4.14×10^{-3} 2000 m; 90°

Note: The polar coordinate corresponding to the location of the maximum is presented below each concentration value.

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Table 4.12.2-8. ISC2 Modeled Maximum Annual Concentration due to Polk Power Station Sources ($\mu g/m^3$) (Page 2 of 2)

Pollutant	1982	1983	1984	1985	1986
Vanadium (V)	1.6×10^{-5} 2500 m; 260°	1.4×10^{-5} 2000 m; 140°	1.6×10^{-5} 2000 m; 260°	1.6×10^{-5} 2000 m; 90°	1.80×10^{-5} 2000 m; 90°
Ammonia (NH_3)	0.632 1415 m; 280°	0.615 1415 m; 280°	0.652 1415 m; 280°	0.569 1415 m; 280°	0.692 1415 m; 280°
Hydrogen sulfide (H_2S)	0.488 1415 m; 280°	0.479 1415 m; 280°	0.506 1415 m; 280°	0.443 1415 m; 280°	0.554 1415 m; 280°
Radionuclides (Uranium 238)	1.0×10^{-6} 2000 m; 250°	1.0×10^{-6} 2000 m; 260°	1.0×10^{-6} 2000 m; 250°	1.0×10^{-6} 2000 m; 250°	1.0×10^{-6} 2000 m; 250°
Sulfuric acid (H_2SO_4) mist	0.093 4000 m; 260°	0.078 3500 m; 270°	0.096 3500 m; 270°	0.102 2500 m; 90°	0.119 2500 m; 90°
Acetaldehyde	8.8×10^{-5} 2500 m; 260°	7.7×10^{-5} 2000 m; 140°	9.1×10^{-5} 2500 m; 260°	8.7×10^{-5} 2000 m; 90°	1.01×10^{-4} 2000 m; 90°
Benzene	4.6×10^{-5} 2000 m; 250°	3.9×10^{-5} 2000 m; 250°	4.9×10^{-5} 2000 m; 250°	4.5×10^{-5} 2000 m; 250°	4.3×10^{-5} 2000 m; 90°
Benzo-a-pyrene	8.8×10^{-5} 2500 m; 260°	7.7×10^{-5} 2000 m; 140°	9.1×10^{-5} 2500 m; 260°	8.7×10^{-5} 2000 m; 90°	1.01×10^{-4} 2000 m; 90°
Formaldehyde	7.47×10^{-4} 2500 m; 260°	6.53×10^{-4} 2000 m; 140°	7.73×10^{-4} 2500 m; 260°	7.23×10^{-4} 2500 m; 260°	8.25×10^{-4} 2000 m; 90°

Note: The polar coordinate corresponding to the location of the maximum is presented below each concentration value.

Source: ECT, 1993.

Table 4.12.2-9. ISC2 Modeled Maximum 24-Hour Concentration due to Polk Power Station Sources ($\mu g/m^3$)

Pollutant	1982	1983	1984	1985	1986
Chromium (Cr) (Total)	0.0217 2135 m; 120°	0.0287 1995 m; 130°	0.0289 1995 m; 130°	0.0282 2000 m; 120°	0.0346 1995 m; 130°
Chromium (VI)	4.4×10^{-4} 2000 m; 130°	5.8×10^{-4} 2000 m; 130°	5.8×10^{-4} 1995 m; 230°	5.8×10^{-4} 2000 m; 120°	7.0×10^{-4} 2000 m; 130°
Cobalt (Co)	2.05×10^{-3} 2000 m; 130°	2.79×10^{-3} 2000 m; 130°	2.69×10^{-3} 1995 m; 130°	2.46×10^{-3} 2000 m; 120°	3.37×10^{-3} 1995 m; 130°
Nickel (Ni) (Total)	0.286 1995 m; 130°	0.390 1995 m; 130°	0.377 1995 m; 130°	0.343 2000 m; 120°	0.471 2000 m; 130°
Selenium (Se)	1.24×10^{-3} 2500 m; 120°	1.70×10^{-3} 2000 m; 130°	1.61×10^{-3} 1995 m; 130°	1.53×10^{-3} 2000 m; 120°	2.05×10^{-3} 2000 m; 130°
Fluoride (F)	7.84×10^{-3} 2500 m; 120°	1.01×10^{-2} 2000 m; 130°	1.00×10^{-2} 1995 m; 130°	9.10×10^{-3} 2000 m; 120°	1.20×10^{-2} 2000 m; 130°
Naphthalene	5.39×10^{-3} 1995 m; 130°	7.31×10^{-3} 1995 m; 130°	7.14×10^{-3} 1995 m; 130°	6.54×10^{-3} 2000 m; 120°	8.81 x 10-3 1995 m; 130°

Source: ECT, 1993.

Step 4
Chemicals that give rise to toxic endpoints other than cancer and gene mutations are often referred to as "systemic toxicants," because of their effects on the functions of various organ systems. Systemic toxicity, whether from carcinogenic elements or noncarcinogenic elements, is treated as if there is an identifiable exposure threshold (both for the individual and for populations) below which there are no observable adverse effects. For purposes of assessing the systemic toxicity (or chronic effects) associated with air toxic emissions, Florida No-Threat Levels (as established by the Florida Air Toxics Permitting Strategies) were used as threshold values (FDER, 1993).

The Florida Air Toxics Permitting Strategy compares a facility's predicted air toxic emission of a given chemical to the ambient exposure level, which is assumed to not cause appreciable health risks (i.e., Florida No-Threat Level). Because of the protective nature of regulatory agencies, the assumptions used to calculate the No-Threat Levels are intentionally conservative. This conservative bias is added to compensate for the possible additive or synergistic effects from simultaneous exposures to multiple toxic air contaminants, and from additional exposures to the same toxic chemicals through other environmental pathways. For this reason, Florida No-Threat Levels are at least equal to (but usually are more conservative) than reference concentrations provided by the Integrated Risk Information System (IRIS, 1993).

A comparison of the maximum predicted concentrations of each air toxic emission (per ISC2 modeling based on full build-out) to the Florida No-Threat Levels should adequately provide an indication of any potential health risks. Tables 4.12.2-10 and 4.12.2-11 illustrate the comparison. The 24-hour modeled results are based on all units operating on the fuel type that produces the greatest emission rate of the specified air toxic emission. For example, the highest 24-hour concentration for mercury would occur during operation of the Polk Unit 1 on distillate oil and the 7EA CTs operating on natural gas (see Table 4.12.2-1). The annual concentrations were based on annualized emission rates corresponding to the operating scenario that produced the greatest emissions. The two scenarios considered were: (1) operating 100 percent of capacity on the primary fuel, or (2) operating for the maximum allowable capacity on the backup fuel and the rest of the capacity on primary fuel. For example, nickel emissions are much higher when firing distillate oil than syngas or natural gas. The highest nickel annual emissions would occur when all units operated for the maximum allowable capacity on backup fuel oil and operated on primary fuel for the remainder of the capacity. However, during the actual operations of the Polk Power Station, such an operational scenario would be extremely unlikely to occur over any year period. This fact further emphasizes the conservative nature of the analysis in that the highest modeled emissions for nickel as well as the other potential pollutants also would be highly unlikely to occur during the actual project operations. Section 4.1.1.2 provides further discussion on the capacity factors and fuel types for the various units.

Table 4.12.2-10. Maximum Modeled Carcinogenic Air Toxic Concentrations, as Compared to Florida No-Threat Levels

Chemical	Maximum Concentration ($\mu g/m^3$)					Maximum Concentration of the '82-86 Period ($\mu g/m^3$)	Florida No-Threat Level ($\mu g/m^3$)
	1982	1983	1984	1985	1986		
Arsenic (As)	5.3×10^{-5}	4.8×10^{-5}	5.3×10^{-5}	5.4×10^{-5}	6.2×10^{-5}	6.2×10^{-5}	2.3×10^{-4}
Beryllium (Be)	1.0×10^{-5}	8.0×10^{-6}	1.0×10^{-5}	1.0×10^{-5}	1.2×10^{-5}	1.2×10^{-5}	4.2×10^{-4}
Cadmium (Cd)	3.5×10^{-5}	2.9×10^{-5}	3.6×10^{-5}	3.4×10^{-5}	3.9×10^{-5}	3.9×10^{-5}	5.6×10^{-4}
Chromium (Cr) VI	1.4×10^{-5}	1.3×10^{-5}	1.3×10^{-5}	1.5×10^{-5}	1.5×10^{-5}	1.5×10^{-5}	8.3×10^{-5}
Lead (Pb)	1.68×10^{-4}	1.44×10^{-4}	1.74×10^{-4}	1.63×10^{-4}	1.87×10^{-4}	1.87×10^{-4}	9.0×10^{-2}
Nickel	3.7×10^{-3}	3.18×10^{-3}	3.82×10^{-3}	3.61×10^{-3}	4.14×10^{-3}	4.14×10^{-3}	4.2×10^{-3}
Uranium 238*	$<1 \times 10^{-6}$	$<1 \times 10^{-6}$	$<1 \times 10^{-6}$	$<1 \times 10^{-6}$	$<1 \times 10^{-6}$	$<1 \times 10^{-6}$	4.8×10^{-1}
Benzene	4.6×10^{-5}	3.9×10^{-5}	4.9×10^{-5}	4.5×10^{-5}	4.3×10^{-5}	4.9×10^{-5}	1.2×10^{-1}
Formaldehyde	7.47×10^{-4}	6.53×10^{-4}	7.73×10^{-4}	7.23×10^{-4}	8.25×10^{-4}	8.25×10^{-4}	7.7×10^{-2}
Acetaldehyde	8.8×10^{-5}	7.7×10^{-5}	9.1×10^{-5}	8.7×10^{-5}	1.01×10^{-4}	1.01×10^{-4}	4.5×10^{-1}
Polycyclic Organic Matter (Benzo(a)pyrene)	8.8×10^{-5}	7.7×10^{-5}	9.1×10^{-5}	8.7×10^{-5}	1.01×10^{-4}	1.01×10^{-4}	**

*24-hour concentration and standard.
**In the absence of a Florida No-Threat Level and EPA-verified reference concentrations, a threshold value of 5×10^{-4} (a proposed criteria for human health protection) was used (FWS, 1987).

Source: ECT, 1993.

Table 4.12.2-11. Maximum Modeled Noncarcinogenic Air Toxic Concentrations as Compared to Florida No-Threat Levels

Chemical	Maximum Concentration ($\mu g/m^3$)					Maximum Concentration of the '82-86 Period ($\mu g/m^3$)	Florida No-Threat Level ($\mu g/m^3$)
	1982	1983	1984	1985	1986		
Antimony (Sb)	6.4×10^{-5}	5.6×10^{-5}	6.6×10^{-5}	6.2×10^{-5}	7.1×10^{-5}	7.1×10^{-5}	3.0×10^{-1}
Chromium* (Cr) Total	0.0217	0.0287	0.0289	0.0282	0.0346	3.46×10^{-2}	1.2
Manganese (Mn)	9.92×10^{-4}	8.84×10^{-4}	1.02×10^{-3}	9.77×10^{-4}	1.12×10^{-3}	9.92×10^{-4}	4.0×10^{-1}
Mercury* (Hg)	3.4×10^{-3}	3.8×10^{-3}	4.8×10^{-3}	4.5×10^{-3}	3.5×10^{-3}	4.8×10^{-3}	2.4×10^{-2}
Vanadium (V)	1.6×10^{-5}	1.4×10^{-5}	1.6×10^{-5}	1.6×10^{-5}	1.80×10^{-5}	1.8×10^{-5}	2.0×10^{1}
Ammonia (NH_3)	0.632	0.615	0.652	0.569	0.692	6.92×10^{-1}	1.0×10^{2}
Hydrogen sulfide (H_2S)	0.488	0.479	0.506	0.443	0.554	5.54×10^{-1}	9.0×10^{-1}
Sulfuric acid (H_2SO_4) mist*	1.33	1.41	1.64	1.62	1.14	1.64	2.4
Cobalt* (Co)	2.05×10^{-3}	2.79×10^{-3}	2.69×10^{-3}	2.46×10^{-3}	3.37×10^{-3}	3.37×10^{-3}	1.2×10^{-1}
Selenium* (Se)	1.24×10^{-3}	1.70×10^{-3}	1.61×10^{-3}	1.53×10^{-3}	2.05×10^{-3}	2.05×10^{-3}	4.8×10^{-1}
Fluoride* (F)	7.84×10^{-3}	1.01×10^{-2}	1.00×10^{-2}	9.10×10^{-3}	1.20×10^{-2}	1.2×10^{-2}	6
Hydrofluoric Acid*†	7.84×10^{-3}	1.01×10^{-2}	1.00×10^{-2}	9.10×10^{-3}	1.20×10^{-2}	1.2×10^{-2}	6.24
Naphthalene*	5.39×10^{-3}	7.31×10^{-3}	7.14×10^{-3}	6.54×10^{-3}	8.81×10^{-3}	8.81×10^{-3}	1.248×10^{2}

* 24-hour concentration and standard.
† Assume all fluorides converted to hydrofluoric acid.

Source: ECT, 1993.

Currently, there is no Florida No-Threat Level or EPA-verified referenced concentration for benzo(a)pyrene. Consequently, a threshold value of 5×10^{-4} $\mu g/m^3$ (a proposed criteria for human health protection) was used (FWS, 1987a).

None of the air toxic emissions are predicted to exceed the threshold values. With the exception of chromium VI, nickel, H_2S, and H_2SO_4 mist, the predicted maximum air toxic emission concentrations are at least one order of magnitude less than the Florida No-Threat Levels. It should be noted that public health effects are unlikely to occur even if an air toxic emission concentration approaches the No-Threat Level, as in the case of nickel, because an ample margin of safety was incorporated in developing the No-Threat Level.

All the air toxic emission concentrations were evaluated at the maximum possible levels using conservative emission factors and under extremely unlikely operating scenarios. Actual concentrations are expected to be significantly lower on the average. Therefore, it is unlikely that any chronic effects to human health would occur as a result of any air toxic emissions from the proposed Polk Power Station.

Step 5

EPA characterizes carcinogenic processes as nonthreshold processes. EPA assumes that a small number of molecular events can evoke changes in a single cell, which can lead to uncontrolled cellular proliferation. The mechanism for carcinogenesis is referred to as "nonthreshold," since there is theoretically no level of exposure that could not potentially cause a carcinogenic response (IRIS Background Document 1A). Thus, estimating the cancer risk due to exposure to carcinogenic air toxics has been considered the appropriate method for assessing carcinogenicity.

Because some of the air toxic emissions under review are classified as either human carcinogens or probable human carcinogens (i.e., having an EPA carcinogenic weight of evidence classification of A or B, respectively), an evaluation of the individual cancer risk due to the direct inhalation of all potential carcinogenic emissions from the proposed facility was deemed necessary.

Lead was not evaluated in this analysis. Data concerning the carcinogenicity of lead in humans is inconclusive. Since lead shows carcinogenic effects in rats and mice, EPA has classified lead as a probable human carcinogen (Class B Carcinogen). Age, health, nutritional state, body burden, and exposure duration probably influence the effects of lead on the body. Due to the uncertainties in quantifying how these parameters affect lead uptake, EPA has recommended that a numerical estimate of cancer risk not be used.

The estimated upper-bound excess lifetime risk per unit of exposure of a specific chemical (risk/[$\mu g/m^3$]) is commonly referred to as a unit risk factor (URF). The URFs used in the inhalation cancer human health analysis were collected from the IRIS, which is an EPA database containing up-to-date health risk and EPA regulatory information for numerous chemicals. Information in IRIS supersedes all other sources. However, if inhalation data were not available in IRIS, then data from the Health Effects Assessment Summary Tables (HEAST) were used. HEAST summarizes interim (and some verified) toxicity information for specific chemicals.

To determine the concentration of chemicals in air at certain levels of lifetime risk, the EPA calculates the ratio of the level of risk to the unit risk for air (IRIS Background Document 2). For example, if a chemical has a URF of 4.3×10^{-3} $\mu g/m^3$, then the concentration of that chemical in air that corresponds to an increased cancer risk of one in a million is:

$$\frac{1.0 \times 10^{-6}}{4.3 \times 10^{-3} \text{ per } \mu g/m^3} = 2.33 \times 10^{-4} \ \mu g/m^3$$

This implies that if one million people breathe this chemical in a concentration of 2.33×10^{-4} $\mu g/m^3$ for an entire lifetime (where 70 years is considered the average lifetime expectancy), then no more than one of the million persons will likely develop cancer as a result of exposure to that pollutant.

Conversely, the estimated individual cancer risk due to exposure of a specific concentration of an air toxic emission can be calculated as follows:

$$\text{Individual Cancer Risk due to chemical } i = C_i \times URF_i$$

where: C_i = maximum annual average concentration for chemical i ($\mu g/m^3$)

URF_i = URF for chemical i $(\mu g/m^3)^{-1}$

The MIR for a person exposed to multiple air toxic emissions is calculated as follows:

$$MIR = \sum_{i=1}^{n} (C_i \times URF_i)$$

where: C_i = maximum annual average concentration for chemical i ($\mu g/m^3$)

URF_i = URF for chemical i $(\mu g/m^3)^{-1}$

n = total number of chemicals

Table 4.12.2-12 shows the results of the cancer human health analysis for direct inhalation of air emissions from proposed project. The total risk (1.789×10^{-6}) shown in Table 4.12.2-12 is for a person exposed to the maximum levels of carcinogenic air toxic emissions from the proposed facility for an entire lifetime. This number can be interpreted to mean 1.789 (or 2) people in every million would be at a risk to develop cancer because of lifetime exposure to emissions from the proposed Polk Power Station.

Table 4.12.2-12. Assessment of Individual Carcinogenic Risk

Chemical	Maximum Annual Concentration ($\mu g/m^3$)	Weight of Evidence	Unit Risk Factor (risk/[$\mu g/m^3$])	Source of Unit Risk Factor	Individual Cancer Risk
Arsenic (As)	6.2×10^{-5}	A	4.3×10^{-3}	1	2.666×10^{-7}
Beryllium (Be)	1.2×10^{-5}	B2	2.4×10^{-3}	1	2.88×10^{-8}
Cadmium (Cd)	3.9×10^{-5}	B1	3.5×10^{-3}	1	1.365×10^{-7}
Chromium VI (Cr)	1.5×10^{-5}	A	1.2×10^{-2}	1	1.87×10^{-7}
Nickel (Ni)	4.14×10^{-3}	A	2.4×10^{-4}	2	9.936×10^{-7}
Acetaldehyde	1.01×10^{-4}	B2	2.2×10^{-6}	1	2.222×10^{-10}
Benzene	4.9×10^{-5}	A	8.3×10^{-6}	1	4.067×10^{-10}
Benzo (a) Pyrene	1.01×10^{-4}	B2	1.7×10^{-3}	2	1.717×10^{-7}
Formaldehyde	8.25×10^{-4}	B1	1.3×10^{-5}	1	1.073×10^{-8}
Uranium 238	$<1.0 \times 10^{-6}$	A	2.4×10^{-8}	2	$<2.4 \times 10^{-14}$
				Total Risk	1.789×10^{-6}

Weight of evidence defined as follows:
- A = Human carcinogen
- B1 = Probable human carcinogen (indicates limited human evidence)
- B2 = Probable human carcinogen (indicates sufficient evidence in animals and inadequate or no evidence in humans)

Sources:
[1] Integrated Risk Information System (IRIS).
[2] EPA'S Health Effects Assessment Summary (EPA, 1991c).

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Several factors need to be considered in interpreting what this data actually means to the public. First, the air toxic emission concentrations used in the comparison were the maximum possible rather than those typically expected. Therefore, the human health analysis was extremely conservative in assuming that an individual would be exposed to the maximum concentrations of any one chemical for an entire lifetime. Furthermore, the assessment assumes exposure to the maximum concentration levels of all the carcinogens over an entire lifetime (where 70 years is considered the average lifetime expectancy). These extremely conservative exposure assumptions are likely to significantly overstate the actual risks involved.

To provide a perspective on the relative significance of this risk level, consider that 1,034 persons died from cancer in Polk County in 1991 (HRS, 1991). The 1992 Florida Statistical Abstract cites the population estimate for Polk County as 414,700 persons in 1991. This translates to approximately 3 persons out of every thousand in Polk County (or 3×10^{-3}) died of cancer in 1991. In comparison, the maximum theoretical excess cancer risk for individuals exposed to the proposed facility air toxic emissions from direct inhalation is 2 persons out of every million (or 2×10^{-6}).

Another way of assessing the inhalation cancer risk is to determine the total population risk (TPR), an estimate of the annual incidence of excess cancers for the entire affected population. The theoretical TPR can be estimated using the following equation:

$$TPR = \sum_{i,j} (C_{i,j} \times P_j \times URF_i) \div 70$$

where:
C_{ij} = maximum annual average concentration of chemical i in area j
P_j = number of persons living in area j
URFi = unit risk factor of chemical i
70 = factor to adjust risks from lifetime to annual risks.

A population estimate of 9,800 persons was used to calculate the TPR. This number was arrived at by assuming the entire 1990 population residing in Ft. Meade, Mulberry, and Bowling Green, the nearest incorporated areas for which population data were available. This is an extremely conservative estimate, because currently there are only approximately 129 residences within a 5-mile radius of the proposed site. Assuming 2.52 persons per residence (Shermyen *et al.*, 1992), the current population in the area is 325 persons. This translates to a 3,000-percent increase in population accounted for in the TPR calculation. Polk County's population is anticipated to increase from 1990 population estimates by only 33.2 percent by the year 2010 (Table 3.7.1-1), that is to say, a 33-percent increase over 20 years. Also, the population in the census tract containing the Polk Power Station actually lost approximately 17.1 percent of the population between 1980 and 1990. Total population in 1990 was 1,638 compared to a population of 1,975 in 1980.

The results of the TPR assessment (TPR=2.5×10^{-4}) indicate that the direct inhalation of maximum ambient pollutant concentrations resulting from Polk Power Station emissions would cause a plausible upper-bound of one additional case of cancer every 4,000 years, which is not considered a significant adverse effect to human health for the area population.

In summary, direct inhalation of air emissions from the operation of the proposed Polk Power Station would not cause significant adverse effects to human health for the area population.

