Appendix E

Applicant's Environmental Report

Subsequent Operating License Renewal Stage

Turkey Point Nuclear Plant Units 3 and 4

January 2018

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS, ACRONYMS, AND SYMBOLS

$	dollar(s) (U.S.)
§	Section
%	percent
°C	degrees Centigrade
°F	degrees Fahrenheit
ΔT	vertical differential temperature
AADT	average annual daily traffic
AD	anno Domini—with respect to time period
AEA	Atomic Energy Act
AECW	auxiliary equipment cooling water
ALARA	as low as reasonably achievable
AO	administrative order
APE	area of potential effect
APT	aquifer performance test
AQCR	air quality control region
ARB	Air Reserve Base
AREOR	annual radiological environmental operating report
ARNI	Aquatic Resources of National Importance
BBWQ	Biscayne Bay water quality
BC	before Christ—with respect to time period
BG	billion gallons
BGPA	Bald and Golden Eagle Protection Act
bgs	below ground surface
BMP	best management practice
Btu	British thermal unit

C&SF	Central and Southern Florida Flood Control District
C&SF-SDCS	Central and Southern Florida-South Dade Conveyance System
CA	consent agreement
CAA	Clean Air Act; addendum to the October 2015 CA
CAP	corrective action program
CCS	cooling canal system
CCW	component cooling water
CDF	core damage frequency
CDMP	Comprehensive Development Master Plan
CERP	Comprehensive Everglades Restoration Plan
CFR	Code of Federal Regulations
cfs	cubic feet per second
cm^2	square centimeter
CO	carbon monoxide; consent order
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CO_2e/kWh	carbon dioxide equivalent per kilowatt hour
COC	Condition of Certification
COL	combined operating license
CSP	concentrated solar power
CVCS	chemical and volume control system
CWA	Clean Water Act (Federal Water Pollution Control Act)
DAW	dry active waste
dBA	A-weighted decibel
DCS	distributed control system

DECON	immediate dismantling and decontamination, one of three NRC decommissioning strategies
DHR	Division of Historic Resources
DOE	U.S. Department of Energy
DOH	Department of Health (Florida)
DPS	distinct population segment
DSM	demand side management
E	east
EAB	exclusion area boundary
EAI	Ecological Associates, Inc.
EDG	emergency diesel generator
EF	enhanced Fujita (tornado scale ranging from 0 to 5)
EFH	essential fish habitat
EIA	Energy Information Administration
EIS	Environmental Impact Statement
ENP-SDCS	Everglades National Park-South Dade Conveyance System
ENTOMB	permanent entombment on site, one of three NRC decommissioning strategies
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
EPU	extended power uprate
ER	environmental report
ESA	Endangered Species Act
EZEMF	EZEMF computer code
F	Fujita (tornado scale)
FAA	Federal Aviation Administration
FAC	Florida Administrative Code

FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FES	final environmental statement
FFWCC	Florida Fish and Wildlife Conservation Commission
FLEX	NRC Order EA-12-049 Mitigation Strategies for Beyond-Design-Basis External Events
FMSF	Florida Master Site File
FNAI	Florida Natural Areas Inventory
FPL	Florida Power & Light Company
FPPA	Farmland Protection Policy Act
fps	feet per second
ft^2/day	square feet per day
ft^3	cubic feet
FPSC	Florida Public Service Commission
FY	fiscal year
GEIS	NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*
GHG	greenhouse gas
gpd/ft	gallons per day per foot
GPI	groundwater protection initiative
gpm	gallons per minute
GWh/yr	gigawatt hours per year
HAP	hazardous air pollutant
HAPC	habitat areas of particular concern
HCM	*Highway Capacity Manual*
HIC	high integrity container

HLW	high-level waste
HUD	U.S. Department of Housing and Urban Development
I-75	Interstate 75
I-95	Interstate 95
ICW	intake cooling water
IGCC	integrated gas-fired combined cycle
IPA	integrated plant assessment
IPEEE	individual plant examination of external events
ISFSI	independent spent fuel storage installation
ISLOCA	interfacing systems loss-of-coolant accident
IWW	industrial wastewater
JRI	Janus Research, Inc.
kV	kilovolt
kV/m	kilovolt per meter
L/min	liters per minute
Leq	noise level equivalent
Ldn	day-night average sound level
LERF	large early release frequency
LLMW	low-level mixed waste
LLRW	low-level radioactive waste
LLW	low-level waste
LOCA	loss-of-coolant accident
LOOP	loss of offsite power
LOS	level of service
LRA	license renewal application
LST	local standard time

LU	land utilization (meteorological tower)
LVW	low-volume waste
m^3	cubic meter
mA	milliamperes
Mb	body-wave magnitude (earthquakes)
MB	maximum benefit
MBTA	Migratory Bird Treaty Act
MDC DERM	Miami-Dade County Department of Environmental Resources Management
MDWASD	Miami-Dade Water and Sewer Department
MEI	maximum exposed individual
mg/L	milligrams per liter
MGD	million gallons per day
MIA	Miami International Airport
MLW	mean level of water
MMBtu	million British thermal units
mph	miles per hour
mrem	millirem
MSA	Magnuson-Stevens Fishery Conservation and Management Act
msl	mean sea level
mSv	millisievert
MSW	municipal solid waste
MW	megawatt
MWd/MTU	megawatt-days per metric ton uranium
MWe	megawatts-electric

MWh	megawatt-hour
MWt	megawatt-thermal
N	north
NA	not available/not applicable
NAAQS	National Ambient Air Quality Standards
NAVD88	North American Vertical Datum of 1988
NCDC	National Climatic Data Center
NCEI	National Centers for Environmental Information
NE	northeast
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act
NESC	National Electrical Safety Code
NETL	National Energy Technology Laboratory
NGCC	natural gas-fired combined cycle
NGVD29	National Geodetic Vertical Datum of 1929
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NNE	north-northeast
NNW	north-northwest
N_2O	nitrous oxide
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NOAA	National Oceanic and Atmospheric Administration
NOV	notice of violation
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service

NRC	U.S. Nuclear Regulatory Commission
NREL	National Renewable Energy Laboratory
NRHP	National Register of Historic Places
NW	northwest
NWI	National Wetlands Inventory
NWS	National Weather Service
ODCM	*Offsite Dose Calculation Manual*
OL	operating license
OSHA	Occupational Safety and Health Administration
OTCW	once-through condenser cooling water
PA	protected area
Pb	lead
pc/h	passenger cars per hour
PCB	polychlorinated biphenyl
pCi/L	picocuries per liter
PILOT	payments in lieu of tax
$PM_{2.5}$	particulate matter less than 2.5 micrometers in diameter
PM_{10}	particulate matter less than 10 micrometers in diameter
PM_t	particulate matter, total
PPSA	Power Plant Siting Act
ppt	parts per thousand
psig	pounds per square inch, gauge
PRA	probabilistic risk assessment
PSD	prevention of significant deterioration
PSU	practical salinity units
PTN	Turkey Point Nuclear Plant Units 3 and 4

PV	photovoltaic
RCRA	Resource Conservation and Recovery Act
RCS	reactor coolant system
rem	roentgen equivalent man
REMP	radiological environmental monitoring program
rms	root mean square
ROW	right-of-way
RWS	recovery well system
RWT	raw water tank
S	south
SAFSTOR	safe storage, one of three NRC decommissioning strategies
SAMA	severe accident mitigation alternative
SAP	site assessment plan
SAR	site assessment report
SBO	station blackout
SCA	site certification application
SDWTP	South District Wastewater Treatment Plant
SEIS	Supplemental Environmental Impact Statement
SERF	small early release frequency
SFWMD	South Florida Water Management District
SHPO	state historic preservation office (or officer)
SLR	subsequent license renewal
SLRA	subsequent license renewal application
SMITTR	surveillance, monitoring, inspections, testing, trending, and recordkeeping
SO_2	sulfur dioxide