4.12.2.2 Wastewater Discharges

Surface Water Discharges

Little Payne Creek, Payne Creek, and the Peace River are all interconnected Class III waters located to the south and east of the proposed Polk Power Station, which would receive treated wastewater and storm water discharges from the proposed site. Human exposure to the plant's wastewater constituents could potentially occur through direct contact resulting from recreational activities (such as swimming) in any of these water bodies, or through ingestion of fish or other aquatic life containing a bioaccumulation of constituents. However, the Florida surface water quality standards for Class III waters provide a set of criteria, which, if met, will allow for safe recreation and the propagation of a healthy, well-balanced population of fish and wildlife (Table 2.3.6-2 lists the Class III surface water standards). Therefore, if discharges from the Polk Power Station do not adversely affect the water quality of the receiving waters, it is reasonable to assume that no adverse human health effects are likely.

Figure 4.12.2-1 shows the water mass balance (annual average makeup) for the proposed project. In this schematic, the discharge from Outfall 001 is the only wastewater stream that might potentially affect the surface water quality in the Little Payne Creek/Payne Creek/Peace River system.

Outfall 001 (Figure 2.3.11-1) would discharge water from the cooling reservoir into the northern portion of the existing reclaimed lake. Water in the lake drains through a swale along its southern edge and exits the site, flowing into a man-made ditch running along the western side of Fort Green Road. This water is ultimately routed to Little Payne Creek.

Table 2.3.6-2 illustrates the predicted long-term quality of the cooling reservoir as reported in Volume 2 of the SCA (TEC, 1992a). As the table shows, the quality of discharges from the reservoir is predicted to meet all applicable Class III surface water standards for the parameters considered. However, several parameters for which Class III standards are established were not accounted for in the predicted water quality of the cooling water reservoir. This was presumed to be due to a lack of available data. For example, PCBs, PAHs, and phenolic compounds were not addressed, when they could potentially be present in the wastewater streams under various operating scenarios. Regardless, if the plan is approved, the actual water quality would have to meet Class III surface water standards for all applicable parameters. Therefore, the discharge from Outfall 001 should not adversely affect water quality in the receiving waters.

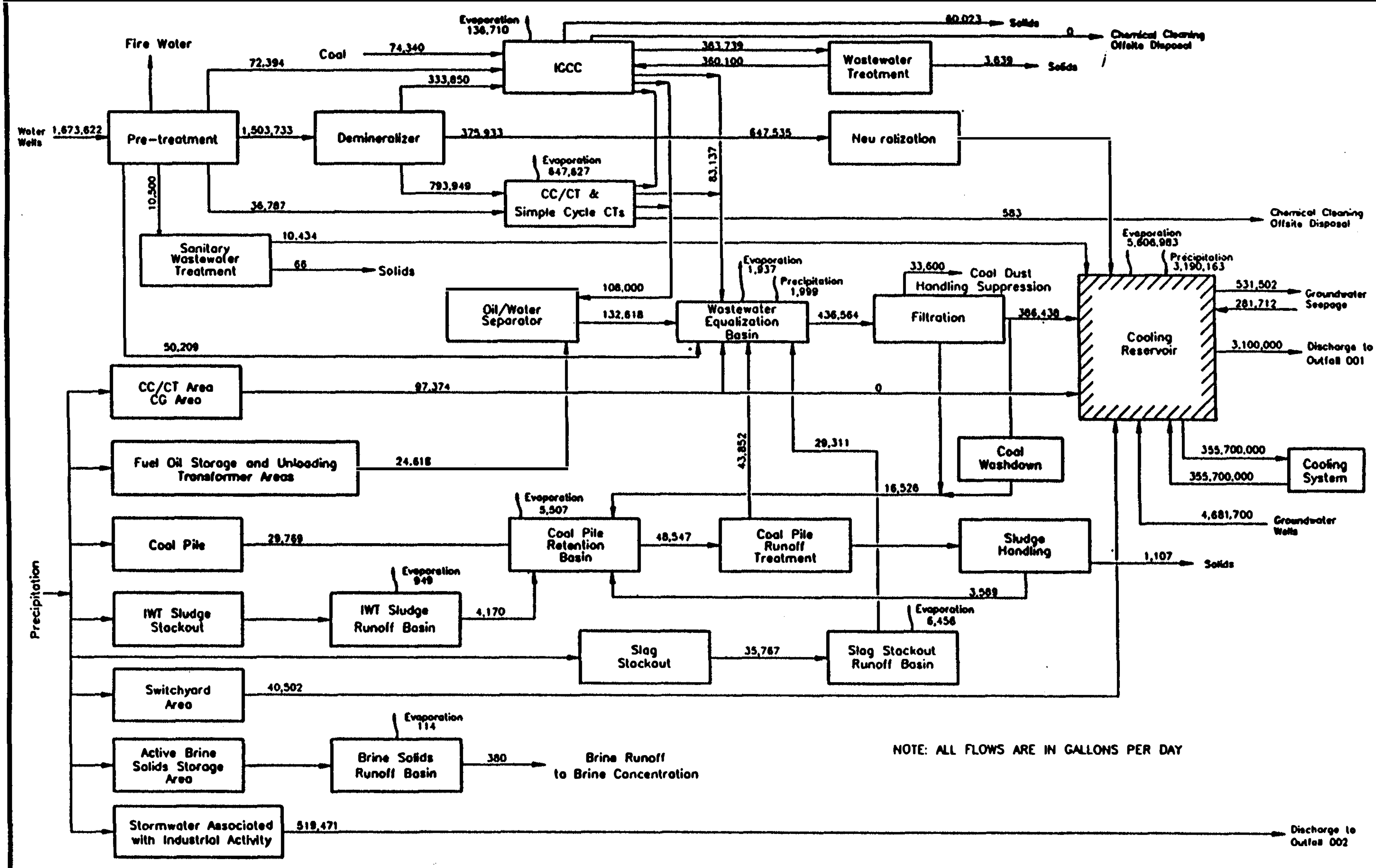

FIGURE 4.12.2-1.
Water Mass Balance, Annual Average Makeup.

SOURCES: UEC, 1992; ECT, 1992; Texaco, 1992; TEC 1992a.

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The proposed IWT system treats all potentially contaminated wastewater streams, including storm water runoff from the slag and H_2SO_4 storage areas. All other storm water runoff would be collected in the storm water detention basin. The runoff from the detention basin would be drained into a wetland area and routed north, then eastward, via swales and Outfall 002 into the old mine cut lake (see Figure 2.3.11-1). Discharge from the old mine cut would be drained southward into the reclaimed lake and, eventually, to the Little Payne Creek system. Discharges from the detention basins will not adversely affect the quality of the receiving water, since they will not contain any potentially contaminated wastewater.

Thus, assuming limited direct contact with surface water in the area of discharge, human health effects from surface water are not expected to be significant. Long-term consumption of untreated receiving water is not expected since the receiving waters are not designated Class I potable water sources, and limited incidental consumption occurs from recreation.

As previously mentioned, water quality standards for Class III waters were developed to allow for the propagation of a healthy, well-balanced population of fish and wildlife. Therefore, ingestion of fish from the Peace River, Little Payne Creek, or Payne Creek is unlikely to cause adverse human health effects.

The policy of Tampa Electric Company is not to allow public fishing in the surface waters on their property. Since the water discharged from the proposed Polk Power Station would meet Class III water quality standards under the NPDES permit, public fishing in downstream waters would not be affected by the proposed project.

Groundwater Discharges

The surficial aquifer is considered a Class G-II aquifer. As such, the water quality of the aquifer must meet Florida's drinking water standards. Violations of these standards could potentially occur as a result of:

- Accidental spills in the chemical handling and storage areas
- Contamination by leachate from the storage areas for brine and slag
- Contamination from cooling reservoir discharges

There would be no direct chemical or biocide discharges to groundwater, except for possible indirect discharges to groundwater that could occur due to accidental spills from chemical handling and storage areas. The proposed measures to prevent and manage such potential discharges are described in the facility's Preliminary SPCC Plan (see DEIS, Appendix T), Preliminary RCRA Contingency Plan (see DEIS, Appendix U), and BMP Plan and PPP (see Appendix A).

The storage areas for brine and slag would be lined with a low-permeability material to reduce the risk of leachate contamination of groundwater.

A net groundwater flow discharge from the cooling reservoir into the surficial aquifer would occur because the normal operating water level in the reservoir would be generally higher than the surficial aquifer water level. The predicted reservoir water quality is illustrated in Table 2.3.6-2, taken from the SCA (TEC, 1992a). Based on the data in the SCA Table 2.3.6-2, there would be no violations of the primary drinking water standards.

PCBs and benzo(a)pyrene, possible water contaminants, were not included in Table 2.3.6-2. Since zero concentration levels are shown for benzene, chromium VI, and silver, but not for benzo(a)pyrene, data for these chemicals were assumed to be unavailable, and they were consequently not considered in the analysis of the reservoir water quality. The primary drinking water standards for benzo(a)pyrene and PCBs are 0.0002 and 0.0005 mg/L, respectively. Per FDEP's conditions for approval of the SCA, primary drinking water parameters would be monitored in on-site wells initially and every 5 years, if the proposed project is approved.

The secondary drinking water standard for iron (0.3 mg/L) and color (15 color units) are exceeded by the predicted concentrations in the reservoir (0.627 mg/L and 50.49 color units). The goal of the secondary standards is to control contaminants that primarily affect the aesthetic qualities of drinking water (40 CFR 143.1). The predicted exceedances of the standards for iron and color would cause some aesthetic degradation, but no adverse effects to human health are expected (TEC, 1992a).

Although there are no predicted exceedances of radionuclide emissions in the cooling reservoir discharges, the results of the groundwater quality monitoring program at the proposed site indicated that radionuclide emissions exceeding primary drinking water standards were detected in the surficial aquifer at Stations GW2 and GW3 and in the intermediate aquifer at Station GW1. Radiation within the groundwater is a result of weathering of uranium-bearing phosphatic soils and rock, and can cause gross alpha activities to exceed state and federal drinking water standards. The radionuclides of general concern include Radium 226, Radon 222, and Polonium 210.

An engineering test was conducted to support the theories that: (1) elevated radionuclide emissions were related to the amounts of solids present within the groundwater samples, and (2) the aquifer would act to filter out solids, and consequently, reduce radionuclide emissions from the groundwater. A comparison of filtered and unfiltered water samples revealed lower radionuclide emissions for the filtered samples with less total solids and TSS. The data also supported the position that the undisturbed aquifer would have a filtering effect on the groundwater and should prevent significant transport of the radionuclides.

In summary, no adverse human health effects from the groundwater are anticipated due to operations at the proposed facility.

4.12.2.3 Electric and Magnetic Fields

Today, there is limited scientific understanding of the potential health risks from 60 Hertz (Hz) electromagnetic fields (EMF) exposure. Electric fields associated with transmission lines are a function of voltage carried by the conductors and the conductor height aboveground; magnetic fields are a function of the amount of current carried by the line and the height of the conductors. EMFs typically are attenuated with distance from the conductors. Therefore, EMFs vary along a transmission line right-of-way. Any device that carries electric current, such as televisions, radios, computers, and home lighting, is a source of EMFs.

There is some epidemiological evidence that suggests an association between magnetic field exposures and certain types of cancer (Padgett *et al.*, 1993); however, though the body of evidence cannot be dismissed, it is not complete enough to draw meaningful conclusions (EPA, 1992c). Currently, it is not known whether certain magnitudes of EMFs are safer or less safe than other levels. With most chemicals, it is assumed that exposure at higher levels is worse than exposures at lower levels. This may or may not be true in the case of EMFs. The basic nature of the interaction between EMFs and biological processes is still not understood, and because of this, it is considered inappropriate to make generalizations about the exposure-response relationship between EMFs and certain cancer outcomes (EPA, 1992d). Also, other health effects have not been studied as extensively as cancer effects, so it is even more uncertain if there are any noncarcinogenic health risks associated with EMFs.

In general, EMFs should be considered by Tampa Electric Company as a potential impact. Accordingly, project design (e.g., transmission line alignments) should consider EMF in a manner similar to other project impacts considered in this EIS (e.g., wetlands, noise, air quality, etc.) and comply with any relevant rules and regulations.

In response to the concern about EMFs, the State of Florida has taken action to limit EMF exposures to present levels along existing rights-of-way (i.e., exposures that may not be exceeded). A right-of-way is the area of land directly under a power line which typically extends 50-65 ft from the center of the line(s). The State of Florida developed an EMF standard for transmission lines and was the first state with both electric and magnetic field limits (Chapter 17-274 FAC). These standards require 230-kV lines to not exceed 2.0 kV/m for electric fields at the edge of the right-of-way. The electric field also cannot exceed 8.0 kV/m anywhere on the right-of-way. The magnetic fields cannot exceed 150 mG at the edge of the right-of-way. The calculated maximum EMF values for the proposed transmission lines are shown in Table 4.12.2-13. These estimates were developed using the Bonneville Power Administration Corona and Field Effects Program. As seen from this table, the proposed project would comply with Florida's standards for EMFs.

Table 4.12.2-13. Calculated Maximum EMF for the Polk Power Station 230-kV Transmission Lines

Configuration	Electric Field (kV/m)*		Magnetic Field (mG)†	
	On Right-of-Way	Edge of Right-of-Way	On Right-of-Way	Edge of Right-of-Way
Northern Corridor				
Single-pole, vertical (1)	5.59	0.24	428.15	61.28
Single-pole, vertical (2A)	5.59	0.28	439.21	65.87
Single-pole, vertical (2B)	5.59	0.26	438.85	67.27
Single-pole, vertical (3)	5.59	0.26	437.78	104.08
Eastern Corridor				
H-frame, horizontal (1)	4.42	1.36	561.85	141.00
Two single-poles, vertical (2)	4.32	0.21	355.72	129.68
Single-pole, vertical (3)	3.62	0.33	411.90	74.25

* Electric field values based on 242-kV operating voltage.
† Magnetic field values based on MCR for the line (1,880 amperes, 749 MVA).

Sources: ECT, 1992.
TEC, 1992a.

Currently, there are no EMF-related OSHA regulations that govern workers at electrical power generation facilities. However, Tampa Electric Company would comply with other OSHA guidelines for employee safety and with NESC requirements, if the project is approved.

Personnel working in areas where EMF values tend to be higher would be exposed for only short durations since substations do not require continuous manual operation. Since EMFs attenuate with distance from the conductors, other workers would receive much less exposure. Because the health issues are unresolved, the human health effects of EMFs from the proposed facility cannot be fully evaluated. However, the proposed facility's power lines would meet Florida standards.

4.12.2.4 Radiation on Phosphate Mined Land

Small amounts of radium (Ra) are contained in the mined phosphate matrix. These are principally Ra^{226}, and Ra^{228}. When the phosphate ore is processed into phosphoric acid, phosphogypsum, a solid waste by-product, becomes enriched with these radioactive substances and can represent a human health hazard when disposal is uncontrolled. Federal standards for disposal are outlined in 40 CFR, Vol. 57 No. 107 (National Emission Standards for Hazardous Air Pollutants), published in June 1992. The threshold radiation limit for phosphogypsum is set at 10 picocuries/gram. Phosphogypsum has been used at some locations for filling mine cuts.

According to G. Michael Lloyd, Research Director of the Florida Institute for Phosphate Research (FIPR), the mined land in the area of Polk County where the proposed Polk Power Station would be constructed does not contain waste phosphogypsum (Lloyd, 1994). The PLK-A site was investigated by Tampa Electric Company and found to contain no phosphogypsum. No phosphate ore was processed on the PLK-A site, and the site was not used for disposal of phosphogypsum from any off-site processing facility (TEC, 1994). Therefore, the human health risks from radiation due to phosphogypsum are considered negligible.

4.12.2.5 Effect on Wildlife from Metals Deposition

Air emissions from the proposed Polk Power Station would affect a 10-km area surrounding the proposed site. The deposition of toxic materials in quantities that could affect resident wildlife can be evaluated as a part of the overall effect. Maximum deposition rates were assessed using the ISC2 dispersion model. The model utilizes steady state, Gaussian plume theory, and can estimate dry deposition rates of particulate emissions from a variety of sources. The modeling was performed using emission factors corresponding to the maximum possible annualized emission rate for the facility at full build-out. Receptor locations were defined by a polar grid centered on the IGCC HRSG stack and extending out 10 km in 10° radial increments, with the 360° (or 0°) radial line being the north axis. Meteorological data for the period 1982 through 1986 were used. As discussed in Section 4.1.1.2, this detailed air quality modeling analysis did not change from the DEIS analysis since relevant project design changes were minor and would not significantly affect the detailed dispersion modeling. The constituents of concern and the annual rate of metal deposition are presented in Table 4.12.2-14.

Table 4.12.2-14. Maximum Annual Deposition of Metals from the Polk Power Station (g/m^2)

Pollutant	1982	1983	1984	1985	1986	Mean
Arsenic (As)	8.72×10^{-4} 400 m; 150°	1.28×10^{-3} 400 m; 150°	1.19×10^{-3} 400 m; 150°	1.10×10^{-3} 400 m; 150°	9.01×10^{-4} 400 m; 150°	1.07×10^{-4}
Beryllium (Be)	1.3×10^{-5} 400 m; 150°	1.8×10^{-5} 400 m; 150°	1.7×10^{-5} 400 m; 150°	1.6×10^{-5} 400 m; 150°	1.3×10^{-5} 400 m; 150°	1.54×10^{-5}
Cadmium (Cd)	5.0×10^{-5} 400 m; 150°	7.4×10^{-5} 400 m; 150°	6.9×10^{-5} 400 m; 150°	6.3×10^{-5} 400 m; 150°	5.2×10^{-5} 400 m; 150°	6.16×10^{-5}
Chromium (Cr) (total)	1.16×10^{-3} 300 m; 20°	1.07×10^{-3} 300 m; 20°	1.02×10^{-3} 300 m; 20°	1.17×10^{-3} 300 m; 20°	1.05×10^{-3} 300 m; 20°	1.09×10^{-3}
Lead (Pb)	2.50×10^{-4} 400 m; 150°	3.68×10^{-4} 400 m; 150°	3.43×10^{-4} 400 m; 150°	3.15×10^{-4} 400 m; 150°	2.59×10^{-4} 400 m; 150°	3.07×10^{-4}
Mercury (Hg)	1.87×10^{-4} 400 m; 150°	2.75×10^{-4} 400 m; 150°	2.58×10^{-4} 400 m; 150°	2.36×10^{-4} 400 m; 150°	1.94×10^{-4} 400 m; 150°	2.30×10^{-4}
Nickel (Ni)	5.57×10^{-3} 400 m; 150°	8.18×10^{-3} 400 m; 150°	7.62×10^{-3} 400 m; 150°	7.01×10^{-3} 400 m; 150°	5.76×10^{-3} 400 m; 150°	6.83×10^{-3}

Note: Location of the maximum by distance in meters and direction in degrees is presented below each deposition value. Deposition values and locations were developed using the ISC2 dispersion model.

Source: ECT, 1993.

These metal components of the emission spectrum are either in particulate form or sorbed to particulates. As Table 4.12.2-14 shows, the average maximum annual amount of deposition ranges from 0.0000154 g/m^2 for beryllium to 0.00683 g/m^2 for nickel. These rates represent average maximum annual deposition for 5 years of meteorological data. Furthermore, the deposition is the maximum extending out 400 meters from the point source at an azimuth of 150°, except for chromium (20°). These deposition rates are conservative estimates based on all sources simultaneously emitting the maximum possible emissions. The actual depositions would be considerably lower, as typical emission rates would be much less than the predicted maximums.

Tampa Electric Company generated land-use cover maps (FLUCCS) and data from the Florida Natural Areas Inventory (FNAI 1990a; Meyers & Ewel, 1990) were used to determine resident species likely to be affected by air emissions. Lists of vertebrates occurring on the site as reported by Tampa Electric Company (TEC, 1992a) were also consulted.

Land-use and cover maps show 17 types of land use and cover within the affected area. Classifications of 300, 400, 500 and 600 were those considered representative of natural or relatively undisturbed areas. These were 323-Shrub and Brushland, 411-Pine Flatwoods, 431-Mixed Oak/Pine Forest, 621-Freshwater Swamp, and 641-Freshwater Marsh. The categories of 510-Streams and Waterways and 520-Lakes were also included.

Health effects and ambient water quality criteria documents prepared by the FWS and EPA were used to assess wildlife receptors.

Effects on wildlife from the deposition of particulates would result from browsing by plant consumers or from ingestion of tissue by predators. For the purposes of this discussion, direct inhalation or ingestion of soil will be considered minor intake routes.

Wildlife receptors in the shrub and brushland environment (FLUCCS 323) include a number of amphibians, reptiles, birds, and mammals. In this assemblage, Meyers and Ewel (1990) show the scrub jay, sand skink, and mole skink as federally listed species. These have been confirmed to be present in Polk County (FNAI, 1990b) and potentially could occur in the impact area. Other species of vertebrates in this association are gopher tortoise, raccoon, white tailed deer, bobcat, gray fox, and spotted skunk.

Pine flatwoods (FLUCCS 411) have many wildlife species in common with the xeric shrub and brushland environment. These include white tailed deer, bobcat, and raccoon. Pine flatwoods are a common vegetative association in Florida and supports a large group of wildlife species. A small isolated parcel is located in the southeast corner of the site. Small fragmented areas are also located west of the site proposed for the power block.

Mixed Oak/Pine Forest (FLUCCS 431) is part of the upland hardwood forest category. Synonyms for this association are mesic hammock, climax hardwoods, and southern mixed hardwoods. This environment contains many species of animals, including pileated woodpecker, barred owl, gray fox, and white tailed deer. Small rodents, such as the gray squirrel, cotton mouse, and wood rat, also use this habitat. This mixed forest association is located primarily in the western and northwestern part of the site. Small areas are north and south of the site. Small parcels also occur along the eastern edge of the area.