SO_X	sulfur oxides
SOR	Save Our Rivers
sp.	single species
SPCC	spill prevention, control, and countermeasure
SPEO	subsequent period of extended operation
spp.	species (plural)
SR	State Route
SSA	sole source aquifer
SSC	system, structure, and component
SSE	south-southeast
SSW	south-southwest
STC	source term category
SU	standard units
SW	southwest
SWPPP	stormwater pollution prevention plan
TDS	total dissolved solids
TEDE	total effective dose equivalent
T&M	test and maintenance
THPO	tribal historic preservation office (or officer)
TIGER/Line	topologically integrated geographic encoding and referencing/line (U.S. Census Bureau spatial data files)
TPC	Turtle Point Canal
TWH	terawatt hour
UFSAR	updated final safety analysis report
UHS	ultimate heat sink
U.S.	United States

US-1	U.S. Highway 1
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USDW	underground source of drinking water
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compound
W	west
WHT	waste holdup tank
WNW	west-northwest
WWTP	wastewater treatment plant

1.0 INTRODUCTION

1.1 Purpose of and Need for Action

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants in accordance with the Atomic Energy Act (AEA) of 1954, as amended, and NRC implementing regulations. Florida Power & Light Company (FPL) operates Turkey Point Nuclear Plant Units 3 and 4 (PTN) pursuant to NRC operating licenses (OLs) DPR-31 and DPR-41, respectively. Based on a license renewal application (LRA) submitted in 2000, the NRC issued renewed OLs in June of 2002, providing authorization to operate for an additional 20 years beyond the original 40-year licensed operating period. Currently, the renewed Unit 3 OL expires at midnight on July 19, 2032, and the renewed Unit 4 OL expires at midnight on April 10, 2033. PTN is located on Biscayne Bay in Miami-Dade County, Florida.

FPL has prepared this environmental report (ER) in conjunction with its application to the NRC for a subsequent renewal of the PTN OLs, as provided by the following NRC regulations:

- Title 10, Energy, Code of Federal Regulations (CFR), Part 54, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, Section 54.23, Contents of Application—Environmental Information [10 CFR 54.23].
- Title 10, Energy, CFR, Part 51, Environmental Protection Requirements for Domestic Licensing and Related Regulatory Functions, Section 51.53, Postconstruction Environmental Reports, Subsection 51.53(c), Operating License Renewal Stage [10 CFR 51.53(c)].

The NRC has defined the purpose and need for the proposed action, renewal of the OLs for nuclear power plants such as PTN, as follows (NRC 2013a):

> The purpose and need for the proposed action (issuance of a renewed license) is to provide an option that allows for baseload power generation capability beyond the term of the current nuclear power plant operating license to meet future system generating needs. Such needs may be determined by other energy-planning decision-makers, such as State, utility, and, where authorized, Federal agencies (other than the NRC). Unless there are findings in the safety review required by the AEA or the National Environmental Policy Act (NEPA) environmental review that would lead the NRC to reject a LRA, the NRC does not have a role in the energy-planning decisions of whether a particular nuclear power plant should continue to operate.

The renewed OLs would allow an additional 20 years of operation for the PTN units beyond their current licensed operating periods. The subsequent renewed license for PTN Unit 3 would expire at midnight on July 19, 2052, and the subsequent renewed license for PTN Unit 4 would expire at midnight on April 10, 2053.

FPL has prepared Table 1.0-1 to verify conformance with regulatory requirements. Table 1.0-1 indicates the sections in the PTN subsequent license renewal (SLR) ER that respond to each requirement of 10 CFR 51.53(c).

Table 1.0-1
Environmental Report Responses to License Renewal Environmental Regulatory Requirements (Sheet 1 of 4)

Description	Requirement	ER Section(s)
Environmental Report—General Requirements [10 CFR 51.45]		
Description of the proposed action	10 CFR 51.45(b)	2.1
Statement of the purposes of the proposed action	10 CFR 51.45(b)	1.0
Description of the environment affected	10 CFR 51.45(b)	3.0
Impact of the proposed action on the environment	10 CFR 51.45(b)(1)	4.0
Adverse environmental effects which cannot be avoided should the proposal be implemented	10 CFR 51.45(b)(2)	6.3
Alternatives to the proposed action	10 CFR 51.45(b)(3)	2.6, 7.0, and 8.0
Relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity	10 CFR 51.45(b)(4)	6.5
Irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented	10 CFR 51.45(b)(5)	6.4
Analysis that considers and balances the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and alternatives available for reducing or avoiding adverse environmental effects	10 CFR 51.45(c)	2.6, 4.0, 7.0, and 8.0
Federal permits, licenses, approvals, and other entitlements which must be obtained in connection with the proposed action and description of the status of compliance with these requirements	10 CFR 51.45(d)	9.0
Status of compliance with applicable environmental quality standards and requirements which have been imposed by federal, state, regional, and local agencies having responsibility for environmental protection, including, but not limited to, applicable zoning and land-use regulations, and thermal and other water pollution limitations or requirements	10 CFR 51.45(d)	9.0

Table 1.0-1
Environmental Report Responses to License Renewal Environmental Regulatory Requirements (Sheet 2 of 4)

Description	Requirement	ER Section(s)
Alternatives in the report including a discussion of whether the alternatives will comply with such applicable environmental quality standards and requirements	10 CFR 51.45(d)	9.7
Information submitted pursuant to 10 CFR 51.45(b) through (d) and not confined to information supporting the proposed action but also including adverse information	10 CFR 51.45(e)	4.0 and 6.3
Operating License Renewal Stage [10 CFR 51.53(c)]		
Description of the proposed action including the applicant's plans to modify the facility or its administrative control procedures as described in accordance with §54.21. The report must describe in detail the affected environment around the plant, the modifications directly affecting the environment or any plant effluents, and any planned refurbishment activities.	10 CFR 51.53(c)(2)	2.1, 2.3, 2.4, 3.0, and 4.0
Analyses of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with license renewal and the impacts of operation during the renewal term, for applicable Category 2 issues, as discussed below	10 CFR 51.53(c)(3)(ii)	2.3 and 4.0
Surface Water Resources		
Surface water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river)	10 CFR 51.53(c)(3)(ii)(A)	4.5.1
Groundwater Resources		
Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river)	10 CFR 51.53(c)(3)(ii)(A)	4.5.2
Groundwater use conflicts (plants that withdraw more than 100 gallons per minute)	10 CFR 51.53(c)(3)(ii)(C)	4.5.3
Groundwater quality degradation (plants with cooling ponds at inland sites)	10 CFR 51.53(c)(3)(ii)(D)	4.5.4
Radionuclides released to groundwater	10 CFR 51.53(c)(3)(ii)(P)	4.5.5

Table 1.0-1
Environmental Report Responses to License Renewal Environmental Regulatory Requirements (Sheet 3 of 4)

Description	Requirement	ER Section(s)
Aquatic Resources		
Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	10 CFR 51.53(c)(3)(ii)(B)	4.6.1
Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds)	10 CFR 51.53(c)(3)(ii)(B)	4.6.2
Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river	10 CFR 51.53(c)(3)(ii)(A)	4.6.3
Terrestrial Resources		
Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river)	10 CFR 51.53(c)(3)(ii)(A)	4.6.4
Effects on terrestrial resources (non-cooling system impacts)	10 CFR 51.53(c)(3)(ii)(E)	4.6.5
Special Status Species and Habitats		
Threatened, endangered, and protected species, and essential fish habitat	10 CFR 51.53(c)(3)(ii)(E)	4.6.6
Historic and Cultural Resources		
Historic and cultural resources	10 CFR 51.53(c)(3)(ii)(K)	4.7
Human Health		
Microbiological hazards to the public (plants with cooling ponds or canals, or cooling towers that discharge to a river)	10 CFR 51.53(c)(3)(ii)(G)	4.9.1
Electric shock hazards	10 CFR 51.53(c)(3)(ii)(H)	4.9.2
Environmental Justice		
Minority and low-income populations	10 CFR 51.53(c)(3)(ii)(N)	3.11.2 and 4.10.1
Cumulative Impacts		
Cumulative impacts	10 CFR 51.53(c)(3)(ii)(O)	4.12