The Freshwater Swamp association (FLUCCS 621) is a forested wetland vegetated with hydrophytic hardwood trees and shrubs. Dominant species within the swamp canopy include blackgum, willow, primrose willow, red maple, loblolly bay, sweet bay magnolia, and swamp red bay. A mixed terrestrial/aquatic fauna exists in this habitat. Typical species are scarlet kingsnake, ring-neck snake, cottonmouth, great horned owl, barred owl, pileated woodpecker, raccoon, otter, bobcat, and white-tailed deer. Various amphibians are associated with this environment. This type of wetland is located in isolated areas mainly in the west and southwest quadrant of the site. A rather large strand is found three to four miles south of the plant site.

Freshwater marsh (FLUCCS 641) is a wetland type dominated by herbaceous vegetation; these are usually hydrologically isolated wetlands. This type of wetland is a common feature within larger upland ecosystems (FNAI, 1990a). This kind of habitat is considered important in breeding and foraging for various species of salamanders and frogs. Because these wetlands are populated with small invertebrates they are important foraging habitat for aquatic birds. There are a few isolated marsh systems north of the plant site, but principally the majority occur west and southwest.

The FLUCCS 500 category includes surface waters that provide habitat for a variety of forage and sport fishes. Lakes, reclaimed mine cuts, and streams beyond the border of the site would be used for recreational fishing (assuming public access). Both within and beyond the plant boundary, surface waters would be utilized by aquatic birds and small mammals that forage freshwater habitat. These are located throughout the site especially in mined sections.

As referenced above, some information on wildlife health effects has been published by FWS and EPA, and these documents were be used for predictive effects.

Arsenic has a cosmopolitan distribution and is found at low levels in plants and animals. Concentrations in air from remote areas are reported as less than 0.02 $\mu g/m^3$. In urban areas the level ranges to a maximum of 0.16 $\mu g/m^3$. In lake water for Florida the maximum concentration has been reported as 3.6 $\mu g/L$. In the United States uncontaminated soils have an arsenic level of 7.4 milligrams per kilogram (mg/kg) dry weight (Eisler, 1988a).

Background concentration in uncontaminated terrestrial flora and fauna, and freshwater biota is usually less than 1 mg/kg fresh weight. Data on arsenic effects to soil biota and insects are limited. Generally, soil microorganisms are capable of tolerating and metabolizing relatively high concentrations of arsenic. Tolerant soil microbiota can withstand concentrations up to 1,600 mg/kg, but growth and metabolism are reduced in sensitive species at levels of 375 mg/kg.

Mammals are exposed to arsenic primarily through ingestion of contaminated food or water. Some feed additives containing arsenic acid derivatives are fed to livestock to promote growth and retard disease. Some commercial pet foods contain up to 2.3 mg/kg of arsenic on a dry weight basis (Eisler, 1988a).

For aquatic organisms, inorganic arsenic (III) and (V) are the most toxic forms. For arsenic (III) EPA (1985a) reported acute values for 16 freshwater species ranging from 812 μg/L for a cladoceran to 97,000 μg/L for a midge. The national criteria for the protection of aquatic life is 190 μg/L, a not-to-exceed level of no more than once on a four-day average every 3 years. The one-hour average concentration is not to exceed 360 μg/L no more than once every 3 years on an average.

Arsenic does bioconcentrate, although somewhat poorly, and there is no evidence of biomagnification in food chains (Eisler, 1987).

The maximum deposition of arsenic in the impact area is estimated to be 0.000107 $g/m^2/yr$ (0.107 milligrams per square meter [mg/m^2]) on an average annual basis (see Table 4.12.2-14). The amount of arsenic deposited in the soil would be transformed into a number of metabolites by microorganisms. Some would be methylated, and so evasion from the soil environment is probable. Resident wildlife is not expected to be at risk from this amount of release. Aquatic environments could experience a higher loading based on the amount of arsenic from storm water runoff. Soil adsorption characteristics and other factors that influence the mobility of arsenic remain unknown and make predictions on movement uncertain.

The maximum deposition of beryllium will amount to 0.0000154 g/m^2 (0.015 mg/m^2) on an annual average basis. Aquatic toxicity studies indicate that beryllium for acute and chronic levels can be as low as 130 μg/L and 5.3 μg/L, respectively. Increased hardness lessens the effect of the metal in acute toxicity studies (EPA, 1986b). In mammalian systems the principal exposure route is through inhalation and ingestion. Toxicity comes almost entirely through retention of particulates in the lungs. Ingestion into the gastrointestinal tract results in no appreciable absorption (less than one percent). In the United States levels of beryllium in soil reported as the geometric mean are 0.6 micrograms per gram (μg/g). In water the concentration ranges from 0.01 μg/L to 1.0 μg/L (EPA, 1986c). Based on the toxic pathway in mammals from this metal there would be little if any significant effect on wildlife. The level of beryllium in water due to storm water runoff is expected not to have a toxic effect on aquatic life due to the elevated levels of hardness and soil binding characteristics.

Cadmium is estimated at a maximum annual average deposition rate of 0.0000616 g/m^2 (0.0616 mg/m^2) over the impact area. Availability of cadmium to biota depends in large part on adsorption and desorption processes and many other modifiers (Eisler, 1985). Cadmium is a naturally occurring element and has been detected in more than 1,000 species of aquatic and terrestrial biota. Based on mg/kg the following examples show the range of values in selected animals: fish, 0.07; starling, less than 0.05 to 0.24; white-tailed deer, 0.7 to 11.7 (kidney), 0.0 to 0.7 (liver), 0.0 to 0.3 (muscle); gray squirrel, 2.0 to 4.6 (kidney); eastern cottontail, 2.1 (liver), 13.5 (kidney), 0.5 (muscle) (Eisler, 1985).

Susceptibility to cadmium varies among species. Birds, for example, are comparatively resistant. Marine and terrestrial animals, including ducks, were abundant around a marine outfall containing relatively high levels of cadmium, and therefore, are probably highly resistant. These animals, however, had elevated body burdens of cadmium and high levels of metallothionins. Metallothionins bind cadmium and provide protection from the deleterious effects of the metal. Amounts of metallothionins in an organism depend on the level of body burden, species and position in the food web. Ducks contained the highest level of metallothionins (Eisler, 1985).

Mammals are also comparatively resistant to cadmium. Tests on rats and guinea pigs showed lethal oral doses to be 250 mg/kg and 150 mg/kg, respectively. Risks to wildlife from cadmium are probably low within the impact area. Feeding studies with mallard ducks with diets containing 200 mg/kg of cadmium produced no obvious effects after 13 weeks. However, kidney levels were 134 mg/kg, an amount near the critical threshold of 200 mg/kg for the human kidney. As a guideline wildlife dietary levels exceeding 100 micrograms per kilogram (μg/kg) diet on a fresh weight basis should be viewed with caution. Furthermore, cadmium residues in vertebrate kidney or liver that exceed 10 mg/kg fresh weight or 2 mg/kg whole body fresh weight should be considered evidence of cadmium contamination. Cadmium levels in tissue of higher trophic level animals, especially predators, of 13 to 15 mg/kg fresh weight represent a significant hazard to these animals (Eisler, 1985). The national criterion for the protection of aquatic organisms is based on the hardness of the receiving water. For freshwaters with hardnesses of 50, 100, and 200 mg/L, the criterion on a not-to-exceed four-day average is 0.66, 1.1, and 2.0 μg/L, respectively. A one-hour average for these same concentrations is 1.8, 3.9, and 8.6 μg/L, respectively. The frequency of both the four-day and one-hour criteria is not to exceed more than once every 3 years (EPA, 1985b). Based on this information, it is not expected that deposition of 0.0616 mg/m^2 cadmium would have a significant effect on wildlife in the area. Cadmium concentration in the cooling reservoir is predicted to be 0.17 μg/L. The Class III standard for the State of Florida is less than 1.17 μg/L.

Total chromium is expected to be deposited at a maximum annual average rate of 0.00109 g/m^2 (1.09 mg/m^2). According to Hawley's Condensed Chemical Dictionary (Sax & Lewis, 1987), chromium has three oxidation states (II, III, VI). Those with the most environmental significance are oxidation state III and VI. The metal can access terrestrial vertebrate systems by absorption through skin, inhalation, or by ingestion. Absorption is less than 5 percent via the gastrointestinal tract. Chromium in excessive amounts accumulates in the lung, liver, spleen, kidney, and bone marrow. Excretion is primarily through urine. The current Florida No-Threat Level for total chromium is 1.2 $\mu g/m^3$. The Florida No-Threat Level for chromium VI is 8.3 x 10^{-5} $\mu g/m^3$ (Table 4.12.2-11). Chromium content in Florida soils have been reported to range between less than 1 mg/kg to 1,000 mg/kg (Eisler, 1986).

In the aquatic environment, chromium III is more toxic at lower hardness and alkalinity. While chromium VI is considered to have an increased toxicity at low hardness and low pH values, EPA considered the data base insufficient to develop the national criteria on the basis of water quality. Therefore, the water quality criteria for chromium VI is not dependent on water hardness (EPA 1985c). The national four-day average criteria for chromium III for the protection of aquatic organisms at hardness levels of 50, 100, and 200 mg/L is 120, 210, and 370 $\mu g/L$, respectively. The national four-day average criteria for chromium VI is 11 $\mu g/L$. The one-hour average criterion for chromium III at hardness levels of 50, 100, and 200 mg/L are 980, 1,700, and 3,100 $\mu g/L$, respectively. For the more toxic chromium VI species, the one-hour average is a not to exceed level of 16 $\mu g/L$. The frequency of both the four-day and one-hour not-to-exceed values is not more than once every 3 years on the average (EPA, 1985c). Deposition of chromium in the impact area of 1.09 milligrams per square meter per year ($mg/m^2/yr$) or less is not expected to adversely affect wildlife.

The maximum annual average deposition of lead into the impact area is estimated to be 0.000307 g/m^2 (0.307 mg/m^2). The effect on wildlife species would be principally through ingestion of lead in or on vegetation, or the consumption of contaminated organisms. Lead is a metal that is ubiquitous and during the last half-century has become widespread throughout the environment due to anthropogenic activity (Eisler, 1988b). Major effects on waterfowl have been through ingestion of lead shot. Lead is not essential for growth of any biological species. The ban on the use of lead shot and leaded gasoline for motor vehicles has reduced the risk to wildlife in the United States. On a global basis, the average concentration in various reservoirs is estimated to be 16,000 $\mu g/kg$ in soils, 47,000 $\mu g/kg$ in sediments, 2 $\mu g/kg$ in lakes and rivers, 20 $\mu g/kg$ in groundwater, 100 $\mu g/kg$ in terrestrial biota, and 2,500 $\mu g/kg$ in freshwater biota. Lead levels in air range from 0.1 $\mu g/m^3$ for non-urban areas to 2.5 $\mu g/m^3$ for urban environments. Atmospheric deposition in the Pine Barrens of New Jersey is reported to be 14 mg/m^2. Soils in the United States range from 10 to 700 mg/kg dry weight with an average of 20 mg/kg. The average in rivers and streams nationwide is 5 and 23 $\mu g/L$. In Florida the average in sediments is 3 mg/kg dry weight. In soils lead concentrates in the organically enriched horizons. Bioavailability of lead to plants depends on reduced soil pH, reduced organic matter, inorganic colloids, reduced iron oxide and phosphorus content. Lead translocates through roots and by absorption of lead adhering to foliage. Lead levels are always higher in older plant parts than in shoots or flowers. Browsing contaminated vegetation or the consumption of contaminated animals is the principal risk for wildlife (Eisler, 1988).

Mammals fed lead-containing diets showed toxic effects at the following dietary levels: dogs, 0.32 mg/kg; goat, total dose 20 to 25 g; horse, total dose 500 to 700 g; swine, total dose 10 to 25 g. Eisler (1988b) suggests the following criteria for domestic animal forage and drinking water: cattle, less than 200 mg/kg (fresh weight); horse, less than 80 mg/kg (fresh weight); and drinking water, less than 100 μg/L. For unstressed animals the levels in blood, liver, and kidney should be less than 0.2, 1.1, and 1.2 mg/kg fresh weight, respectively.

Within the site the background levels of lead are unknown, but expected to be low based on the absence of significant sources. A 0.307 mg/m^2 annual loading should be below threshold levels for grazing animals. Furthermore, the site should represent no significant hazards for migratory birds. Organisms probably most affected would be invertebrates, such as earthworms, which could bioconcentrate lead from upper soil and litter zones.

In freshwater decreased hardness elevates the toxicity of lead. The national criterion is based on hardness of the receiving water. For hardness levels of 50, 100, and 200 mg/L the four-day average concentrations for lead are 1.3, 3.2, and 7.7 μg/L, respectively. The one-hour average concentrations at equivalent hardness values are 34, 82, and 200 μg/L. These criteria are not to be exceeded more than once every three years on the average (EPA, 1986b). Receiving waters based on predicted water quality of the cooling reservoir would not exceed Class III standards for the State of Florida.

Mercury is estimated to deposit at a maximum annual average of 0.00023 g/m^2 (0.23 mg/m^2) within the impact area. The element has no known biological function and the presence in organisms represents contamination from natural or anthropogenic sources. Eisler (1987), commenting on ecotoxicity, presents a summary that states: (1) forms of mercury with relatively low toxicity can be transformed into highly toxic methylmercury via biological mediation; (2) methylmercury can be bioconcentrated and biomagnified through food chains, returning mercury directly to man and other upper trophic level consumers; (3) mercury is a mutagen, teratogen, and carcinogen (note: IRIS reports relevance of animal carcinogenicity data for inorganic mercury as uncertain) and causes embryocidal, cytochemical, and histopathological effects; (4) high body burdens encountered in some species of fish and wildlife from remote locations emphasize the complexity of natural mercury cycles and human impact on these cycles; and (5) the anthropogenic use of mercury should be curtailed because the difference between tolerable natural background levels of mercury and harmful effects in the environment is exceptionally small.

Adverse effects of mercury compounds to mammals have been recorded at administered doses of 0.25 mg/kg, daily dietary levels of 111 mg/kg, and blood mercury levels of 1.2 mg/kg. Terrestrial ungulates and various species of rabbits usually contain less than 1.0 mg/kg fresh weight in liver and kidneys, while fish-eating carnivores frequently contain more than 30 mg/kg. Among sensitive avian species, adverse effects principally on reproduction have been reported at levels of 5,000 μg/kg in feathers, 900 μg/kg in egg, 50 to 100 μg/kg in diet, and daily administered doses of 640 μg/kg, fresh weight (Eisler, 1987).

In aquatic environments, the national criterion for mercury II is a not to exceed four-day average of 0.012 μg/L and a one-hour level of 2.4 μg/L. These events must not exceed a frequency once every 3 years on an average. If the four-day average exceeds the 0.012 μg/L level more than the prescribed frequency of 3 years, the edible portion of the consumed species should be analyzed to determine whether or not the concentration of methylmercury exceeds the EPA screening level. In fish, this value is 0.6 ppm (EPA, 1993d). Since mercury represents the most risk to wildlife, an assessment was made for the southern bald eagle in Section 4.12.2.5.

Nickel released in air emissions would be deposited at a maximum annual average rate of 0.00683 g/m^2 (6.83 mg/m^2). The toxicity to man and animals from this metal is a function of the chemical form and route of exposure. For oral intake metallic nickel is relatively nontoxic. Exposure to nickel by inhalation or cutaneous contact has more toxicological significance. Based on animal studies, nickel appears to have a half-life of a few days with little evidence of bioaccumulation. The principal excretory route is through urine, and the secondary route is hair. The atmosphere is a major cycling mechanism for nickel. Loading originates both with natural and anthropogenic sources. Wet and dry precipitations deposit nickel in soils and surface waters. In soils, nickel can be taken up by plants. Movement of nickel in soil depends on factors such as pH, soil type, and chemical exchange capacity. Soils normally contain nickel in the range of 5 to 500 ppm.

The following average serum nickel levels have been found in healthy adult animals: domestic horse, 2.0 μg/L; Jersey cattle, 2.6 μg/L; beagle dog, 2.7 μg/L; domestic cat, 3.7 μg/L; Yorkshire pig, 5.3 μg/L, Maine lobster, 12.4 μg/L (EPA, 1983). Effects of nickel on animals have been documented mainly for the purpose of understanding toxic pathways in man. Risk to terrestrial wildlife from nickel would principally occur through inhalation. Studies on the pulmonary effects from nickel carbonyl in laboratory animals via inhalation show action levels at 1.4 mg/L (50-minute exposure) for the rabbit. A 30-minute for the rat at concentrations ranging from 0.24 to 1 mg/L produced pulmonary congestion or capillary congestion. Edema and intraalveolar hemorrhage were also noted in both species (EPA, 1983). Average levels of nickel from the proposed Polk Power facility are estimated at 0.00369 $\mu g/m^3$. At this concentration, no significant effect is anticipated.

In the aquatic environment, nickel toxicity is affected by the hardness level. Therefore, the national criterion for freshwater is based on the hardness concentration. For hardness values of 50, 100, and 200 mg/L, the concentration of nickel for the 24-hour average should not exceed 56, 96, and 160 μg/L, respectively, and concentrations should not exceed 1,100, 1,800, and 3,100 μg/L at any time (EPA, 1986b). The Class III water quality standard for Florida would not be exceeded in the surface waters in the immediate vicinity of the plant and therefore, no risk to aquatic organisms is anticipated.

4.12.2.6 Assessment of Risk to Foraging Birds

Operation of the proposed power station facility would result in an array of organic and inorganic constituents discharged to the cooling reservoir and then to the reclaimed lake. In addition, particulates from air emissions would affect a 10-km area, including surface waters, in the immediate vicinity of the plant.

Following construction of the proposed cooling reservoir, this aquatic environment would gradually be populated by a succession of organisms that adapt to ambient conditions. This would include aquatic plants, macroinvertebrates, and a vertebrate community consisting of reptiles, amphibians, and fish. The top of the food chain would be aquatic birds and small mammals. Foraging birds are predicted to be a principal receptor of toxic materials that bioaccumulate in the food chain. However, small mammals such as raccoons and otters would also be at risk.

The plant and cooling reservoir have been designed so that Florida Class III surface water quality standards would not be exceeded. Table 2.3.6-2 shows the predicted water quality in and discharged from the proposed cooling reservoir. State standards are also predicted to be met in the reclaimed lake with the exception of thermal limitations. A small mixing zone requested by Tampa Electric Company would meet the thermal requirements.

Florida Class III water quality standards for surface water are promulgated for the maintenance of an ecologically sound and healthy ecosystem. The standards are based on federal water quality criteria formulated by EPA. The environment in the cooling reservoir and in the reclaimed lake, based on the assumption of no exceedances of the standards, should pose no undue risk to the resident biota. However, since some of the constituents bioconcentrate, there is a risk to wildlife predators foraging on vertebrates and invertebrates in these receiving waters. The constituents of concern are arsenic, beryllium, cadmium, chromium VI, lead, and mercury. Of these metals, mercury is considered to represent the most risk to foraging wildlife species. Therefore, an ecological assessment was completed for this element.

Mercury is currently recognized by Florida regulatory agencies as a statewide problem. Health advisories have been issued for the consumption of fish, and mercury poisoning has been implicated in deaths of the endangered Florida panther (Roelke *et al.*, 1991). Mercury in the aquatic environment can be biologically scavenged from the water column and can accumulate in fish by a factor of three million times over the concentration observed in the surrounding water (Zillioux *et al.*, in press). Birds, such as the great blue heron and white heron, are at risk from foraging on contaminated fish. Zillioux *et al.* (in press) reports that these species had liver burdens of methylmercury in adults ranging from 0.87 to 74.54 ppm on a weight-to-weight basis. These results relate to birds from the Florida Everglades. Small mammals, such as raccoons and otters, are also at risk. The mercury burden in Florida panthers is attributed to a consumption of raccoons in the absence of ungulate prey, such as deer and feral hogs (Roelke *et al.*, 1991).

Mercury II in a natural aquatic system is biologically transformed to methylmercury. This speciation represents the most risk to organisms. Uptake of the metal occurs by absorption on surfaces. In fish, this takes place on the gills, gastrointestinal tract, and skin. In passive transport, the metal moves to the internal organs via blood and accumulates in liver, kidney, and muscle tissue. Since methylmercury has a high bioconcentration potential, aquatic organisms can acquire a considerable body burden.

Mercury toxicity in birds has been noted by Eisler (1987) to range from 2.2 to 31 mg/kg body weight. In experimentally poisoned birds, Eisler (1987) reported mercury residues as highest in the brain, and decreasing in order for liver, kidney, and muscle. Effects on birds from mercury have been studied through oral administration via various diets. Among sensitive avian species, adverse effects are mainly on reproduction (Eisler, 1987).

In 1991, a wildlife risk assessment was conducted for mercury emissions from a proposed hazardous waste incinerator. This facility has a proposed location adjacent to the eastern boundary of the Tampa Electric Company proposed site. This ecological assessment used the bald eagle as the selected endpoint since an active nest was located in the immediate vicinity (Newman *et al.*, 1991a), the eagle is a sensitive endangered species, nesting bald eagles feed in open water habitats in the area, and eagles are top carnivores likely to be exposed to any mercury bioaccumulated in the food web (Newman *et al.*, 1991a).

The FWS contaminant hazard review of mercury was employed as a reference for evaluating concentrations in the conduct of the study. This document (Eisler, 1987) contains a proposed criterion for the protection of wildlife species. For sensitive avian species, the proposed mercury criterion is a daily dose of less than 640 μg/kg of whole body weight. This criterion was used by the Newman study team as a daily diet value for the bald eagle. This conservative approach for the risk evaluation of mercury was considered appropriate also for the proposed Tampa Electric Company Polk Power Station. The Newman study group considered risk factors to the eagles based on diet preferences, foraging patterns, and the mercury burden in target fish species. Principal surface waters used by eagles for foraging are the reclaimed lake and several unreclaimed mine cuts southwest and southeast of the nest site. Based on observations of flight patterns, the foraging area was assumed to be within 5 km from the proposed plant site. Collections of fish were completed for these surface waters to determine community structure. Samples of catfish, largemouth bass, and mosquitofish were analyzed for mercury content (Newman *et al.*, 1991b). An evaluation of risk to eagles was made on the basis of present conditions and the additional mercury burden from the proposed incinerator facility.