Table 1.0-1
Environmental Report Responses to License Renewal Environmental Regulatory Requirements (Sheet 4 of 4)

Description	Requirement	ER Section(s)
Severe Accident Mitigation Alternatives		
Severe accidents	10 CFR 51.53(c)(3)(ii)(L)	4.15
All Plants		
Consideration of alternatives for reducing adverse impacts for all Category 2 license renewal issues	10 CFR 51.53(c)(3)(iii)	4.0 and 6.2
New and significant information regarding the environmental impacts of license renewal of which the applicant is aware	10 CFR 51.53(c)(3)(iv)	4.0 and 5.0

1.2 Environmental Report Scope and Methodology

NRC regulations for domestic licensing of nuclear power plants require reviews of environmental impacts from renewing an OL. NRC regulation 10 CFR 51.53(c) requires that an applicant for license renewal submit with its application a separate document (Appendix E of the application) entitled, "Applicant's Environmental Report—Operating License Renewal Stage." In determining what information to include in the PTN SLR applicant's ER, FPL has relied on NRC regulations and the following supporting documents that provide additional insight into the regulatory requirements:

- NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), Revision 1 (NRC 2013a), and referenced information specific to transportation (NRC 1999)
- NRC supplemental information in the *Federal Register* (78 FR 37282)
- *Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses* (NRC 1996a)
- Regulatory Guide 4.2, Supplement 1, Revision 1, *Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications* (NRC 2013b)

1.3 Turkey Point Station Licensee and Ownership

FPL is a principal subsidiary of NextEra Energy Inc. (formerly FPL Group, Inc.), and the third-largest electric utility in the United States. FPL is a Juno Beach, Florida-based utility company serving approximately 4.9 million customer accounts or an estimated 10 million people across nearly half of the state of Florida. PTN is owned and operated by FPL, the licensee and applicant.

2.0 PROPOSED ACTION AND DESCRIPTION OF ALTERNATIVES

2.1 The Proposed Action

In accordance with 10 CFR 51.53(c)(2), the ER must contain a description of the proposed action. The proposed action is to renew the OLs for PTN, which would preserve the option for FPL to continue to operate PTN to provide reliable base-load power throughout the 20-year SLR period to meet future power generating needs. For PTN Unit 3, the requested renewal would extend the OL from midnight on July 19, 2032, to midnight on July 19, 2052. For PTN Unit 4, the requested renewal would extend the OL from midnight on April 10, 2033, to midnight on April 10, 2053.

In addition to continuing operation and maintenance activities associated with SLR, activities to allow for extended plant operation may include refurbishment. However, refurbishment is not anticipated for PTN. The relationship of refurbishment to license renewal is described in Section 2.3.

During the SLR term, changes to surveillance, monitoring, inspections, testing, trending, and recordkeeping (SMITTR) could be undertaken as a result of the 10 CFR Part 54 aging management review. Potential SMITTR activities are described in Section 2.4. No other plant upgrades to support extended operations that could directly affect the environment or plant effluents are planned. However, the onsite independent spent fuel storage installation (ISFSI) will need to be expanded during the SLR period to accommodate the greater accumulation of spent fuel due to the additional operating years if the U.S. Department of Energy (DOE) has not begun taking ownership of commercial spent fuel by the time the additional storage is needed for PTN.

2.2 General Plant Information

The ER must contain a description of the proposed action, including the applicant's plans to modify the facility or its administrative control procedures. This report must describe in detail the affected environment around the plant and the modifications directly affecting the environment or any plant effluents. [10 CFR 51.53(c)(2)]

The Turkey Point site includes five units. Units 1 and 2 were formerly operated as natural-gas/oil steam-generating units. However, Units 1 and 2 have been repurposed in the synchronous condenser mode to support transmission reliability and will be maintained in this condition through the subsequent period of extended operation (SPEO). The Units 1 and 2 generators remain on site to help stabilize and optimize grid performance, but do not generate power or process water. Units 3 and 4 are the nuclear pressurized water reactors that are the subject of this report. Unit 5 is a natural-gas combined-cycle steam-generating unit.

The principal structures at PTN are the reactor containments, auxiliary building, control building, turbine building, radwaste building, intake structure, discharge structures, steam generator storage compound, and administration building. Main structures outside the power block are the

ISFSI, sewage treatment plant, 230-kilovolt (kV) switchyard, meteorological tower, intake canal, discharge canal, and cooling canals. Figure 3.1-1 shows the general features of the facility and the exclusion area boundary (EAB).

2.2.1 Reactor and Containment Systems

The PTN reactors (see Figure 3.1-1) are Westinghouse designed (FPL 2000a, Section 1.2). Each unit is a pressurized light-water reactor with three steam generators, which produce steam that turns turbines to generate electricity. Each unit is capable of an output of 2,644 megawatt-thermal (MWt) (NRC 2012a). Units 3 and 4 have a reliable net summer rating of 811 and 821 megawatts-electric (MWe), respectively, or a combined PTN output of 1,632 MWe (FPL 2017a).

Each reactor containment structure is 210 feet tall and 124 feet in diameter. Each is a dry containment structure designed to withstand environmental effects and the internal pressure and temperature accompanying a postulated loss-of-coolant accident (LOCA) or steam line break. Together with its engineered safety features, each containment structure is designed to adequately retain fission products that escape from the reactor coolant system (RCS). (FPL 2000b, Section 3.1.1) Both Units 3 and 4 are licensed for fuel that is slightly enriched uranium dioxide, up to 5.0 percent by weight uranium-235. FPL operates the reactors at an equilibrium core maximum fuel discharge burnup rate of 62,000 megawatt-days per metric ton uranium (MWd/MTU).

Each nuclear steam supply system consists of a pressurized water reactor, RCS, and associated auxiliary fluid systems. The RCS is arranged as three closed reactor coolant loops connected in parallel to the reactor vessel, each loop containing a reactor coolant pump and a steam generator. An electrically heated pressurizer is connected to one of the loops. (FPL 2017b, Section 1.2.2)

The reactor core is composed of uranium dioxide pellets enclosed in Zircaloy-4, ZIRLO®, Optimized ZIRLO™ high performance fuel cladding material tubes with welded end plugs. The tubes are supported in assemblies by a spring clip grid structure. The mechanical control rods consist of clusters of stainless steel-clad absorber rods and guide tubes located within the fuel assembly. (FPL 2017b, Section 1.2.2)

FPL refuels each PTN nuclear unit on an 18-month schedule, which means at least one refueling every year and two refuelings every third year (FPL 2000b, Section 3.4). The core fuel is loaded in three regions. New fuel is introduced into the outer region, and partially spent fuel is moved inward into a checkerboard pattern at successive refuelings when the inner region is discharged to spent fuel storage. (FPL 2017b, Section 1.2.2)

The fuel assemblies are designed to perform satisfactorily throughout their lifetime. The loads, stresses, and strains resulting from the combined effects of flow-induced vibrations, earthquakes, reactor pressure, fission gas pressure, fuel growth, thermal strain, and differential expansion during both steady-state and transient reactor operating conditions have been considered in the design of the fuel rods and fuel assembly. The assembly is also structurally designed to withstand handling and shipping loads prior to irradiation, and to maintain sufficient integrity at the completion of design burnup to permit safe removal from the core and subsequent handling during cooldown, storage, and shipment. (FPL 2017b, Section 3.1.3)