This approach, as reported by Newman *et al.* (1991a, 1991b), was used for the proposed Polk Power Station as the study represents current mercury burdens in fish and is amenable to ascertain risk based on projected water quality and deposition from air emissions. Although birds such as the green heron and the snowy egret species with smaller ranges are also at risk, sufficient data are not available for as complete an assessment as for the bald eagle. Therefore, the bald eagle was selected as the target species on the basis that it is a federally listed species and that the data are specific to the Polk Power Station site area.

The mean levels of mercury in wet weight for whole fish from the reclaimed lake were: largemouth bass, 0.360 mg/kg; catfish, 0.160 mg/kg; and mosquitofish, 0.079 mg/kg. For the unreclaimed lakes, the levels were: largemouth bass, 0.270 mg/kg; catfish, 0.053 mg/kg; and mosquitofish, 0.046 mg/kg. Since the diet of eagles showed a preponderance of catfish, this species was selected for the analysis of risk (Newman *et al.*, 1991a). Therefore, Table 4.12.2-15 shows the current background mercury level in fish from the reclaimed lake and unreclaimed mine cut lakes southwest of the site.

Based on literature, estimates were made for the diets of juvenile and adult birds. Daily requirements range from 5.5 to 12.2 percent of body weight. The upper limit was used for the daily intake for both age classes. Therefore, for adults with a weight of 3.4 kg and juveniles with a weight of 3.1 kg, the daily food intake was estimated at 415 g and 387 g, respectively. For present conditions, the results of the study showed that eagles could be exposed to average daily dietary doses as high as 19.5 μg/kg wet weight of mercury from catfish in the reclaimed lake and as low as 6.9 μg/kg wet weight from the unreclaimed mine cuts. Based on the current criterion of 640 μg/kg whole body weight, the present environmental conditions are not a risk to the bald eagle (Newman *et al.*, 1991b).

Mercury emissions released to the atmosphere from plant operations are estimated to be 0.000177 $\mu g/m^3$ as an annual maximum concentration. Deposition of the metal is estimated to be a maximum of 0.000275 g/m^2. Mercury deposition entering the reclaimed lake is based on a watershed area of 0.291 km^2 and a lake surface area of 0.214 km^2 (Newman *et al.*, 1991a). The predicted concentration of mercury per unit volume of lake water was made using literature-based values for watershed contribution. A conservative estimate of 26 percent was selected based on the upper-bound value reported for Minnesota lakes (Swain *et al.*, 1992). Other studies have shown that undisturbed wetlands within the watershed retain as much as 95 percent of the metal (Zillioux *et al.*, in press). Mercury loading to the reclaimed lake watershed was determined using a methodology reported by Newman (1991a), but modified for the Polk Power Station analysis.

Deposition estimates were made by Tampa Electric Company using ISCLT2 air quality/deposition model. The model was run for years 1982 through 1986. Model year 1983 was selected since it represented the maximum deposition rate (0.000275 g/m^2). A deposition rate representative of the watershed was calculated from ten model receptors located within or immediately adjacent to the reclaimed lake watershed. The individual values ranged from 0.000011 g/m^2 to 0.000026 g/m^2. The average deposition of 0.0000181 g/m^2 was used to calculate mercury loadings to the lake according to the following equation:

$$C_i = [(Fa * WA_W) + (0.26 * Fa * WA_L)] / Vf_X * \text{conversions}$$

Table 4.12.2-15. Results of Mercury Analysis in Tissue of Fish Taken from Water Bodies Near the Site of the Proposed Polk Power Station

		Mercury Concentration† (mg/kg wet weight)		
Species*	N	Mean	(Range)	SD
Reclaimed Lake				
Largemouth bass	5	0.360	(0.20-0.70)	0.210
Catfish	5	0.160	(0.04-0.24)	0.78
Mosquitofish	4	0.079	(0.058-0.10)	0.017
Unreclaimed Lake				
Largemouth bass	25	0.270	(0.097-0.92)	0.180
Catfish	26	0.053	(<0.020‡-0.13)	0.030
Mosquitofish	9	0.046	(0.0344-0.051)	0.005

Note: SD = standard deviation.

* Largemouth bass *(Micropterus salmoides)*, catfish *(Ictalurus spp.)*, and mosquitofish *(Gambusia holbrooki)*.

† Concentrations in bass and catfish are for individual fish; concentrations in mosquitofish are for pooled individuals.

‡ Detection limit is 0.020 mg/kg.

Source: Newman *et al*, 1991b.

where:

C_i	=	concentration in the reclaimed lake (mg/L)
Fa	=	annual mass of contaminant fallout per unit area (0.0181 kg/km^2)
WA_L	=	land area of watershed receiving fallout (0.291 km^2)
WA_W	=	water area of lake receiving fallout (0.214 km^2)
Vf_X	=	dilution volume for water (1,168,565 m^3/yr = lake outflow volume, 96,183 m^3/yr + lake volume, 1,072,382 m^3/yr)
conversions	=	10^6 mg/kg * 1 $m^3/10^3$L

Values for WA_L, WA_W, and Vf_X were taken from Newman *et al.* (1991a).

This estimate also assumes no partitioning to lake sediments and no loss through evasion. Based on this analysis, the predicted mercury concentration in the reclaimed lake is 0.0045 μg/L. This value is below the not-to-exceed 0.012 μg/L Class III Florida water quality standard.

The methylation rate of mercury (II) has been shown to range from 0.1 to 5.2 percent (HSDB, 1991). Following the Newman assessment the highest rate is used here. The predicted highest ambient water concentration of methylmercury is 0.00023 μg/L. Therefore, water concentration times bioconcentration factor equals projected bioaccumulation in fish. A bioconcentration factor of 81,700 for the fathead minnow was used (EPA, 1985d), resulting in a predicted value in fish of 18.79 μg/kg. As Table 4.12.2-16 shows, the predicted maximum daily dose of mercury per kg of body weight is 21.82 μg. This prediction is based on a feeding frequency of less than eight percent. Frequency estimates are based on field observations as discussed by Newman (1991a). On the basis of this predictive analysis, the total daily dietary exposure to foraging eagles is less than four percent of the protective criterion.

4.12.2.7 Assessment of Risk to Small Mammals

Small mammals that forage in aquatic environments would also be at risk from the consumption of contaminated organisms. Resident wildlife expected to be receptors include raccoons and otters. While the toxic dose-response for mercury data is unknown in these species, some information on body burden has been documented in literature.

In a study on mercury contamination in panthers by the State of Florida, raccoons and otters in the south Florida environment were analyzed for body burden of this metal. A total of 48 raccoons were collected from 12 areas in the southern part of the state. The results based on geometric means showed a range in muscle tissue of 0.22 to 1.80 mg/kg (wet weight). Liver tissue had higher levels ranging from 1.35 to 24.0 mg/kg on a wet weight basis. No data were reported for muscle tissue of otters, but levels of mercury in liver ranged from 0.10 to 6.78 mg/kg in an analysis of 20 animals

Table 4.12.2-16. Predicted Exposure (Daily Dietary Doses) of Methylmercury in Bald Eagles Including Observed Background Levels in Catfish and Predicted Levels in Catfish from Proposed Emissions from Polk Power Station

Exposure Scenarios	Background	+	Predicted	=	Total MeHg in Fish (µg Hg/kg fish)	x	Daily Food Consumption (kg fish/day/bird)	=	Predicted Maximum Daily MeHg Dose per Adult (µg Hg/day/bird)	÷	Adult Body Weight (kg)	=	Predicted Maximum Daily Dose per Kg Body Weight (µg Hg/kg body weight)
Reclaimed Lake	160.0	+	18.79	=	178.79	x	0.415	=	74.2	÷	3.4	=	21.82

Note: MeHg = methylmercury.
µg Hg = micrograms of mercury.

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(Roelke, *et al.*, 1991). Eisler (1987) reports that among sensitive species such as cats, dogs, pigs, mink, river otters, and monkeys, death occurs when daily organomercury concentrations of 0.1 to 0.5 mg/kg (body weight) or 1.0 to 5.0 mg/kg (diet) are reached.

4.12.3 Alternative: Tampa Electric Company's Alternative Power Resource Proposal (Without DOE Financial Assistance)

The alternative proposal for the Polk Power Station involves substituting a 500-MW PC unit with FGD for the 260-MW IGCC unit and two 75-MW CTs. Air emissions effects would most likely be greater under the PC alternative, resulting in the potential for greater human health effects. Based on studies comparing IGCC and PC plants, the alternative 500-MW PC plant would be expected to emit significantly greater SO_2, NO_x, and PM emissions than the proposed IGCC plant. This is illustrated in Table 2.4.3-1, which compares actual emissions from nominal 400-MW capacity IGCC and PC plants. The values for the emissions in the study are based on actual emissions data, and as such, would be significantly less than proposed maximum emissions used for permitting purposes. Therefore, the study simply serves to illustrate that a PC plant would have significantly greater actual emissions than an IGCC plant of equivalent capacity. Amounts of arsenic, cadmium, beryllium, and chromium (VI) emitted would depend on the content of each element in the original coal, on the effectiveness of control technologies in removing these elements, and on the degree of volatilization of each element in the process. The EPRI study estimates an emission of 33 lb/hr of particulates for the 400-MW PC plant. Measurements of inorganic hazardous pollutants for less than 10-μm-sized fractionated particles from power plant stack gas were presented by Radian Corporation (Maxwell *et al.*, 1993). Applying these results to the EPRI particulate emission estimate, adjusted to 500 MW by multiplying 33 lb/hr by the ratio 500/400, yields the following emission estimates for air toxics:

- Arsenic 0.08 lb/hr
- Beryllium 0.003 lb/hr
- Cadmium 0.004 lb/hr
- Chromium 0.06 lb/hr
- Cobalt 0.0009 lb/hr
- Lead 0.007 lb/hr
- Manganese 0.007 lb/hr
- Mercury <0.0003 lb/hr
- Nickel 0.028 lb/hr
- Selenium 0.032 lb/hr

Risks to wildlife from air emissions for the alternative proposal with the PC unit would increase based on the emission estimates shown above.

Wastewater discharges would be less for the PC alternative than the IGCC unit as shown in Table 2.4.3-1. Moreover, cooling and boiler blowdown and storm water runoff from coal and by-product storage areas would increase for the PC unit since the proposed CG facilities would have no liquid discharges. However, the higher ratio of cooling water to noncooling wastewaters may result in similar dilute concentrations of pollutants in the cooling reservoir, assuming that the compositions of wastewaters for the PC unit are roughly equivalent to those for the IGCC. The proposed project would not pose a significant risk to human health and the alternative proposal with a PC unit would pose similar risk from wastewater discharge.

EMF effects would remain the same under the alternative proposal, since the size of the power plant would not significantly change and transmission line needs would be the same.

4.12.4 Alternative: No Action

Under the No-Action Alternative, Little Payne Creek, Payne Creek, and the Peace River would be expected to stay at existing water quality levels. EMF effects and air emissions effects would not be relevant under the No-Action Alternative.

4.12.5 Comparison of Impacts

Potential human health and wildlife effects due to air pollutant emissions would probably be less for the proposed project than for the alternative proposal. The PC units tend to have higher air emissions levels, as discussed above. Potential health effects due to wastewater discharges would be negligible for the proposed project unit and would likely be similar for the alternative proposal. EMF effects for both alternatives would be essentially the same, complying with FDEP regulations for transmission lines.

4.13 CUMULATIVE IMPACTS

A cumulative effect is defined in 40 CFR 1508.7 (1993) as, "... the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertake such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over time." A recent report on cumulative effects initiated by EPA noted "Environmental problems--whether global warming, depletion of the stratospheric ozone layer, loss of wetlands, species extinction, or lakes contaminated by toxic chemicals--tend to be cumulative. They build up over a period of time and usually have more than one cause. They may affect an entire region or even the globe. Resource and environmental managers are caught between this recognition of the interactive, longer-term, larger scale nature of many of the problems and the reality of laws and programs that, to a great extent, continue to address a single pollutant, a single project, or a single part of the environment" (World Wildlife Fund [WWF], 1992).

Cumulative effects have the potential to affect any of the physical, biological, and socioeconomic systems discussed in previous sections. Cumulative effects raised during the scoping process (see Section 1.4.2) included regional air quality, mercury levels in the environment and the resultant effects on fish and wildlife resources, addition of greenhouse gases, regional groundwater impacts, water quality, ecological effects to premining vegetation communities and wildlife habitat values, and road and rail transportation effects. Analyses of cumulative impacts for many of these and other issues are contained in Sections 4.1 to 4.12. Consideration of cumulative effects is also implicit in many of the federal, state, and local regulatory requirements. For example, cumulative impact analysis was completed for air quality. Where analysis of cumulative effects has already been discussed, a summary is provided in this section and the reader is referred to the appropriate section of the EIS for additional information. Other potential cumulative effects not addressed previously, such as addition of greenhouse gases, are discussed in this section.

Ideally, analysis of the cumulative consequences to physical, biological, and socioeconomic resources would consider the nature of the potential cumulative effects, their repercussions, and the geographic and temporal boundaries of the effect. However, assessing cumulative effects and making decisions that take cumulative effects into account can be difficult for a variety of reasons, including: (1) the intricacies of environmental systems that have only begun to be understood; (2) adequate data about environmental changes, or causes, particularly at appropriate timeframes and spatial distribution are often lacking; (3) predictions about what might occur in the future that are inherently uncertain; and (4) legal mandates and organizational interests that frequently do not match the boundaries of environmental problems (WWF, 1992).

4.13.1 Cumulative Air Quality Impacts

Existing and planned sources of air pollutant emissions in the vicinity of the site were inventoried to determine sources to be included in the AAQS dispersion modeling. As discussed in Section 3.1, existing sources consist primarily of phosphate-related chemical plants and power generation facilities. These sources are listed in Table 4.13.1-1. The table includes SO_2 sources within 75 km, and PM and NO_x sources within 50 km of the proposed facility. Emissions from planned sources in the vicinity of the site are also included. These include the existing TECO Power Services Hardee Power Station and the proposed FPC Polk County, Mission Energy Company Auburndale Cogeneration, and Decker Energy-Ridge, Inc., Ridge Cogeneration facilities.

Strictly in terms of quantity of emissions from the sources listed in Table 4.13.1-1, the Polk Power Station project would increase SO_2 emissions 0.39 percent, NO_x emissions by 2.78 percent, and PM emissions by 0.97 percent. As discussed in Section 4.1, all estimates of predicted total emission impacts were found to be less than AAQS, PSD Class II increments, and PSD Class I increments. Therefore, operation of the Polk Power station would not cause or contribute to a violation of any PSD increment or AAQS.

Cumulative air toxic emission effects due to new area sources were determined for chromium (VI), nickel, H_2S, and H_2SO_4. These compounds were selected for cumulative impact analyses because their anticipated maximum concentrations (due to the proposed Polk Power Station only) were in the same order of magnitude as the Florida No-Threat Levels (see Section 4.12.2). Mercury was also selected for cumulative impact analyses because of the environmental concern in Florida. Sources included in the modeling were:

Table 4.13.1-1. Comparison of Existing and Planned Emission Sources Included in AAQS Dispersion Modeling and Emissions from Proposed Polk Power Station

Facility	County	Distance from Site (km)	SO_2 (tpy)	NO_x (tpy)	PM (tpy)
Hardee Power Station Ft. Green Springs	Hardee	10.3	16,080.0	8,400.0	1,251.0
C F Industries (Central Phosphate)	Hillsborough	50.7	9,035.0		
TECO Hooker's Point	Hillsborough	49.2	13,522.0	1,256.0	1,231.0
Cargill Fertilizer Inc. (Gardinier)	Hillsborough	41.0	5,480.0		932.0
TECO Big Bend	Hillsborough	39.9	371,760.0	50,132.0	7,897.0
TECO Gannon	Hillsborough	45.8	126,940.0	28,126.0	5,857.0
Gulf Coast Lead Company	Hillsborough	45.5	1,709.0		
Consolidated Minerals, Inc. Plant City	Hillsborough	30.2	942.0		756.0
IMC Ft. Lonesome	Hillsborough	11.4	1,717.0	611.0	678.0
Mobil Mining & Minerals Big Four Mine	Hillsborough	6.8	569.0	155.0	
Royster Phosphate (AMAX) Piney Point	Manatee	53.4	2,084.0		
Florida Power & Light	Manatee	36.2	55,143.0	17,349.0	40,179.0
Florida Power Intercession City	Osceola	74.4	24,763.0		
Florida Power PL Bartow	Pinellas	60.6	61,853.0		
Florida Power Higgins	Pinellas	71.7	12,071.0		
Florida Power Bayboro	Pinellas	62.3	6,876.0		
Pinellas Resource Recovery Facility	Pinellas	68.0	3,418.0		
Lakeland City Power Larsen Power Station	Polk	36.7	3,926.0		
Lakeland City Power McIntosh	Polk	40.0	30,176.0	5,237.0	15,138.0
Gardinier	Polk	14.8	1,173.0		
Seminole Fertilizer (W R Grace)	Polk	21.6	9,129.0	539.0	2,760.0
Mobil Mining & Minerals SR 676	Polk	18.3	832.0		990.0
Royster Company	Polk	19.0	1,265.0		1,393.0
US Agri-Chemicals Hwy 60	Polk	22.8	1,575.0		443.0
US Agri-Chemicals Hwy 630	Polk	15.1	6,881.0		1,071.0
C F Industries Bonnie Mine Rd	Polk	17.1	5,413.0		1,319.0
Farmland Industries Green Bay Plant	Polk	15.6	4,213.0	410.0	1,486.0
Agrico Chemical Co Pierce	Polk	12.3	417.0	118.0	840.0
Agrico Chemical Co South Pierce	Polk	7.9	4,740.0		1,096.0
Conserv Inc.	Polk	17.4	1,586.0		1,598.0
IMC Fertilizer New Wales	Polk	13.1	6,296.0	494.0	1,430.0
Mobil-Electrophos Division	Polk	13.2	1,440.0		544.0
Imperial Phosphates Ltd.	Polk	4.5	275.0		162.0
Auburndale Cogeneration*	Polk	41.3	882.0	736.0	161.0
Hillsborough Co Resource Recovery	Hillsborough	41.7	702.0		
Pasco Co Cogeneration Facility	Pasco	73.6	175.0		
Ridge Cogeneration*	Polk	36.9	479.0	55.0	
Tampa City McKay Bay Refuse-to-Energy	Hillsborough	48.0	1,489.0	2,630.0	
TECO Sebring Airport	Highlands	70.7	3,864.0		
FPC-POLK*	Polk	13.6	1,718.6	5,575.0	297.6
Citrus World	Polk	44.9		1,381.0	
Estech	Polk	12.7			311.0
LaFarge Corp	Hillsborough	49.3			1,221.0
Estech-Duette Phosphate Mine	Manatee	23.2			750.0
IMC Noralyn Mine	Polk	19.1			1,689.0
IMC Kingsford	Polk	9.1			422.0
IMC/Uranium Recovery C F Industries	Polk	17.4			1,071.0
TOTAL			802,608.6	123,204	94,973.6
Proposed Polk Power Station			3,147	3,421	920
Percent Increase due to Polk Power Station			0.39%	2.78%	0.97%

* Planned sources, not yet constructed.

NOTE: This table has changed from the DEIS because of modifications to the design of the proposed facility. See tables in Chapter 2.0 for more detail.

Sources: ECT, 1993; TEC, 1992a.

- Tampa Electric Company - Polk Power Station (Proposed)
- Florida Power Corporation - Polk County Site (Proposed)
- TECO Power Services - Hardee Power Station (Operational)
- Florida First Processing, Inc. (FFPI), hazardous waste incinerator (Proposed)

Stack parameters and most emission rates for the FPC plant were obtained from the SCA for that facility (FPC, 1992). Similarly, stack parameters and most emission rates for the Hardee Power Station were obtained from the SCA for that facility (Hardee, 1989). Finally, emission rates and stack parameters for the FFPI incinerator were obtained from the health risk assessment for that facility (KBN Engineering and Applied Science, Inc., [KBN], 1992a). Because a mercury emission rate for natural gas firing was not available for either the FPC or Hardee facilities, mercury emissions for these two plants were derived from the Tampa Electric Company Polk Power Station mercury emission rate using the megawatt rating of similar individual units as a basis of comparison. The nickel emission rate for the Hardee Power Station was derived similarly. A nickel emission rate was not available and was not included for the FFPI incinerator. A H_2S emission rate was not available for the FPC facility. Because H_2S emissions from CG units are generally fugitive, FPC facility H_2S emissions were estimated and characterized based on Tampa Electric Company Polk Power Station.

A comparison of the cumulative maximum annual average concentration to Florida No-Threat Levels is provided in Table 4.13.1-2. The maximum annual average concentrations for the period 1982 through 1986 were used in this assessment. The annual average concentrations for mercury and sulfuric acid mist were multiplied by four to estimate 24-hour concentrations, because the Florida No-Threat Levels were for 24-hour periods rather than annual. With the exception of nickel, all chemicals are predicted to be below the Florida No-Threat Levels; therefore, no adverse human health effects due the cumulative emissions of these chemicals are anticipated.

Predicted nickel concentrations exceed the No-Threat Level by approximately 35 percent, so chronic effects from nickel related air emissions are possible based on the modeling results. However, as previously discussed in Section 4.12.2.1, the assumed emission factors for the analysis are conservative (i.e., purposely high to overestimate predicted concentrations), and the assumed operating scenario (i.e., all units at Polk Power Station and the FPC and Hardee Power Stations fired on backup fuel oil) would be extremely unlikely to occur. Therefore, actual nickel concentrations in the area are anticipated to be significantly lower. Emissions from the Polk Power Station alone did not exceed the No-Threat Level (see Section 4.12.2). Also, per guidance from FDEP, all nickel emissions were assumed to be either metallic or insoluble. It is likely that a significant percentage of the nickel emissions are soluble compounds (for which there is a separate No-Threat Level). It is possible that neither of the No-Threat Levels would be exceeded if metallic and insoluble compounds were separated from soluble compounds. However, no guidance was presented in the literature on how to reasonably predict the ratio of the emission rates of the two groups of compounds.