Each reactor is controlled by a coordinated combination of chemical shim and mechanical control rods. Supervision of both the steam supply and turbine generator systems is accomplished from the control room shared by Units 3 and 4. (FPL 2017b, Section 1.2.3)

The containment structure completely encloses the RCS to minimize release of radioactive material to the environment should a failure of the RCS occur. The structure provides adequate biological shielding for both normal operation and the hypothetical accident condition. The containment structure is licensed and designed for pressure of 55 pounds per square inch, gauge (psig) and 283 degrees Fahrenheit (°F). (FPL 2017b, Section 5.1.1)

The reactor containment, a continuous, post-tensioned concrete structure, with a welded steel liner to provide leak tightness, completely encloses the entire reactor and RCS to ensure, with certain engineered safeguards that an acceptable upper limit for leakage of radioactive materials to the environment will not be exceeded, even if maximum hypothetical accident were to occur. The design assures that the integrity of the reactor containment is maintained under normal and accident conditions. The containment structure, including access openings and penetrations, is designed to a maximum allowable leak rate of 0.20 percent by weight of containment air per day at the containment design pressure of 55 psig under extended power uprate (EPU) conditions. Under maximum hypothetical accident conditions, the site boundary and offsite doses are below the guidelines of 10 CFR 50.67. (FPL 2017b, Section 5.1.1.1)

2.2.2 Maintenance, Inspection, and Refueling Activities

2.2.3 Cooling and Auxiliary Water Systems

Each PTN unit has three main cooling water systems, as do other pressurized water reactors. The primary system is a closed loop that removes heat from the reactor and passes through a steam generator, where it transfers heat through non-contact cooling to the secondary system before returning to the reactor. The primary system maintains its water under pressure so that the water does not flash to steam. Secondary-system water does flash to steam in the steam generator, and the steam turns the turbine to generate electricity. After exiting the turbine, secondary-system water passes through a condenser, where it cools and condenses into liquid before returning to the steam generator to complete the secondary loop. (FPL 2000b, Section 3.1.2)

Circulating water of the intake cooling system (tertiary system) cools secondary-system water in the condenser by non-contact cooling. Circulating water is withdrawn from and discharged to a closed system of cooling canals. Traveling screens and strainers remove debris from the cooling water intake flow, and plastic foam (Amertap) balls minimize biological growth and other fouling inside the condenser tubes. Chemicals used in plant systems are not allowed to discharge to surface waters. All plant outfalls discharge into the cooling canal system (CCS). (FPL 2000b, Section 3.1.2) As discussed in Section 2.2.3.2 and Section 3.6, the CCS is an industrial wastewater (IWW) facility and is not a "waters of the U.S." or "waters of the State." The cooling canals are closed to the public and do not discharge to surface water.

The auxiliary coolant system consists of three loops: the component cooling loop, the residual heat removal loop, and the spent fuel pit cooling loop. The component cooling loop is the heat sink for the residual heat removal loop, the chemical and volume control system (CVCS), the spent fuel cooling loop, and various RCS components. The residual heat removal loop is designed to remove residual and sensible heat from the core and reduce the temperature of the RCS during the second phase of plant cooldown. During the first phase of cooldown, the temperature of the RCS is reduced by transferring heat from the RCS to the Steam and Power Conversion System. (FPL 2017b, Secton 9.3.1) The spent fuel pit cooling loop is designed to remove residual heat from fuel assemblies stored in the high density storage racks contained within the spent fuel pit (FPL 2017b, Section 9.5.3.2).