Table 4.13.1-2. Assessment of Cumulative Air Toxic Impacts

Pollutant	Maximum Annual Cumulative Concentration ($\mu g/m^3$)	Estimated 24-hr Concentrations ($\mu g/m^3$)	Florida No Threat Level ($\mu g/m^3$)
Chromium VI	5.1×10^{-5}		8.3×10^{-5}
Mercury*	7.24×10^{-4}	2.9×10^{-3}	2.4×10^{-2}
Nickel	5.63×10^{-3}		4.2×10^{-3}
Hydrogen Sulfide	0.628		0.9
Sulfuric Acid Mist*	0.268	1.07	2.4

* Standards provided were for 24-hr concentrations; the modeled annual concentrations were multiplied by 4 to approximate 24 hour concentrations.

[1] Sources included:

- Tampa Electric Company - Polk Power Station 1,150 MW, Completion in 2010.
- Florida Power Corporation - Polk County Site 940 MW, Completion in 2000.
- TECO Power Services - Hardee Power Station 660 MW with 295 MW operational as of January 1, 1993.
- FFPI Hazardous Waste Incinerator, Project on hold.

Source: ECT, 1993.

Nickel and chromium (VI) are both EPA-designated human carcinogens. The URFs for nickel and chromium (VI) are 2.4×10^{-4} per $\mu g/m^3$ and 1.2×10^{-2} per $\mu g/m^3$, respectively. Multiplying the predicted maximum concentrations of nickel and chromium (VI) by their unit risk factor would give an indication of the increased risk of cancer that each of these chemicals would pose to the people in the area of effect (see Section 4.12.2 for further discussion on unit risks). That increased risk was determined to be 1.35×10^{-6} (or approximately one in a million) for nickel and 0.61×10^{-6} (or less than one in a million) for chromium (IV). This is not considered a significant increase in the cancer risk (see Section 4.12.2 for further discussion on the interpretation of risks).

4.13.1.1 Cumulative Mercury Impacts

<u>Historical Aspects</u>

Mercury contamination has become a problem of both national and international scope, and although it has been recognized in many areas, site-specific data are not always available. In 1989, Florida's governor established the Mercury in Fish and Wildlife Task Force and charged it with the responsibility to evaluate and report to the governor on the nature, extent, and possible causes of toxic levels of mercury in Florida fisheries and wildlife, and to assay the public health significance thereof. The goal of the Mercury in Fish and Wildlife Task Force is to promote a solution to Florida's mercury problem. However, the solution(s) must await an understanding of the mechanisms of mercury's origin, transport, deposition, and environmental chemistry (FDER, 1991). The complexity associated with the behavior of mercury in the environment is equaled only by the lack of conclusive data on mercury in the air column, water column, and soils (most importantly, in peat deposits found scattered throughout Florida) (FDER, 1990b).

In the environment, mercury is transformed by microorganisms to the high toxic form, methylmercury, which is then bioaccumulated to significant concentrations in fish. Exposure to elevated levels of methylmercury is manifested in humans as neurological dysfunction, specifically visual and locomotor impairment in adults, and irreversible retardation of central nervous system development in fetuses and children. At the levels of mercury found in Florida fish, overt mercury poisoning is unlikely, but the concerns about potential long-term effects on adults and children are real. Mercury may also have adverse ecological effects and is bioconcentrated through food chains (FDER, 1991).

Studies conducted for the Mercury in Temperate Lakes project in northern Wisconsin report that lakes located in the same geographic area show small but significant differences in concentrations of mercury that seem to be associated with water chemistry constituents. Although methylmercury has been identified in precipitation, atmospheric deposition is less important than internal generation as a source in the Wisconsin study lakes. Oceanic measurements of atmospheric mercury concentrations and mercury deposition in the northern hemisphere do not differ substantially from values for Northern Wisconsin or for the Olympic Peninsula. This result suggests that mercury has a global cycle that controls deposition in many remote areas (Verry and Vermette, 1991).

Anthropogenic mercury emissions in the United States have been estimated to be about 1,400,000 pounds per year (lb/yr) and global anthropogenic mercury emissions have been reported to be 7,900,000 lb/yr (Nriagu & Pacyna, 1988). Based on other literature, this value may be an overestimate. Total mercury emissions on a global basis is approximately 13,200,000 lb/yr and one-third is considered appropriate for a human contribution (Fitzgerald, 1986, 1989).

The preparation of an accurate mass balance for mercury cycling on a global scale has been hindered historically by errors introduced by collection and analysis procedures. It has been emphasized that the key to understanding the mercury cycle is accurate data produced by clean sampling, handling, and storage techniques coupled with robust and sensitive analytical procedures that measure individual species (Verry and Vermette, 1991). They state that without accurate and reproducible measurements, understanding mercury cycling is impossible. The import of small differences in mercury deposition is in the ecological impact produced by bioconcentrating and biomagnifying in food chains.

Recently, Zillioux *et al.* (in press) have reviewed mercury cycling and effects in freshwater wetland ecosystems. They reported deposition rates for the midcontinental United States of approximately 10 micrograms per square meter per year ($\mu g/m^2/yr$), which differs only slightly from ocean deposition estimates. This has led to speculation (Benoit *et al.*, in press) that regional sources could be significant and cause deposition to vary as has been observed in the Scandinavian countries.

Deposition in aquatic systems leads to bioaccumulation in the organisms inhabiting these environments. Zillioux *et al.* (in press) report that methylmercury in soft water is accumulated by a factor of three million times in fish. This observation means that fish can contain more than 1 ppm in water containing less than 1 part per trillion (ppt) of total mercury. The magnitude of the bioconcentration factor (BCF) in aquatic organisms has ecological and human health implications as noted above.

FDEP recently released a statewide mercury air emission inventory study which contains estimates of mercury emissions from anthropogenic and natural sources. Table 4.13.1-3 lists by county estimated emissions in Florida in 1990. The four largest sources reported were municipal solid waste incinerators (MSW) (9,150 lb/yr), medical waste incinerators (8,815 lb/yr), paint (6,980 lb/yr), and utilities (6,706 lb/yr). Total anthropogenic sources were estimated at 38,163 lb/yr while natural sources (excluding fires) were estimated to be 24,440 lbs/yr (KBN, 1992b).

Estimates of mercury emissions from utility sources in Florida are listed in Table 4.13.1-4. The emission factors used as the basis for the reported estimates are contained in Table 4.13.1-5. Average estimates of annual mercury emissions for Hillsborough, Polk, and Manatee Counties were 1,748.6 lb/yr, 289.9 lb/yr, and 149.3 lb/yr, respectively (KBN, 1992b). At the time of the study, no utility sources were listed for Hardee County.

Table 4.13.1-3. Summary of Countywide Mercury Emissions in Florida, 1990 (Page 1 of 3)

	Anthropogenic Mercury Emissions (lb)																Natural Mercury Emissions (lb)		
County	MSW	Utilities	Medical Waste	Sugar	Cement	Other Fuels	Paint	Elect. Appar.	Dental	Lab Use	Diesel Fuel	Motor Gas	Aviat. Fuels	Open Burning	Sewage	TOTAL Anthro.	Soil Degassing	TOTAL Natural	GRAND TOTAL
Alachua	0	176	217	0	0	6	98	52	1	2	3	6	0	3	2	566	343	343	909
Baker	0	0	9	0	0	1	10	5	0	0	1	1	0	1	0	28	35	35	63
Bay	394	201	3	0	0	34	69	36	0	1	3	5	0	1	1	748	240	240	988
Bradford	0	0	0	0	0	1	12	6	0	0	1	1	0	0	0	22	43	43	65
Brevard	0	87	62	0	0	14	215	114	2	5	9	14	0	5	4	532	754	754	1,285
Broward	0	104	746	0	0	40	677	359	5	14	22	37	1	0	12	2,018	2,372	2,372	4,389
Calhoun	0	0	0	0	0	0	6	3	0	0	0	0	0	1	0	10	21	21	31
Charlotte	0	0	36	0	0	30	60	32	0	1	3	4	0	8	1	174	210	210	384
Citrus	0	1,763	320	0	0	3	50	27	0	1	1	3	0	2	1	2,171	177	177	2,348
Clay	0	0	0	0	0	4	57	30	0	1	2	3	0	1	1	99	200	200	299
Collier	0	0	190	0	0	5	82	44	1	2	3	6	0	7	1	342	287	287	630
Columbia	0	0	5	0	0	1	23	12	0	0	5	3	0	2	0	52	80	80	133
Dade	1,686	46	2,847	0	41	129	1,045	554	8	22	36	56	2	0	18	6,491	3,659	3,659	10,150
De Soto	0	0	3	0	0	1	13	7	0	0	1	1	0	7	0	33	45	45	78
Dixie	0	0	0	0	0	0	6	3	0	0	1	0	0	0	0	10	20	20	30
Duval	0	493	379	0	0	72	363	193	3	8	37	24	1	0	6	1,579	1,271	1,271	2,851
Escambia	0	565	258	0	0	38	142	75	1	3	8	9	0	2	3	1,103	496	496	1,600
Flagler	0	0	19	0	0	1	15	8	0	0	1	1	0	0	0	45	54	54	100
Franklin	0	0	0	0	0	0	5	3	0	0	0	0	0	1	0	9	17	17	26
Gadsden	0	0	13	0	0	5	22	12	0	0	1	1	0	1	0	56	78	78	133
Gilchrist	0	0	0	0	0	0	5	3	0	0	0	0	0	1	0	10	18	18	28
Glades	0	0	0	5	0	0	4	2	0	0	0	0	0	6	0	18	14	14	32
Gulf	0	0	0	0	0	12	6	3	0	0	0	0	0	1	0	22	22	22	44
Hamilton	0	0	1	0	0	1	6	3	0	0	7	1	0	1	0	20	21	21	41

Table 4.13.1-3. Summary of Countywide Mercury Emissions in Florida, 1990 (Page 2 of 3)

County	Anthropogenic Mercury Emissions (lb)																Natural Mercury Emissions (lb)		
	MSW	Utilities	Medical Waste	Sugar	Cement	Other Fuels	Paint	Elect. Appar.	Dental	Lab Use	Diesel Fuel	Motor Gas	Aviat. Fuels	Open Burning	Sewage	TOTAL Anthro.	Soil Degassing	TOTAL Natural	GRAND TOTAL
Hardee	0	0	163	0	0	1	11	6	0	0	1	1	0	5	0	188	37	37	225
Hendry	0	0	5	56	0	2	14	7	0	0	2	1	0	7	0	94	49	49	142
Hernando	0	0	16	0	61	232	55	29	0	1	3	3	0	2	1	402	191	191	593
Highlands	0	0	8	0	0	5	37	20	0	1	3	3	0	15	1	93	129	129	222
Hillsborough	2,330	1,749	953	0	0	28	450	239	3	9	30	27	1	2	8	5,828	1,576	1,576	7,404
Holmes	0	0	0	0	0	1	9	5	0	0	1	1	0	1	0	17	30	30	47
Indian River	0	0	35	0	0	3	49	26	0	1	5	3	0	6	1	129	170	170	299
Jackson	0	79	20	0	0	1	22	12	0	0	5	2	0	3	0	145	78	78	223
Jefferson	0	0	0	0	0	0	6	3	0	0	5	1	0	4	0	19	21	21	41
Lafayette	0	0	0	0	0	0	3	2	0	0	0	0	0	0		5	11	11	16
Lake	0	0	2	0	0	5	82	44	1	2	5	5	0	5	1	153	287	287	440
Lee	0	86	333	0	0	11	181	96	1	4	10	12	0	3	3	740	633	633	1,373
Leon	0	2	147	0	0	6	104	55	1	2	4	7	0	5	2	336	364	364	699
Levy	0	0	0	0	0	1	14	7	0	0	1	1	0	0	0	24	49	49	73
Liberty	0	0	0	0	0	1	3	2	0	0	0	0	0	2	0	8	11	11	19
Madison	0	0	0	0	0	1	9	5	0	7	1	0	0	0	0	23	31	31	54
Manatee	0	149	0	0	0	7	114	61	1	2	6	6	0	6	2	355	400	400	755
Marion	0	0	15	0	0	6	105	56	1	2	13	8	0	4	2	213	368	368	581
Martin	0	70	0	4	0	3	54	29	0	1	3	4	0	0	1	170	191	191	360
Monroe	0	11	5	0	0	3	42	22	0	1	1	3	0	0	1	88	147	147	236
Nassau	0	0	0	0	0	95	24	13	0	0	5	2	0	1	0	139	83	83	222
Okaloosa	0	0	16	0	0	5	78	41	1	2	2	5	0	4	1	154	272	272	426
Okeechobee	0	0	2	0	0	1	16	8	0	0	2	1	0	8	0	38	56	56	94
Orange	0	120	172	0	0	22	366	194	3	8	32	27	1	4	6	954	1,280	1,280	2,234

Table 4.13.1-3. Summary of Countywide Mercury Emissions in Florida, 1990 (Page 3 of 3)

	Anthropogenic Mercury Emissions (lb)																Natural Mercury Emissions (lb)		
County	MSW	Utilities	Medical Waste	Sugar	Cement	Other Fuels	Paint	Elect. Appar.	Dental	Lab Use	Diesel Fuel	Motor Gas	Aviat. Fuels	Open Burning	Sewage	TOTAL Anthro.	Soil Degassing	TOTAL Natural	GRAND TOTAL
Osceola	0	4	28	0	0	3	58	31	0	1	4	5	0	15	1	150	203	203	354
Palm Beach	150	24	473	230	0	28	466	247	3	10	17	28	0	10	8	1,695	1,631	1,631	3,326
Pasco	0	125	165	0	0	9	152	80	1	3	4	8	0	3	3	553	531	531	1,084
Pinellas	4,590	85	209	0	0	27	459	244	3	10	10	24	0	0	8	5,670	1,609	1,609	7,279
Polk	0	290	549	0	0	78	219	116	2	5	25	14	0	8	4	1,310	766	766	2,076
Putnam	0	397	0	0	0	17	35	19	0	1	2	2	0	2	1	476	123	123	599
St. Johns	0	0	10	0	0	3	45	24	0	1	5	4	0	1	1	94	158	158	252
St. Lucie	0	0	65	0	0	5	81	43	1	2	6	5	0	13	1	222	284	284	506
Santa Rosa	0	0	13	0	0	3	44	23	0	1	1	3	0	5	1	94	154	154	248
Sarasota	0	0	11	0	0	9	150	80	1	3	5	9	0	3	3	273	525	525	798
Seminole	0	0	49	0	0	9	155	82	1	3	4	8	0	0	3	314	543	543	858
Sumter	0	0	0	0	0	1	17	9	0	0	10	2	0	2	0	42	60	60	102
Suwannee	0	5	0	0	0	1	14	8	0	0	4	1	0	1	0	35	51	51	86
Taylor	0	0	0	0	0	4	9	5	0	0	2	1	0	0	0	22	32	32	54
Union	0	0	101	0	0	0	6	3	0	0	2	0	0	0	0	113	19	19	132
Volusia	0	75	140	0	0	12	200	106	1	4	7	12	0	1	4	562	700	700	1,262
Wakulla	0	0	0	0	0	1	8	4	0	0	0	0	0	5	0	18	27	27	45
Walton	0	0	0	0	0	1	15	8	0	0	2	1	0	2	0	29	53	53	82
Washington	0	0	0	0	0	1	9	5	0	0	0	1	0	1	0	17	32	32	49
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	9,150	6,706	8,815	295	102	1,050	6,980	3,705	46	140	401	428	7	215	123	38,163	24,440	24,440	62,604

Source: KBN, 1992b.

Table 4.13.1-4. Estimation of Mercury Emissions from Electric Utility Sources in Florida, 1990

County	Mercury Emissions (lb/year)		
	Low	Average	High
Alachua	104.30	175.67	229.00
Bay	119.65	201.20	261.84
Bradford	0.00	0.04	0.11
Brevard	9.21	86.94	223.72
Broward	11.03	104.08	267.72
Citrus	1,048.36	1,763.03	2,294.72
Dade	4.85	45.77	117.69
Duval	275.09	492.89	688.41
Escambia	335.86	564.63	734.59
Gulf	0.00	0.00	0.00
Highlands	0.01	0.11	0.29
Hillsborough	1,037.80	1,748.68	2,281.31
Indian River	0.00	0.04	0.08
Jackson	46.88	78.76	102.41
Lee	9.16	86.38	222.50
Leon	0.24	2.31	5.83
Manatee	15.84	149.38	384.75
Martin	7.39	69.73	179.34
Monroe	1.13	10.65	27.44
Orange	71.40	119.96	155.95
Osceola	0.44	4.13	10.62
Palm Beach	2.54	24.02	61.71
Pasco	13.27	125.09	322.20
Pinellas	9.00	84.82	218.48
Polk	170.35	289.92	382.63
Putnam	235.93	397.42	518.08
St. Lucie	0.01	0.06	0.13
Suwannee	0.57	5.42	13.93
Volusia	7.96	75.06	193.31
Wakulla	0.01	0.14	0.35
Total:	3,538.30	6,706.33	9,899.17

Note: Coal emissions based on 25-percent removal for ESPs and 70-percent removal for scrubbers.

Source: KBN, 1992b.

Table 4.13.1-5. 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]	5.79×10^{-5}	5.46×10^{-4}	1.41×10^{-3}
Distillate Oil	NA	lb/10^{12} Btu	0.4	3.4	8.8
		lb/10^3 gal[c]	4.99×10^{-5}	4.71×10^{-4}	1.21×10^{-3}
Natural Gas	NA	lb/10^{12} Btu[d]	0.001	0.014	0.027
		lb/MMcf	1.25×10^{-6}	1.44×10^{-5}	2.75×10^{-5}

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, 1992b.

A number of studies have documented accumulation of mercury in fish and wildlife in Florida. An analysis of largemouth bass from 53 lakes throughout Florida showed accumulation of mercury in axial muscle that exceeded the Florida action level of 0.5 μg/g wet weight. The relationships developed in the study suggest that in-lake processes control the production of methylmercury and its subsequent bioaccumulation in largemouth bass in Florida lakes. The study concluded that piscivorous fish (e.g., largemouth bass, gar, bowfin) from numerous soft water lakes in Florida have the potential to accumulate mercury burdens exceeding levels considered safe for consumption. The study reported that no data were available to suggest that differences in atmospheric loadings in Florida cause the variability in mercury concentrations among lakes. Table 4.13.1-6 and Figure 4.13.1-1 summarize the location; water quality characteristics; and the number, mean, range, and expected mercury concentrations for axial muscle tissue of largemouth bass from 53 Florida lakes, 1990-1991 (Lange, *et al.*, 1992). Mercury levels in largemouth bass for the two lakes nearest the proposed plant, Lake Parker (35 km) and Lake Shipp (37 km), had mercury concentrations of 0.04 and 0.21 μg/g, respectively; both were below the Florida action level of 0.5 μg/g wet weight. Meteorological conditions in west central Florida are discussed in Section 3.1.1 and wind roses for TIA and the Polk Power Station site as provided in Figures 3.1.1-1 and 3.1.1-2, respectively.

Another study of 22 lake stations and 74 stream stations in Florida indicated that 45 percent of the lakes sampled and 70 percent of the streams sampled contained fish with tissue concentrations of mercury that exceeded 0.5 mg/kg, the levels at which Florida HRS issues limited consumption advisories (FDER, 1990b).

A report on mercury levels in wildlife (Roelke *et al.*, 1991) identified mercury as an important contaminant in free-ranging panthers, raccoons, otters, and alligators, but not in bobcats, in southern Florida. Mercury toxicosis may have been responsible for one panther death in Everglades National Park and is strongly implicated in two others since 1989.

Since discovery of elevated mercury levels in freshwater fish in 1989, health advisories have been issued because of the toxicity of methylmercury to humans. Approximately one million acres of the Everglades have been placed under health advisories recommending largemouth bass and several other species of fish not be consumed. An additional one million acres of freshwaters in Florida have been placed under health advisories to restrict consumption of largemouth bass.

A combination of factors, both natural and human induced, may be responsible for the higher tissue mercury observations in Florida. Correlations have been found between low pH, high tissue mercury levels, and peat deposits (especially deposits undergoing hydrologic fluctuations induced by water management practices and those disturbed by dredge-and-fill activities or agriculture). Other possible sources of mercury include atmospheric deposition from the burning of fossil fuels, incineration processes, emissions from the manufacture of paints and plastics, past agricultural and silvicultural

Table 4.13.1-6. Mercury Concentrations of Largemouth Bass from 53 Florida Lakes, 1990-1991 (Page 1 of 2)

	Lake	Alkalinity (mg/L as $CaCO_3$)	pH	Calcium (mg/L)	Chlorophyll *a* (µg/L)	Mercury concentration (µg/g) Mean (N, range)	*E*Hg
1	Alligator	5.9	6.1	3.0	0.7	1.23 (5, 0.85-1.43)	1.53
2	Annie	3.5	5.1	1.9	3.2	1.33 (7, 0.92-1.90)	1.33*
3	Apopka	116.0	9.1	44.1	128.3	0.04 (6, 0.04-0.06)	0.04*
4	Blue Cypress	39.4	6.9	16.4	3.5	0.44 (12, 0.13-0.84)	0.44*
5	Brick	2.5	4.6	2.9	1.8	1.20 (12, 0.69-1.50)	1.33
6	Bryant	19.6	7.3	4.5	44.1	0.27 (14, 0.04-0.48)	0.25
7	Cherry	5.2	5.4	2.8	3.4	0.48 (10, 0.30-0.72)	0.45
8	Crescent	71.4	8.1	55.2	33.7	0.19 (12, 0.08-0.38)	0.16
9	Deer Point	26.4	5.8	9.2	1.6	0.83 (24, 0.26-1.40)	0.72
10	Dias	4.8	6.4	4.6	22.5	0.81 (12,0.41-1.47)	0.81
11	Dorr	6.6	5.4	2.7	14.9	0.71 (12, 0.52-0.86)	0.71
12	Down	16.5	7.2	13.8	4.0	0.50 (12, 0.10-0.73)	0.51
13	Eaton	25.4	7.2	25.2	11.6	0.49 (7, 0.26-1.01)	0.54
14	East Tohopekaliga	7.1	5.8	5.2	5.8	1.16 (43, 0.50-2.03)	1.00
15	Farm-13	128.0	7.6	86.5	71.1	0.05 (11, 0.04-0.11)	0.05*
16	George	83.7	8.2	66.5	78.6	0.15 (10, 0.12-0.18)	0.15
17	Griffin	108.5	8.7	35.6	80.1	0.19 (40, 0.07-0.43)	0.19
18	Harney	61.3	7.8	57.4	13.9	0.77 (6, 0.32-1.50)	0.49
19	Hart	6.4	5.8	4.0	4.6	1.08 (10, 0.64-1.33)	1.02
20	Hatchineha	31.0	6.7	15.0	17.0	0.98 (6, 0.67-1.44)	0.70
21	Iamonia	7.5	4.4	2.0	9.6	0.63 (12, 0.33-0.93)	0.45
22	Istokpoga	17.3	6.7	10.7	9.5	0.56 (12, 0.37-0.94)	0.59
23	Jackson	12.6	6.1	3.7	21.0	0.41 (12, 0.25-0.61)	0.41*
24	Josephine	7.0	6.9	6.3	32.1	0.73 (12, 0.33-2.04)	0.81
25	Kingsley	10.5	5.5	6.3	1.6	0.34 (10, 0.25-0.62)	0.42
26	Kissimmee	30.0	6.9	13.9	21.5	0.59 (36, 0.23-1.12)	0.53
27	Lochloosa	55.4	7.3	15.9	24.7	0.34 (10, 0.17-0.52)	0.31
28	Louisa	3.9	4.5	3.3	7.0	0.84 (8, 0.59-1.38)	0.87
29	Miccasukee	5.5	4.8	1.7	14.8	0.50 (11, 0.31-0.84)	0.50*
30	Minneola	6.3	5.8	3.3	0.7	0.34 (10, 0.19-0.69)	0.47
31	Monroe	67.0	7.8	58.6	43.8	0.28 (10, 0.16-0.59)	0.25

Table 4.13.1-6. Mercury Concentrations of Largemouth Bass from 53 Florida Lakes, 1990-1991 (Page 2 of 2)

Lake	Alkalinity (mg/L as $CaCO_3$)	pH	Calcium (mg/L)	Chlorophyll *a* (µg/L)	Mercury concentration (µg/g) Mean (N, range)	*E*Hg
32 Newnans	28.8	7.4	10.2	32.7	0.34 (10, 0.16-0.65)	0.41
33 Ocean Pond	5.8	3.6	1.6	3.2	0.87 (12, 0.31-1.90)	0.87*
34 Ocheese Pond	4.5	4.4	1.1	3.2	0.56 (13, 0.25-1.02)	0.56*
35 Okeechobee	119.1	7.9	38.4	16.1	0.17 (12, 0.07-0.30)	0.16
36 Orange	25.4	7.1	8.8	45.2	0.18 (13, 0.09-0.29)	0.16
37 Panasoffkee	106.5	6.8	90.7	16.5	0.19 (13, 0.05-0.37)	0.23
38 Parker	53.0	8.4	45.6	152.4	0.04 (4, 0.04-0.06)	0.04*
39 Placid	8.5	7.0	2.5	12.8	0.49 (12, 0.31-0.63)	0.56
40 Puzzle	87.6	7.5	85.5	20.1	1.10 (10, 0.79-1.41)	0.89
41 Rodman	114.0	7.0	72.6	6.4	0.16 (14, 0.04-0.26)	0.18
42 Rousseau	97.5	6.8	45.5	6.2	0.10 (12, 0.05-0.26)	0.19
43 Sampson	11.8	5.9	24.2	1.6	0.48 (10, 0.27-1.05)	0.44
44 Shipp	66.5	8.3	26.0	68.2	0.21 (12, 0.05-0.48)	0.16
45 Talquin	16.0	6.7	41.2	24.1	0.86 (12, 0.36-1.40)	0.67
46 Tarpon	5.0	6.2	23.6	9.6	0.52 (12, 0.31-0.95)	0.55
47 Trafford	81.5	8.9	20.5	9.6	0.27 (6, 0.04-0.40)	0.27*
48 Trout	1.2	4.3	2.1	6.4	0.94 (10, 0.59-1.24)	0.98
49 Tsala Apopka	34.0	7.0	13.1	4.6	0.40 (12, 0.08-0.90)	0.31
50 Weir	15.5	6.9	5.2	16.5	0.43 (11, 0.23-0.69)	0.43
51 Tohopekaliga	25.6	6.2	12.6	27.7	0.65 (44, 0.30-1.10)	0.58
52 Wildcat	17.3	5.2	3.0	2.6	0.25 (12, 0.15-0.40)	0.28
53 Yale	71.8	7.9	20.5	8.8	0.27 (12, 0.15-0.51)	0.25

* Mean mercury concentration where largemouth bass age data were not available.

Note: Location, water quality characteristics (mean value for August 1990 and April 1991), and the number, mean, range, and expected mercury concentrations (*E*Hg) for axial muscle tissue of largemouth bass from 53 Florida Lakes, 1990-1991. Lake numbers correspond to those in Figure 4.13.1-1 The expected mercury concentration is that for a 3-year-old fish as obtained by regression analysis of mercury versus fish age.

Source: Lange *et al.*, 1992.

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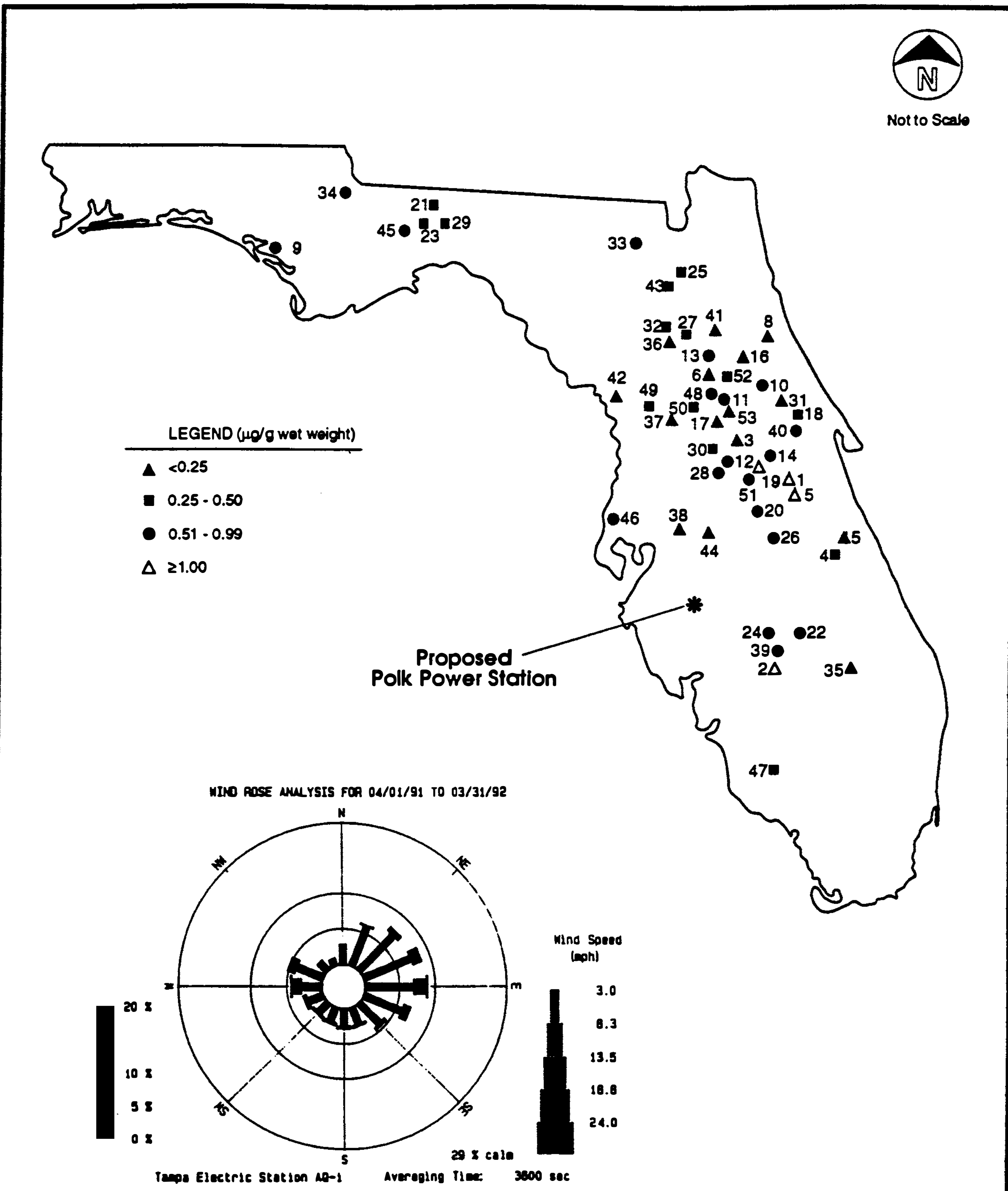

FIGURE 4.13.1-1. Map of Florida Showing the Distribution of 53 Study Lakes with the Expected Mercury Concentrations for 3-Year Old Largemouth Bass (*E*Hg), 1990-1991. SOURCE: Lange, et. al., 1992.	**U.S. Environmental Protection Agency, Region IV** ***Environmental Impact Statement***	**Polk Pow r Station Polk County, Florida**

practices, current agricultural operations that occur on peat deposits, industrial discharges, waste water treatment plants, and interstate transfer of mercury through the air and water (FDER, 1990b).

<u>Potential Mercury Impacts in the Plant Vicinity</u>

ISC2 modeling was performed to determine potential impacts due to mercury deposition for the 10-km area surrounding the site. Modeling was limited to sources for which data were readily available. The sources modeled included the proposed FPC Power Station, the existing Hardee Power Station, the proposed FFPI Incinerator, and the proposed Polk Power Station. Modeling was performed using meteorological data for the years 1982 through 1986. Table 4.13.1-7 illustrates the results of this modeling and indicates a predicted maximum mercury deposition of 3.05×10^{-4} g/m^2 for the 10-km area.

The predicted mercury content in the unnamed reclaimed lake on the proposed site was estimated as 0.017 µg/L (calculations are outlined in Section 4.12.1.5). This predicted concentration indicates the potential for an exceedance of the Florida Class III water standards (0.012 µg/L). However, it should be noted that the emission from the proposed Polk Power Station contributes only 26 percent of the total mercury loading to the lake.

The proposed Polk Power Station is expected to emit 1,000 lb/yr of mercury (TEC, 1992a). Based on Table 4.13.1-4, which estimates mercury emissions from electric utilities in Florida, this seemed unreasonably high. However, on further examination, it was noted that there is a major difference in the emission factors used for calculating mercury emissions from natural gas sources. The FDEP study (Table 4.13.1-4) used an emission factor of 0.014 lb/10^{12} Btu of mercury, whereas an emission factor of 6.05 lb/10^{12} Btu of mercury was used in predicting the Polk Power Station emissions from natural gas sources in the SCA (TEC, 1992a). That is to say, the emission factor used by Tampa Electric Company to calculate mercury emissions for the proposed project's natural gas sources was far more conservative (by orders of magnitude) than what was used in the FDEP study. Of the 1,000 lb/yr of mercury estimated for the proposed plant operating at full capacity, approximately 796 lb/yr would be from combustion sources using natural gas, while 204 lb/yr would be from combustion sources using coal; therefore, the difference in natural gas emission factors would dramatically change the total lb/yr of mercury emitted.

For purposes of assessing the proposed facility's percent contribution to the total mercury emissions from electric utilities in Florida, the proposed Polk Power Station mercury emissions were recalculated using the natural gas emission factors from the FDEP study and compared to the total emission rate presented in the FDEP study. The results indicate that Polk Power Station would contribute 3.06 percent of the total average mercury emissions from Florida utilities. It should be noted that the same percent contribution would be arrived at, if the data from the FDEP study were recalculated using Tampa Electric Company's emission factors and then used in a comparison with the 1,000 lb/yr of mercury predicted for the Polk Power Station. At this time, there are no data to suggest which

Table 4.13.1-7. Maximum Cumulative Annual Deposition (g/m^2)

Pollutant	1982	1983	1984	1985	1986
Mercury	2.15×10^{-4} 400m; 105°	3.08×10^{-4} 400m; 150°	2.89×10^{-4} 400m; 150°	2.64×10^{-4} 400m; 150°	2.25×10^{-4} 400m; 150°

Note: Included are Hardee Power Station, FFPI, the FPC Power Station in Polk County, and the Polk Power Station.

Source: ECT, 1993.

natural gas factor is correct; however, the current estimate for the facility (calculated by Tampa Electric Company) was arrived at using the more conservative of the two numbers. Regardless, the proposed power station would be expected to contribute to approximately 3.06 percent of the total average mercury emissions from Florida electric utilities.

The Tampa Electric Company SCA did not contain any specific BACT for mercury for the 7EA CTs operating in either simple cycle or combined cycle modes, which are the major mercury emitting sources for the proposed facility. However, the SCA did address BACT for PM and trace heavy metals in general. There are currently only a few costly control technologies specific to mercury emissions. For example, the widely discussed method for mercury control is the injection of activated carbon into the exhaust gases, followed by collection of the carbon in a baghouse. It is expected that some of the mercury would be adsorbed on the carbon. This technique would fail to be economically feasible in the case of the proposed facility due to the numerous exhaust stacks and the complexity of the design plan. Similarly, it is expected that any other specific mercury controls would fail BACT analysis either in terms of technical feasibility or economic feasibility. FDEP has considered the BACT for PM and heavy metals and found it suitable for mercury; therefore, FDEP approved the Final PSD Determination, which includes the PSD permit (see Appendix D).

4.13.1.2 Greenhouse Gas Emission Impacts

Solar radiation as light energy that reaches earth is absorbed and reradiated back to the atmosphere as infrared energy. However, the CO_2 in the lower atmosphere tends to trap the heat, causing absorption of the heat, resulting in a warming of the atmosphere and earth's surface. This phenomena is the so-called "greenhouse effect," which affects the overall climatic conditions of the earth.

Gases, such as CO_2, methane, nitrous oxide (N_2O), chlorofluorocarbons (CFC), and other trace gases that can cause the greenhouse effect are called "greenhouse gases." The largest single factor affecting greenhouse gas emissions is the production of energy from carbon-based fuels. Based on the atmospheric concentrations, residence times, and radiative forcing, the relative contribution of each of these greenhouse gases to global warming potential has been determined. These relative contributions to the global warming potential (based on 1985 data) are as follows (Lashof and Ahuja, 1990):

- CO_2, 71.5 percent
- CFC, 9.5 percent
- Methane, 9.2 percent
- CO, 6.5 percent
- N_2O, 3.1 percent

The primary anthropogenic activities that alter the levels of these greenhouse gases in the atmosphere, and their estimated contribution to greenhouse warming, include energy use and production

(57 percent), industrial activities that use CFC (17 percent), agricultural practices (14 percent), land-use modifications/deforestation (9 percent), and other industrial activities.

Concerns have been raised about increasing levels of greenhouse gases in the atmosphere. Federal guidance on the need to address global climate change and greenhouse gas emissions in proposed federal projects is being developed, though the specific details of the policy have not been decided. In the absence of federal guidance on greenhouse gas emissions, the following discussion focuses on estimates of potential effects of greenhouse gas emissions from the proposed Polk Power Station and potential mitigation techniques to help offset those consequences.

The proposed Polk Power Station would include one IGCC unit and its associated facilities, two CC units, and six stand-alone CTs. The IGCC unit would use syngas as fuel. The CCs and CTs would use either oil or natural gas as fuels. As discussed in the literature, among these fuels, syngas emits the highest level of CO_2 which is the most important greenhouse gas, while natural gas emits the least amount of CO_2. In order to be conservative, it is assumed that the proposed IGCC unit would utilize syngas throughout its life with all other proposed power generating units using only distilled No. 2 fuel, oil as fuel which is the proposed backup fuel for these units.

Table 4.13.1-8 provides conservative estimates of the yearly emissions for the greenhouse gases from the proposed Polk Power Station. Table 4.13.1-9 provides estimates of emissions over the life of the facility. Other assumptions were made to develop the estimates depicted in Tables 4.13.1-8 and 4.13.1-9:

- The CO_2 emission rates were calculated based on the carbon content in the fuel assuming total combustion occurs.
- Existing data indicated methane emissions are negligible for the facility. There would be no CFC emissions.
- Table 4.13.1-8 is based on 1,150 MW operation using syngas for IGCC unit and No. 2 fuel oil for other proposed power generating units throughout the total project life of 30 years.
- Emissions of greenhouse gases resulting from the production of coal gas were not included in this analysis.

As shown in Table 4.13.1-9, the contributions of CO_2 greenhouse gas emissions are nearly the same from the IGCC unit (260 MW), the two CCs units (440 MW), and the six stand-alone CTs (450 MW). The IGCC unit and its associated systems would be the major contributor of NO_x emissions; however, with relatively lower levels of CO emission. The total estimated annual emissions of these greenhouse

Table 4.13.1-8. Greenhouse Gas Emission Estimates (tons per 30-year project life)

	1-year	5-year	15-year	30-years
CO_2	6,951,700	34,758,500	104,275,500	208,551,000
NO_x	3,421	17,105	51,315	102,630
CO	2,530	12,650	37,950	75,900
VOC/O_3	396	1,980	5,940	11,800
Methane	neg	neg	neg	neg

Notes:

1. NO_x is precursor to N_2O and secondary greenhouse gases such as O_3; however, specific amounts of these end products could not be accurately predicted for this project.
2. The highest annual emission rates from IGCC unit and its associated systems (including fugitive emissions) were used for conservative estimates.
3. This table has changed from the DEIS because of modifications to the design of the proposed facility. See tables in Chapter 2.0 for more detail.

Table 4.13.1-9. Projected Maximum Annual Emissions (tpy)

	IGCC	CC	CT	Total
CO_2	2,098,363	2,399,403	2,453,934	6,951,700
NO_x	1,099	1,308	1,014	3,421
CO	460	1,092	978	2,530
VOC/O_3	48	180	168	396
Methane	neg	neg	neg	neg

Notes:
1. IGCC emissions include the highest annual emission estimates from the 7F CT during the post-demonstration period, plus other associated process and fugitive emissions.
2. CC represents the total four stand-alone CTs with oil fuel, and CTs represents six stand-alone CTs in simple-cycle mode.
3. This table has changed from the DEIS because of modifications to the design of the proposed facility. See tables in Chapter 2.0 for more detail.

gases would be 6.9 million tpy for CO_2, 3,421 tpy for NO_x, 2,530 tpy for CO, and 396 tpy for VOC/O_3. The emission of methane would be negligible.

As a means of providing a perspective on the magnitude of the emissions from this proposed plant, a comparison was made to both national and regional total carbon emissions from fossil fuel combustion for energy production. For example, the total carbon emissions released from fossil fuel combustion for energy production nationally was 1.38 billion tpy in 1985 (DOE, 1989). Estimated carbon emissions from the proposed IGCC unit would be about 0.572 million tpy. Therefore, the proposed Polk Power Station would represent approximately 0.041 percent of the total fossil fuel carbon emissions produced in 1985 for energy production in the United States. Based on a total of 248 million tons of carbon emissions from fossil fuel combustion for energy production in the eight states in EPA Region IV (AL, FL, GA, KY, MS, NC, SC, TN) in 1986 (Machado and Piltz, 1988), the IGCC unit of the proposed Polk Power Station would emit approximately 0.85 percent of fossil-fuel-combustion carbon emitted in 1986 in Region IV.

The utility industry has traditionally used a number of techniques for reducing fossil fuel consumption, such as promoting energy efficiency, conservation, and least-cost planning (see Section 1.2.2.3). In addition, the use of generating technologies that minimize greenhouse gas emissions would also effectively lessen the historical emission rates. For example, the CG technology proposed for Polk Unit 1 results in the production of less CO_2 per unit of electricity produced than a PC combustion unit. Recently, scientists have also proposed the use of two additional methods to offset increased CO_2 emissions: afforestation and energy conservation planting (University of California, 1989; DOE, 1988). Afforesting open land offsets CO_2 emissions because trees fix, or sequester, atmospheric CO_2. Using data developed by the World Resources Institute (Trexler *et al.*, 1989), the number of trees required to offset emissions contributed by the proposed Polk Power Station can be calculated. Assuming a moderate stemwood growth rate of 10 m^3 per hectare per year, a biomass multiplier of two, and a stand density of 2,000 trees per hectare, approximately 761,600 acres of open land, an area the size of Connecticut, would need to be planted with trees to offset the CO_2 emissions from the proposed plant while operating on natural gas, while 1.6 million acres of trees planted would be needed to offset the carbon emissions while operating on syngas. Tampa Electric Company will plant trees on the power station property. This area is much less than 1 percent of the area computed, but it does offer some offset for CO_2 emissions.

Energy conservation planting is a proposed method for reducing energy demand in which trees are strategically placed around residential buildings to shade the building, thereby reducing the energy required for air conditioning. If the source of energy is fossil fuel combustion, then the reduction in energy consumption would result in a reduction in CO_2 emissions. In addition, the trees also fix atmospheric CO_2.

The estimates described for afforestation and energy conservation incorporate numerous assumptions regarding environmental conditions. Depending on site-specific conditions, these estimates may be higher or lower by an order of magnitude. In addition, the technical and economic feasibility of implementing these mitigation techniques specifically for Tampa Electric Company's proposed project have not been investigated. As discussed previously, the information presented in this section is intended to provide a better understanding of greenhouse gas emissions from the proposed facilities and is not intended to be used as a basis for implementing a particular mitigation strategy. Despite the present absence of federal guidance requiring mitigation for predicted greenhouse effects, EPA would encourage Tampa Electric Company to voluntarily implement mitigation techniques, such as afforestation and reforestation, to help offset greenhouse effects for the proposed Polk Power Station. In addition to mitigation methods, pollution prevention activities that minimize the net increase of greenhouse gases are also strongly encouraged by EPA.

Tampa Electric Company's efforts to reduce greenhouse effects have been through its existing conservation, load management, and cogeneration programs (also see Section 1.2.2.3: Demand and Energy Reductions).

These programs have three major objectives:

- To defer capital expansion, particularly production plant
- To reduce marginal fuel cost by reducing energy usage during high fuel cost periods
- To give the customers some ability to control their energy usage and reduce their energy costs

The company has a mix of existing programs and activities to accomplish these objectives. Coupled with an educational program, there are a number of specific conservation and load management programs designed to help both the customer in current energy usage and all customers over the long-term through lower energy costs. These include (excerpted from TEC, 1993c):

- Heating and Cooling - a program encouraging the installation of high-efficiency heating and cooling equipment. The program goals are a reduction of winter demand by 475 MW, summer demand by 7 MW, and energy consumption by 147 GWH by 2002.

- Load Management - a residential program to reduce weather-sensitive heating, cooling, water heating, and pool pump loads through a radio signal control mechanism. At year-end 1992, 66,908 customers were participating. By 2002, the program goal is to have a combined estimated demand effect of 310 MW in winter, 131 MW in summer, and 1 GWH in energy savings. In addition, a commercial/industrial program is in effect.

- Energy Audits - presently four audits are available to Tampa Electric Company's customers; two are for the residential class and two are for commercial/industrial customers. The program is a "how to" information and analysis guide for customers. The expected savings from these programs during the next ten years are 25 MW in summer, 52 MW in winter, and 78 GWH in energy.

- Ceiling Insulation - an incentive program for existing residential structures that will help to supplement the cost of adding additional insulation. During the next ten years this program will be the catalyst for an 8 MW reduction in winter, a 6-MW reduction in summer, and a 10-GWH reduction in energy.

- Commercial Indoor Lighting - an incentive program to encourage investment in more efficient lighting technologies in existing commercial facilities. By 2002, this program is expected to save 4 MW in winter, 11 MW in summer, and 39 GWH in energy.

- Standby Generator - a program designed to utilize the emergency generation capacity of commercial/industrial facilities to reduce weather-sensitive peak demand. By 2002, this program is expected to save 9 MW of winter demand, 9 MW of summer demand, and 1 GWH of energy.

- Conservation Peak Value - a program for commercial/industrial customers that encourages additional investments in substantial demand shifting or demand reduction measures. Reductions of 5 MW in summer, 1 MW in winter, and 8 GWH of energy savings for 1992-2002.

- Duct Repair - an incentive program for existing residential structures that encourages the repair of the air distribution system. By 2002, the program goal is to have a demand of 4 MW in the summer, 16 MW in the winter, and 18 GWH of energy savings.

- Cogeneration - a program whereby large industrial customers with waste heat or fuel resources may install electric generating equipment, produce their own electrical requirements, and/or sell their surplus to the company. During the next ten years cogeneration additions are expected to total 166 MW, generating 645 GWH. By 2002 it is expected that cogeneration will total 414 MW in the winter, 413 MW in the summer, and 2,831 GWH of energy annually.

- Street and Outdoor Lighting Program - completed in 1990, is anticipated to continue to provide energy reductions. The program, which provided for the replacement of mercury vapor lighting with the more efficient high-pressure sodium lighting, is expected to provide energy reductions of 32 GWH by 2002.

4.13.2 Cumulative Surface Water Impacts

During the construction phase, 253 acres of USACOE jurisdictional wetlands would be filled. Hydrologic impacts would occur from construction of the cooling reservoir and the power block. Storm water during construction would be contained in subareas of the cooling reservoir on site. A temporary reduction in water quality may occur during these activities. However, Tampa Electric Company filed its notice of intent for coverage under the General Permit for Storm Water Discharges from Construction Sites, which EPA had previously issued on September 25, 1992. This includes a preliminary PPP for minimization of hydrologic and water quality impacts from storm water (see DEIS, Appendix K). Tampa Electric Company has subsequently achieved coverage under this general permit.

During the proposed power plant operation, 3.1 mgd would be discharged from the cooling reservoir to the reclaimed lake. Water quality standards would be maintained in the reclaimed lake except for temperature. A small mixing zone would be required to comply with the Florida thermal standards. Discharge from the reclaimed lake would enter Little Payne Creek. The creek, presently an intermittent stream, would now have continuous flow. The discharge at Fort Green Road would increase from an estimated premining 8.2 cfs to an average of 11.9 cfs. This increase would diminish downstream and is not expected to affect downstream flooding.

4.13.3 Cumulative Groundwater Resources Impacts

Groundwater is the principal source of fresh water for public supply, rural, industrial, and irrigation purposes in Florida. Average groundwater withdrawals from all sources throughout Florida total over 7.5 billion gpd. Approximately 92 percent of the state's population depends on underground sources for its drinking water supply (Miller, 1990).

The proposed Polk Power Station project would withdraw groundwater from the Floridan aquifer system, which is one of the most productive in the United States, extending across all of Florida, southern Georgia, and parts of Alabama and South Carolina.

Potential cumulative effects to the Floridan aquifer system from depletion of groundwater resources include reversal of predevelopment potentiometric gradients in coastal areas creating the potential for encroachment of saltwater from the gulf or ocean; upward movement of poor quality, highly mineralized groundwater from deep parts of the aquifer; reduction in lake levels; and loss of habitat.

The proposed Polk Power Station is located in the Southwest Central Florida Groundwater Basin (SWCFGWB) as delineated by SWFWMD. Water levels in the SWCFGWB declined slowly from earliest observations in the 1930s to the early 1960s. Accelerated rates of decline began in the 1960s and have continued to the present. Annual fluctuations have also greatly increased from previous norms of less than 5 ft to current fluctuations exceeding 30 ft in some parts of the basin (SWFWMD, 1993a).

Regionally, long-term average declines are evident throughout much of the basin. As shown in Figure 4.13.3-1, declines in the Upper Floridan aquifer potentiometric surface in the vicinity of the proposed site from the predevelopment period to 1989, based on annual-average conditions, range from 30 to 50 ft (SWFWMD, 1993a). Under worst-case conditions (dry season during May 1989 drought year), declines in the potentiometric surface exceeded 60 ft in many areas.

Besides the declines in water levels, other significant hydrologic trends have been observed during the past decade in the SWCFGWB. Wells west of I-75 have experienced increasing trends in chloride concentrations while several wells in the interior areas (east of I-75) have experienced increasing trends in sulfate concentrations. In addition, lowering of lake levels in Highlands and Polk Counties in the recharge area of the basin, the Highlands Ridge, has been observed since the late 1960s (SWFWMD, 1993a).

To gain a perspective on the nature of the cumulative effects to groundwater resources, withdrawals from the proposed project were compared to the estimated 1990 average daily water use in the four-county regional study area. Groundwater was the source of approximately 80 percent of water used in the region (SWFWMD, 1993a). In 1990, water use in the four-county study area averaged 928.4 mgd. The proposed Polk Power Station project would use approximately 6.6 mgd, or 0.7 percent of the 1990 usage. Table 4.13.3-1 lists major water uses in the four-county regional study area in 1990. Agriculture was by far the largest user, accounting for 48.9 percent of estimated 1990 usage. Public supply, industrial, and mining uses combined accounted for 46.3 percent of use. (SWFWMD, 1992)

By 2020, average water use is projected to increase by 347.4 mgd (37.4 percent) in the four-county region. The three largest areas of increase are agricultural (152.7 mgd), public supply (144.2 mgd), and industrial (64.2 mgd). Mining uses are projected to decrease during this timeframe by approximately 33.2 mgd. The projected increase due to withdrawals from the Polk Power Station project represents 1.9 percent of the increase in use between 1990 and 2020. (SWFWMD, 1992) However, some reduction in groundwater withdrawals would occur on the site following cessation of mining activities. Table 4.13.3-2 lists projected 2020 average daily water use and percentage increase in average daily water use between 1990 and 2020.

Consideration of the cumulative effects of groundwater withdrawal have previously been discussed in Section 3.3 and 4.3. Major regional water users (average permitted quantities above 0.5 mgd)

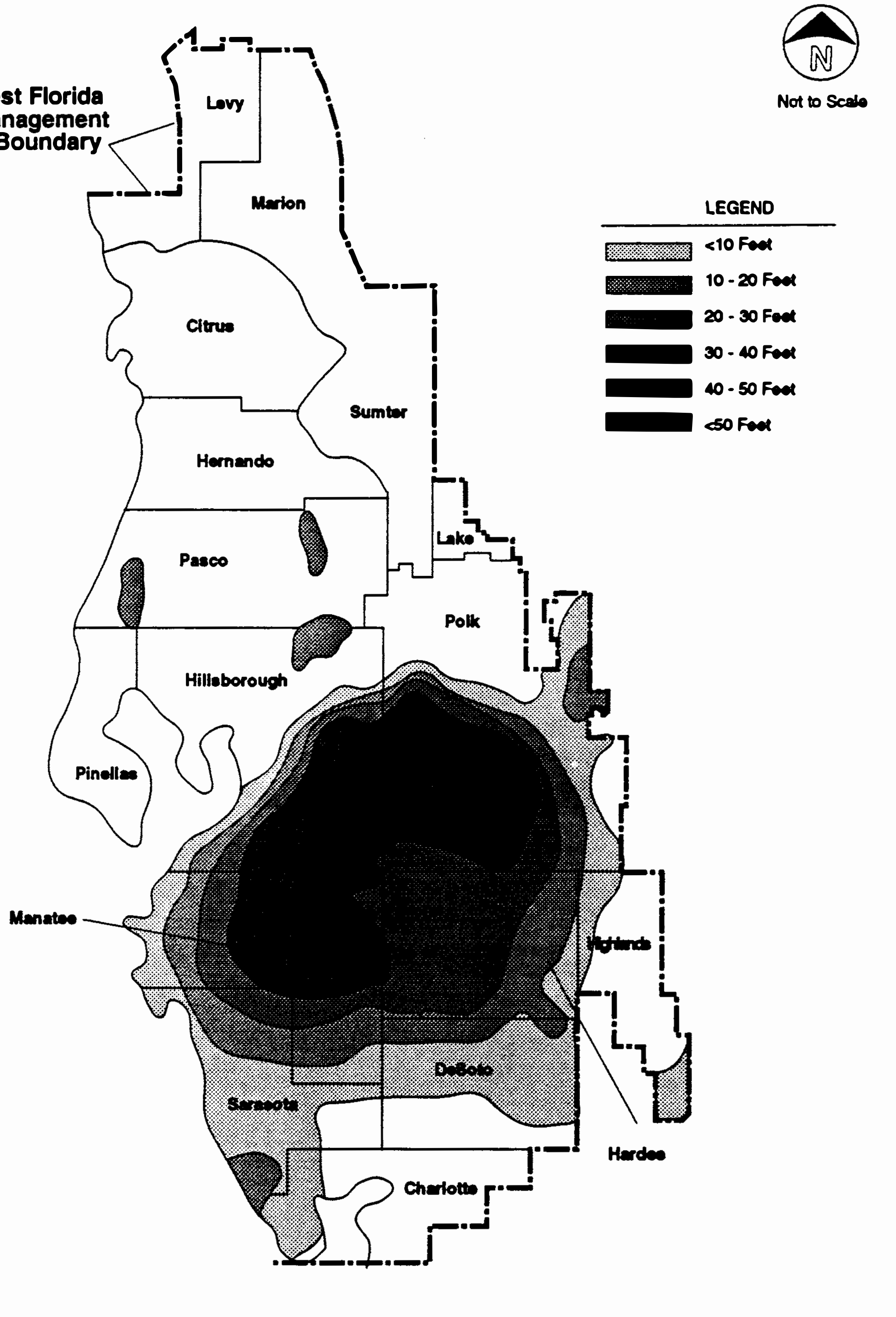

FIGURE 4.13.3-1.
Decline of the Upper Floridan Aquifer Potentiometric Surface: Predevelopment Period to 1989 Annual Average Condition.

SOURCE: SWFWMD, 1993a.

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Table 4.13.3-1. Total Estimated Average Daily Water Use (mgd) in 1990 in Hardee, Hillsborough, Manatee, and Polk Counties

County	Public Supply	Rural	Agriculture	Industrial	Mining	Recreation	Total
Hardee	0.9	2.0	82.3	0.1	1.9	0.2	87.4
Hillsborough	113.8	5.6	110.0	22.3	27.9	11.4	291.0
Manatee	29.0	0.7	121.4	13.4	1.6	2.5	168.6
Polk	60.5	14.5	140.4	67.7	90.7	7.6	381.4
Totals	204.2	22.8	454.1	103.5	122.1	21.7	928.4

Source: SWFWMD, 1992.

Table 4.13.3-2. Total Estimated Average Daily Water Use (MGD) in 2020 in Hardee, Hillsborough, Manatee, and Polk Counties and Projected Percent Change in Average Daily Water Use in Regional Study Area 1990 - 2020

	Public Supply		Rural		Agriculture		Industrial		Mining		Recreation		Total	
County	2020	% Change 1990-2020	2020	% Change 1990-2020	2020	% Change 1990-2020	2020	% Change 1990-2020	2020	% Change 1990-2020	2020	% Change 1990-2020	2020	% Change 1990-2020
Hardee	1.0	11.11%	2.2	10.00%	86.7	5.35%	3.9	3,800.00%	51.2	2,594.74%	0.2	0.00%	145.2	66.13%
Hillsborough	201.4	76.98%	16.9	201.79%	145.5	32.27%	22.3	0.00%	0.6	-97.85%	16.2	42.11%	402.9	38.45%
Manatee	50.4	73.79%	0.6	-14.29%	150.0	23.56%	13.3	-0.75%	0.0	-100.00%	3.8	52.00%	218.1	29.36%
Polk	95.6	58.02%	12.8	-11.72%	224.6	59.97%	128.2	89.36%	37.1	-59.10%	11.3	48.68%	509.6	33.61%
Totals	348.4	70.62%	32.5	42.54%	606.8	33.63%	167.7	62.03%	88.9	-27.19%	31.5	45.16%	1275.8	37.42%

Source: SWFWMD, 1992.

considered in the regional groundwater modeling for the project are shown in Table 4.13.3-3. The area considered for modeling purposes included a 36- by 42-mile area (967,680 acres) believed to encompass all influenced areas. Potential average and maximum withdrawals from water supply wells in the study area with average permitted quantities above 0.5 mgd total 54.0 mgd and 89.4 mgd, respectively. Potential average and maximum withdrawals from mining uses in the study area total 203.4 mgd and 281.7 mgd. Finally, average and maximum permitted withdrawals from industrial uses total 108.7 mgd and 171.1 mgd (Table 4.13.3-3).

Future foreseeable consequences to groundwater resources could result from new proposed facilities in the region, such as the Auburndale Cogeneration facility, the Ridge Cogeneration facility, and the FPC power station east of the site. As noted above, the major increases in water usage are projected to result from increased public supply demand and from agricultural uses. Mining water use is expected to decline over 59 percent in Polk County and 27 percent in the four-county regional study area by the year 2020.

Groundwater level measurements taken of the Floridan aquifer system at the Polk Power Station site showed the potentiometric surface ranged from approximately 40 to 53 ft-NGVD from the end of the dry season (May 1991) to the end of the wet season (October 1991). As discussed in Section 4.3.1.2, a regional model of the Floridan aquifer centered on the Polk Power Station was developed using MODFLOW to assess the drawdown effects from plant operation. Conclusions were that a peak pumping rate of 9.3 mgd would cause an 8.8-ft drawdown within the active wellfield, a drawdown of 5.8 ft a distance of 0.5 mile from the pumped well, and a maximum drawdown of 2.0 ft at a distance of 5 miles from the pumped well. The proposed withdrawal rates from and estimated drawdowns within the upper Floridan aquifer are not expected to cause or result in saltwater intrusion. In addition, based on the conditions simulated, no existing legal withdrawal is expected to be adversely affected. A groundwater monitoring program would be developed and implemented for the operation of the proposed project in accordance with applicable FDEP regulatory requirements under Chapter 17-28, Part VII, FAC (see DEIS, Appendix S).

The proposed project processes and systems would be designed to maximize water reuse and recycling, minimize groundwater withdrawals, minimize water consumption, and optimize the water quality of the off-site surface water and groundwater discharges. The water cooling system alternatives and the cooling water makeup/process water source alternatives are discussed in Sections 2.6.3 and 2.6.4, respectively.

Due primarily to concerns about overpumping and saltwater intrusion, the SWFWMD established the Southern Water Use Caution Area (SWUCA) in October 1992. The area encompasses approximately 5,100 mi^2 and lies south of Interstate 4 in Polk County and SR 60 in Hillsborough County (Figure 4.13.3-2). A Southern Basin SWUCA Work Group was authorized by the Governing Board of the SWFWMD to help solve problems in the area. The Work Group is to develop short- and mid-

Table 4.13.3-3. Water Use Permits (WUP) with Average Permitted Quantities Above 0.5 mgd as of August 1990 (Page 1 of 2)

Map Number	Name	Total Average Permitted (mgd)	Total Maximum Permitted (mgd)
Water Supply Wells			
1	City of Mulberry	1.3	1.8
2	City of Fort Meade	1.7	3.3
3	City of Bartow	3.5	6.3
4	Polk County Board of County Commissioners/Lake Garfield	1.3	2.8
5	Polk County Board of County Commissioners/Lake Garfield	1.6	2.5
6	City of Winter Haven	7.6	13.1
7	South Central Hillsborough Regional	24.1	44.6
8	City of Wauchula	0.9	1.5
9	MCPWD-East County Wellfield	12.0	13.5
	Subtotal--Water Supply Wells	54.0	89.4
Industrial Wells			
1	Allsun Products	0.7	1.0
2	Nitram, Inc.	0.6	0.9
3	W.R. Grace & Company	7.5	8.6
4	IMC Fertilizer, Inc.	3.7	4.6
5	U.S. Agri-Chemicals	7.4	9.7
6	Royster Company	2.0	2.5
7	Conserv, Inc.	6.3	10.5
8	Orange-Co of Florida, Inc.	0.7	--
9	Mobil Mining & Minerals Company	13.3	15.1
10	CF Chemical, Inc.	7.8	18.5
11	Farmland Industries, Inc.	9.5	15.0
12	Kaplan Industries, Inc.	1.0	--
13	IMC Fertilizer, Inc.	20.7	32.0
14	Tampa Electric Company	1.0	1.9
15	Tampa Electric Company	8.6	10.8
16	Agrico Chemical Company	2.3	8.2
17	U.S Agri-Chemicals	8.6	12.0
18	Florida Power & Light Company	1.9	8.6
19	American Orange Corporation	1.3	2.6
20	TECO Power Services--Hardee Power Station	3.8	8.6
	Subtotal--Industrial Wells	108.7	171.1

Table 4.13.3-3. Water Use Permits (WUP) with Average Permitted Quantities Above 0.5 mgd as of August 1990 (Page 2 of 2)

Map Number	Name	Total Average Permitted (mgd)	Total Maximum Permitted (mgd)
Mining Wells			
1	IMC Fertilizer, Inc.	0.5	0.7
2	IMC Fertilizer, Inc.	2.7	3.6
3	Mobil Mining & Minerals Company	13.2	15.1
4	IMC Fertilizer, Inc.	23.3	27.0
5	Phillips & Jordan, Inc. (Corporation)	0.5	2.2
6	IMC Fertilizer, Inc.	20.7	32.0
7	Seminole Fertilizer, Inc.	5.8	7.2
8	Mobil Mining & Minerals Company	14.0	15.0
9	IMC Fertilizer, Inc.	7.5	14.8
10	Mobil Oil Corporation	6.4	7.9
11	IMC Fertilizer. Inc.	6.0	7.7
12	U.S. Agri-Chemicals	9.3	15.3
13	Gardinier, Inc.	12.0	15.0
14	Estech, Inc.	6.5	13.7
15	Agrico Mining Company	9.0	12.0
16	Agrico Mining Company	13.8	17.3
17	Mobil Mining & Minerals Company	16.5	19.0
18	IMC Fertilizer, Inc.	10.8	15.0
19	CF Industries, Inc.	7.7	10.3
20	Nu-Gulf Industries, Inc.	8.0	12.9
21	Farmland Industries, Inc.	9.2	18.0
	Subtotal--Mining Wells	203.4	281.7
	TOTAL	366.1	542.2

Source: TEC, 1992a.

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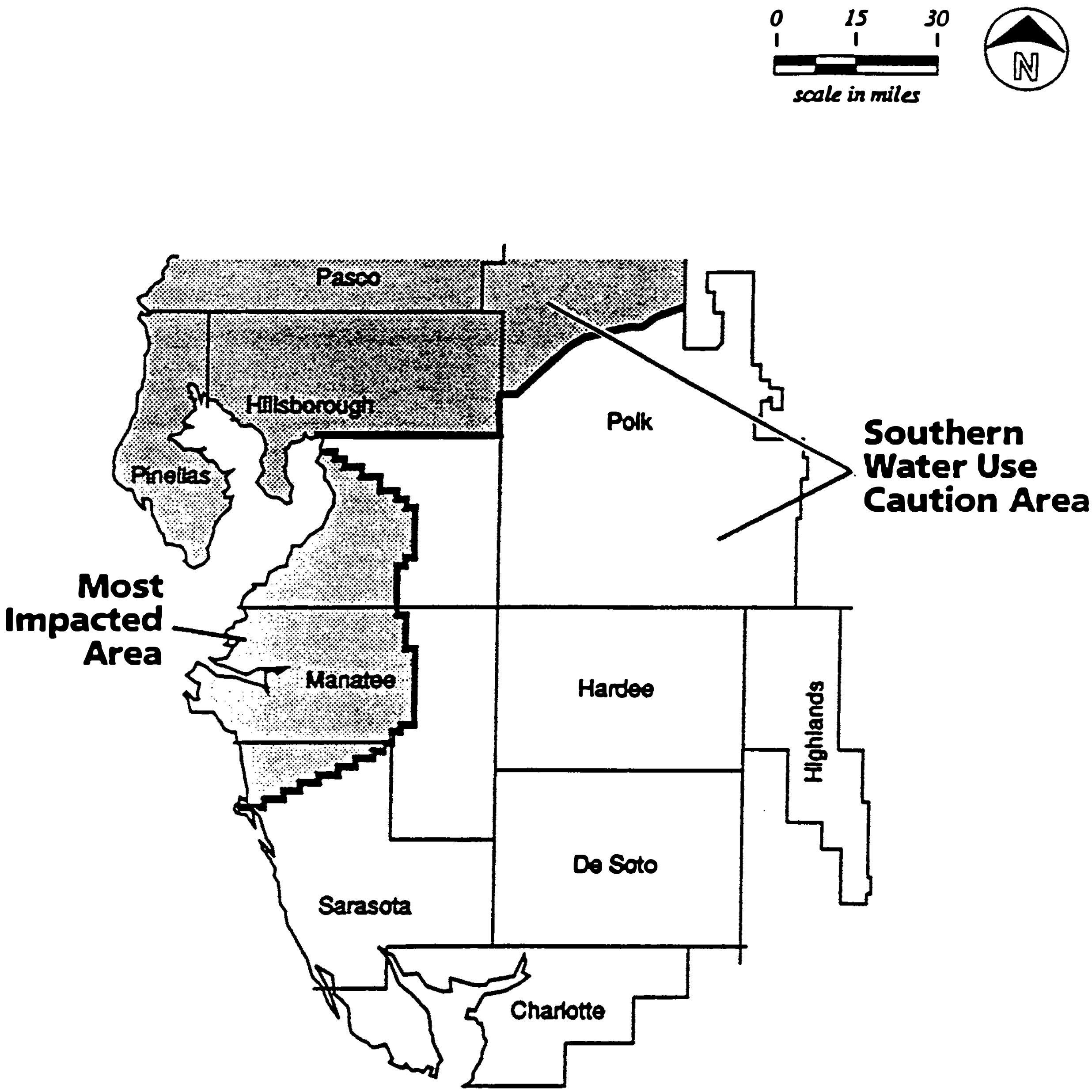

FIGURE 4.13.3-2.
Location of the Most Impacted Area (MIA) and the Southern Water Use Caution Area (SWUCA).

SOURCE: SWFWMD, 1993a.

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term recommendations to the Governing Board that will include management options within the SWUCA. Final recommendations are expected in the latter part of 1993 (SWFWMD, 1993b). A Draft Management Plan for the Southern Basin SWUCA was published by SWFWMD in April 1993 for discussion purposes (SWFWMD, 1993c).

In 1989, total groundwater use in the SWUCA was estimated at 839 mgd. Agriculture accounted for 536 mgd (63 percent), public supply about 123 mgd (15 percent), and mining and industrial uses approximately 168 mgd (20 percent). From 1970 to 1990, public supply, including surface water use, has increased from 60 to 165 mgd. Industrial and mining use has declined from 233 mgd in 1977 to 162 mgd in 1990. Reduction is primarily due to recycling of water by the phosphate mines initiated in the late 1970s and reduced phosphate mining activities in the late 1980s due to economic conditions (SWFWMD, 1993b).

The primary goal of the draft management plan is "to halt regional deterioration of groundwater quality and lowering of lake levels in the SWUCA by maintaining the potentiometric surface of the Floridan aquifer at levels necessary to keep the freshwater/saltwater interface at or near its current location, and to maintain lake fluctuations in the Highlands Ridge at or above those experienced in recent years." It should be noted that the SWFWMD has been a commenting agency in the state site certification process.

4.13.4 Cumulative Geologic and Soil-Related Impacts

The predominant land use in the vicinity of the Polk Power Station is phosphate mining, which has a significant direct effect on the geology and soils in the region. The Polk Power Station would have no measurable effect on the future mining of phosphate in the region since it would occupy lands previously mined. The proposed Polk Power Station would have a primarily beneficial impact on the geology and soils within the site boundaries. The planned reclamation activities would return the land surface to resemble premining conditions and will allow the soils to regain more natural characteristics.

Since the Polk Power Station would not alter the degree of phosphate mining in the region, no impacts to phosphatic (and overlying) strata would occur. Coal and oil extractions to fuel the Polk Power Station are impacts related to the proposed project. These impacts are separately reviewed and controlled through other relevant state and federal permitting regulations.

4.13.5 Cumulative Terrestrial and Aquatic Ecological Impacts

The loss of 253 acres of jurisdictional wetlands would be offset by the proposed mitigation plan (see Section 5.2.3 and Appendix C). The proposed reclamation development plan for the site would meet and, in some cases, exceed the FDEP regulatory requirements for reclamation of mined lands. The proposed plan would result in an overall net increase in wetland acreages compared to premining conditions (see Table 5.2.3-1). Reclamation of the site would increase both potential habitat acreage and habitat diversity. Other cumulative effects such as loss of wetlands or loss of habitat for endangered or threatened species or species of special concern are not anticipated.

4.13.6 Cumulative Socioeconomic Impacts

While not directly leading to further development in Polk County and surrounding counties, availability of electric power can be expected to secondarily support additional population growth and economic development.

Economic development analysts designate establishments engaged in manufacturing production and certain types of service activities as the prime determinants of community growth. For a community to grow, it must manufacture and export goods and services to regions beyond its own area or engage in activities that will bring new money into its economy. Development induced by construction and operation of the proposed Polk Power Station, even if large multiplier effects are assumed, would still be a minor component of population growth and economic development in the region. Much of the population growth in the area is attributable to in-migration, a high proportion of whom are retirees that have decided to retire in Florida. It is unlikely that availability of electrical energy, an ubiquitous service in Florida, is one of the prime factors influencing the relocation decisions of in-migrants.

A large number of factors influence a firm's relocation decision. The advent of electric power and continued improvements in long distance transmission technology has made most of today's industry free from dependency upon the location of power sources. Only a few industries have transmission requirements or electrical costs per dollar of product value great enough to make them dependent on power source locations. The electrical costs incurred by most industries are low in comparison to the total value of their finished product. Therefore, availability of electrical power is not the decisive locational factor for most industry.

FPSC is responsible for determining and approving the need for construction of new power plants in Florida. By statute, FPSC must consider four specific items in determining the need for a new power plant: need for electric system reliability and integrity, need for adequate electricity at a reasonable cost, cost-effectiveness of the proposed power plant versus available alternatives, and conservation measures that might mitigate the need for the proposed power plant. These items are evaluated not only in relation to the needs of the applicant but also to the power supply and customer needs of Florida. Tampa Electric Company, as a public utility, has the obligation to provide reliable and economical electric power service to its existing and future customers. Additional power supply needs are primarily based on future electricity demands created by ongoing and projected population growth within its service area.

Compared to many other regions of the nation, the Lakeland-Winter Haven MSA is expected to grow rapidly. The long-term population forecast for the Lakeland-Winter Haven MSA calls for population in Polk County to increase from 443,700 in 1995 to 540,000 by the year 2010. By the year 2020, population is projected to reach 596,000 persons. During the time the proposed Polk Power Station is under construction (1994-2010), population in Polk County is projected to increase by 96,300 persons (BEBR, 1992a).

Faced with continued population growth, Florida enacted some of the most stringent growth management regulations in the nation in the 1980s. Today, the vast majority of counties and municipalities have in place both comprehensive plans and land development regulations to manage the effects of growth. A critical feature of Florida's Growth Management Act is concurrency, which requires that the necessary public facilities and services to maintain locally adopted levels of service must be available when the effects of development occur. Public facilities that must be available concurrent with the impacts of development. Public facilities for which LOS standards must be adopted, roads, sanitary sewer, solid waste, drainage, potable water, parks and recreation, and mass transit, if applicable. It is through each local government jurisdiction's concurrency management system that cumulative impacts to facilities and services are addressed. As previously addressed, the proposed Polk Power Station would comply with Polk County's Concurrency Management Ordinance. From the standpoint of cumulative impacts, each new development in Polk County is also required to comply with the county's concurrency requirements.

4.13.7 Cumulative Impact Comparison by Construction Phase

Analyses were conducted to determine the potential cumulative impacts associated with the proposed development phases of the Polk Power Station. Phase I would include the construction and operation of one IGCC and its associated facilities. Phase II would involve the addition of two CC units and a simple-cycle CT unit. At full build-out, Phase III, five simple-cycle CT units will be added.

4.13.7.1 Air Pollutant Impacts

Comparison of the potential air quality impacts of emissions from the Polk Power Station by operational phases are shown in Table 4.13.7-1. The IGCC unit and its associated systems will be the major contributor of SO_2 and NO_x emissions. Relatively lower quantities of CO, VOC, PM, and other trace constituents present in the fuel will also be released from the IGCC unit.

The estimated annual emissions of SO_2 from the IGCC unit (Phase I, post-demonstration) would be 1,773 tpy. An additional 720 and 650 tpy of SO_2 would be generated by the CC (Phase II) and CT (Phase III) units, respectively. The IGCC unit would produce about 56 percent of the total estimated annual emissions of SO_2 at full build-out (3,147 tpy). The CC units would contribute approximately 23 percent of the total annual emissions with the remaining 21 percent attributed to the CT units.

Estimated IGCC, CC, and CT annual emissions of NO_x are 1,099, 1,308, and 1,014 tpy, respectively. The total estimated annual emissions of NO_x at full build-out is 3,4211 tpy. The IGCC unit would produce approximately 32 percent of the total annual emissions of NO_x with the CC units contributing approximately 38 percent and the CT units contributing approximately 30 percent.

Table 4.13.7-1. Summary of Cumulative Impacts Relative to Phases of the Polk Power Station (Page 1 of 2)

IMPACT	Cumulative Impacts Comparison by Phase			
	Post Demonstration PHASE I IGCC UNIT*	PHASE II CC UNITS†	PHASE III CT UNITS‡	FULL BUILD-OUT
AIR POLLUTANT IMPACTS (tpy)				
$PM(PM_{10})$§	414	260	246	920
SO_2	1,773	720	654	3,147
NO_x	1,116	1,308	1,014	3,421
CO	471	1,092	978	2,541
Ozone/VOC	51	180	168	399
Lead	0.10	0.28	0.17	0.55
H_2SO_4 mist	249	80	72	401
Fluorides	0.92	0.17	0.1	1.19
Mercury	0.02	0.21	0.19	0.42
Beryllium	0.009	0.013	0.008	0.0380
Total reduced sulfur (Incld H_2S)	8.0	0	0	8.0
Reduced sulfur compounds (Incld H_2S)	8.0	0	0	8.0
Vinyl Chloride	0	0	0	0
Asbestos	0	0	0	0
CONSTRUCTION & EMPLOYMENT IMPACTS				
Construction Personnel (Average Personnel Per Phase)	650	83	73	N/A
Operational Personnel (Total Personnel Per Phase)	130	182	210	N/A
LAND USE IMPACTS				
Transportation (Estimated Traffic Volume)	530	197-220	225	N/A
Cooling Reservoir Area (acres)	860	860	0	860
Fuel Delivery				
Coal Delivery, Rail (Train Units per Week)	2	N/A	N/A	N/A
Coal Delivery, Truck (Trucks per Day)	80-100	N/A	N/A	N/A

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Table 4.13.7-1. Summary of Cumulative Impacts Relative to Phases of the Polk Power Station (Page 2 of 2)

	Cumulative Impacts Comparison by Phase			
IMPACT	Post Demonstration PHASE I IGCC UNIT*	PHASE II CC UNITS†	PHASE III CT UNITS‡	FULL BUILD-OUT
WATER SUPPLY IMPACTS				
Monthly Process Water Demand				
Service Water Uses (gpd)	72,400	0	109,200	181,600
Demineralized Water Uses (gpd)	333,700	513,300	280,600	1,127,600
Cooling Reservoir Required Flows (gpm)	115,800	247,000	0	N/A
NOISE IMPACTS				
Plant Operational Related Noise (dB: $L_{eq(24)}$)‖	50	51	51	51
Coal Delivery, Truck Related Noise (dB: $L_{eq(1)}$)#	≤57.5	≤57.5	≤57.5	57.5

Notes: One 75-MW CT in Phase II was considered as Phase III for this analysis.
This table has changed from the DEIS because of modifications to the design of the proposed facility. See tables in Chapter 2.0 for more detail.

* IGCC emissions include the highest annual emissions estimates from the 7F CT (based on the larger of 100 percent CGCU or 50/50 CGCU/HGCU), plus related combustion emissions (e.g., thermal oxidizer), plus other associated process and fugitive emissions (PM, CO, VOC, and H_2S).
† CC emissions represent the totals for four stand-alone CTs in CC mode.
‡ CT emissions represent the totals for six stand-alone CTs in simple-cycle mode.
§ PM(PM_{10}) includes H_2SO_4 mist.

‖ Noise impacts predicted for the nearest residence (1.6 miles from power block).
Noise impacts predicted for the nearest residence 85 feet from the edge of the proposed truck delivery route. Analysis was conducted for full build-out. Noise levels for other phases can be expected to be similar to or less than for full build-out (57.5 dB: $L_{eq(1)}$)

Source: Modified from TEC, 1992a.

The IGCC unit and its associated facilities would produce over 43 percent of the total annual emissions for both SO_2 and NO_x. Cumulative impacts to air quality from emissions related to the construction of the CC and CT units would result in an increase of approximately 31 percent and 26 percent of the total annual emissions of SO_2 and NO_x per phase at full build-out. Individually, the CC and CT units would have lower combined SO_2 and NO_x emission rates per unit than the IGCC unit. However, at full build-out, the CC and CT units combined would generate as much total SO_2 and NO_x as would the IGCC unit.

4.13.7.2 Construction and Employment Impacts

As shown in Table 4.13.7-1, employment is expected to be highest during initial project phases (Phase I) because of the construction activities associated with overall site reclamation and construction. Construction employment would average approximately 650 personnel throughout the 27-month initial construction phase. The construction labor force would be reduced to an average of 73 to 83 personnel during the construction of the CC and CT units. Most of these construction personnel would be drawn from Polk County and commute to the job site from nearby cities. Construction employees moving to the area from outside the region would range from a peak of 70 persons during the initial construction phase to a peak of five persons during the subsequent construction of the CT and CC units.

The IGCC unit will employee an estimated 130 operational related personnel. The addition of the CC and CT units will increase the number of personnel employed by 52 and 22, respectively. At full build-out, the Polk Power Station will employ approximately 210 operational related personnel. Cumulative impacts related to the increase in operational personnel employed are expected to be insignificant.

4.13.7.3 Water Supply Impacts

Water to supply the potable, process, and cooling reservoir makeup needs for proposed operation would be provided by groundwater withdrawals from the Floridan aquifer. It is estimated that the total groundwater withdrawal would be approximately 9.3 mgd on a maximum daily basis and 6.4 mgd under average annual operations at full build-out.

The monthly average process water demand is projected to be approximately 0.33 mgd with the IGCC unit operating alone. Additional groundwater withdrawals of 0.51 mgd and 0.28 mgd would be required by the CC and CT units, respectively. Estimated withdrawal quantities for the CC and CT units are based on the use of water injection for control of NO_x emissions in those units when fuel oil is used. If the CC and CT units are fired with natural gas, NO_x control is no longer needed resulting in reduced need for withdrawal.

The total monthly average water demand is estimated to be approximately 5.2 mgd with the IGCC unit in operation only, and approximately 6.4 mgd at full build-out. The addition of CC and CT units would increase withdrawals by 1.2 mgd.

To provide a perspective on the cumulative impacts from withdrawals to groundwater resources, withdrawals from the proposed action were compared to estimated 1990 average daily water use for four counties in the vicinity of the proposed Polk Power Station. In 1990, water use in the four-county study area averaged 928.4 mgd. At full build-out, the Polk Power Station would use approximately 6.4 mgd on a monthly average, or 0.7 percent of the 1990 usage. Furthermore, the addition of the CC and CT units will use approximately 0.1 percent of the 1990 usage withdrawals in the local vicinity. Thus, cumulative impacts to regional groundwater resources associated with the operation of the IGCC unit, as well as the additions of the CC and CT units, are considered to be insignificant.

The steam electric generating components of the proposed IGCC unit and two CC units require water to cool or condense exhaust steam. The proposed cooling reservoir that would provide the necessary water for cooling would be constructed in the mined areas currently filled with water. The total water surface area would be an estimated 727 acres. The monthly maximum water makeup supplied to the reservoir from groundwater withdrawals would be 6.5 mgd. The required recirculating cooling water flows would be nearly 115,800 gpm for the IGCC unit and 247,000 gpm with the addition of the two CC units. Cumulative impacts to the required reservoir capacity associated with the operation of the CC units would be approximately 131,200 gpm. This represents an insignificant demand on the total capacity of the cooling reservoir.

4.13.7.4 Land-Use Impacts

The main power plant facility, including the IGCC unit, CC units, and CT units, would be primarily constructed on lands that have not been mined for phosphate, but have been disturbed by associated mining activities. The area developed for the main power plant facilities would be approximately 150 acres, or 3 percent of the entire proposed Polk Power Station site. Since the entire power plant facility site would be prepared during the initial construction of the IGCC unit, there would be limited additional impacts to land use, soils, geology, or topography from the construction or operation of the additional CC and CT units.

4.13.7.5 Transportation Impacts

Phase I construction-related transportation impacts would occur from the movement of construction personnel, machinery, and equipment to and from the proposed Polk Power Station site. The initial construction phase would employ an average of 650 employees. Impacts associated with this phase are expected to be temporary and would not have significant adverse effects on the transportation facilities.

While the proposed project, including all phases through full build-out, would have some operation-related impacts, all existing roadway links and intersections are expected to operate at an acceptable LOS.

Fuel deliveries of natural gas, fuel oil, and coal are expected to the proposed Polk Power Station. Coal would be delivered to the site either by unit train (70-100, 100 ton-cars) rail cars or by trucks. Two unit trains per week would be needed to meet the IGCC's fuel requirements if all coal is delivered by train. If all coal is delivered by truck, 80 to 100 daily, 28-ton payload capacity trucks would be needed. Natural gas would be directly delivered to the site via pipelines from the existing and future natural gas transmission system in the region.

Cumulative impacts to transportation facilities associated with delivery of coal to the IGCC unit are judged to be insignificant. Furthermore, there would be no cumulative impacts associated with delivery of natural gas to the CC and CT units since the fuel would be transmitted via pipeline.

4.13.7.6 Noise Impacts

The major construction activities for the proposed Polk Power Station project involve the construction of the IGCC, the two CC units, and the six simple-cycle CT units. Construction of the IGCC unit and associated facilities, as well as initial overall site preparation, would encompass the bulk of construction-related noise. Construction of the CC and CT units would be of a much smaller scale with overall site preparation scheduled for completion prior to construction of the CC and CT units. Thus, cumulative impacts related to the construction of the CC and CT units would be insignificant relative to the construction of Phase I.

Potential operational noise impacts were assessed for a select group of residential receptors in the vicinity of the proposed Polk Power Station. Table 4.13.7-1 presents the results of the noise modeling at each of the three receptor locations for three different phases in the overall project development (i.e., IGCC unit only, IGCC and CC units, and full build-out). For the IGCC unit only, the highest $L_{eq(24)}$ value predicted is 51 dB. The highest $L_{eq(24)}$ of 51 dB was also predicted for the other two development phases. In summary, the cumulative impacts from plant operations are not expected to cause significant noise impacts to the area surrounding the proposed Polk Power Station.

The cumulative noise impacts to residences from increased traffic associated with the Polk Power Station together with existing traffic noise along SR 674 should not result in the exceedance or significantly contribute to the exceedance of FHWA noise guidelines (although FHWA guidelines additionally consider background noise contributions not considered here). The maximum noise level associated with the project traffic would be the passing of construction-related trucks, approximately 91 dB at 50 ft (EPA, 1971). This level is currently experienced along the proposed coal delivery route numerous times throughout the day and night due to ongoing truck traffic associated with phosphate mining operations, and other trucking.

Because actual site-specific data on current truck traffic noise are not available, the FDOT FLAMOD traffic noise model was used to estimate current traffic noise for comparison to the project-related noise. The maximum possible daily truck traffic trips for the Polk Power Station would be 302 trips/day (total to and from the site). This estimate includes 160 trips/day coal delivery, 112 trips/day fuel oil delivery, 12 trips/day by-product hauling, and 18 trips/day slag hauling. This scenario is for full build-out, assuming no back-hauling of slag and by-products by coal trucks, and requirement of fuel oil backup fuel instead of natural gas. Assuming all trucks followed the same route, and if 10 percent of these trips occurred in one hour (they could occur at any time, so 10 percent is a conservative maximum estimate), the $L_{eq(1)}$ would be 57 dB at 100 ft (see Section 4.11.1.2). Existing traffic along SR 674 is approximately 3,600 trips/day (Lincks, 1992). Assuming 10 percent of the daily volume occurs in the maximum hour (Lincks, 1992) and 13 percent are heavy trucks (Kimley-Horn, 1989), the $L_{eq(1)}$ at 100 ft is 63 dB, 6 dB higher than the Polk Power Station project contribution. The addition of the project would increase the peak hour overall traffic noise by approximately 1 dB, which is typically not a detectable increase.

4.13.7.7 Impacts from Construction of Other Power Facilities in the Area

Three other power facilities are scheduled to begin operation in the area before the year 2000. These are the proposed Mission Energy Company, Auburndale Destec Energy, Inc., Tiger Bay, Decker-Ridge, Inc., Ridge, and FPC Polk County facilities. The construction schedules of these facilities are staggered such that no significant cumulative construction impacts should occur. The Auburndale facility is scheduled to begin operation in June 1994 and the Tiger Bay facility January 1995. As previously discussed, the major peak in construction activities at the proposed Polk Power Station would occur from 1994 to 1996 with the IGCC unit becoming operational in 1996. The first phase of the FPC facility is scheduled to begin operation in 1998. Construction peaks for the FPC facility would be after the construction peaks for the proposed Polk Power Station.

4.13.7.8 Induced Impacts

As discussed in Section 4.13.6, while not directly leading to further development in Polk and surrounding counties, the proposed project and availability of electric power can be expected to secondarily support additional population growth and economic development in the region. Accordingly, developments resulting from this secondary or induced growth can be expected to create additional potential impacts in the region such as additional air pollution, soil erosion, water use, and wetland losses. These potential developments and impacts would be reviewed and controlled separately from this EIS by applicable federal, state, and local permitting and approval processes.