The intake cooling water (ICW) system is provided with normally cross-connected, redundant headers, such that the heat exchangers in the auxiliary coolant system and the turbine plant cooling system normally receive flow from both headers. The ICW system supplies cooling canal water to the tube side of the component cooling water (CCW) heat exchangers. The ICW system also supplies saltwater to the cold side of the turbine area cooling water heat exchangers. The redundant header system is provided with isolation valves that can be shut so that failure of one loop does not require immediate shutdown of the unit. (FPL 2017b, Section 9.6.2)

Three ICW pumps are provided for each unit. One, two, or three pumps are operated as required to support normal plant operating conditions. During normal operations two ICW pumps provide flow to the three CCW heat exchangers and to the turbine plant cooling water heat exchangers. During an accident, one or two ICW pumps can provide flow to two or three CCW heat exchangers. Periodic cleaning of the CCW heat exchangers by chemical injection can be performed to minimize tube-side fouling, thus preserving the heat transfer capability of the heat exchangers. (FPL 2017b, Section 9.6.2)

A common water treatment system is provided for Units 3 and 4 to provide demineralized water of the required quality. The water treatment system is designed to provide all demineralized water requirements of Units 3 and 4. Adequate primary water storage is provided to fulfill the water requirements load fluctuations and leakage in the RCS during normal unit operation. The primary water is unborated, deaerated, demineralized water suitable for use in the RCS. Boric acid may be added to this water in the desired concentration before it is used as the reactor coolant. (FPL 2017b, Section 9.6.2)

The PTN water system flow diagram is illustrated in Figure 2.2-1. A typical water budget schematic is illustrated in Figure 2.2-2. The water budget of the CCS relies on modeled predictions of water flow between the CCS and the surrounding environment during the June 2015 through May 2017 period of record, including the effects of precipitation and evaporation that occurred during that time. The water budget also reflects the influences associated with canal sediment removal and salinity reduction actions. Increased water storage occurs when more water enters the CCS than exits, net positive flow. Conversely, a net negative flow implies a decrease in storage during a specified period of time. Generally, the wet seasons are indicative of increased storage and inflow, while the dry seasons are marked by reductions in CCS water storage and general outflow. Although the water budget is typically not equilibrated at any given time, the functioning of the CCS is expected to continue within its historic range of water levels (EEI 2017).

The closed-cycle circulating water flow for Units 3 and 4 is 1,872 million gallons per day (MGD) (FPL 2000b, Section 3.1.2). The circulating water flow for Units 1 and 2 in their current synchronous condenser mode is 17.3 MGD. The water budget also includes 14 MGD from the Upper Floridan Aquifer (FPL 2016a), which is discussed in more detail in Section 2.2.3.2. PTN has no cooling towers; therefore, no cooling tower blowdown is produced. Plant wastewaters are recycled to the CCS (FPL 2008). Additional discussion on makeup water sources and usage of the CCS unrelated to Units 3 and 4 is provided in Section 3.6. Water usage unrelated to Units 3 and 4 would continue regardless of the status of Units 3 and 4.

The circulating water system is designed to provide water from the canal, regardless of weather conditions, to the suction of the condenser circulating pumps and ICW pumps. Canal water flows into four separated screen wells through steel trash racks (Figure 2.2-1). The trash racks protect the traveling screens against damage from heavy debris. The water passes through traveling screens where debris is removed. Water from each individual screen well flows to the suction of the motor driven, vertical, mixed-flow circulating water pumps. Each of the four circulating water pumps provides a design flow of 156,250 gallons per minute (gpm) minimum. An online condenser cleaning system using sponge rubber balls is used to prevent scale build-up on condenser tubes, thus helping to maintain the thermal efficiency of the condenser. The three ICW pumps are also installed in the intake structure. Their capacity is 16,000 gpm each (Figure 2.2-2). (FPL 2017b, Section 10.2.2)

Support systems maintain high water quality in primary and secondary systems by using chemical controls and by removing water and adding demineralized water as makeup (FPL 2000b, Section 3.1.2). Ammonium hydroxide, oxygen scavengers (e.g., hydrazine, carbohydrazide), or an alternate amine is added to the secondary to control secondary chemistry parameters (FPL 2017b, Section 10.2.4.1).

A steam generator blowdown recovery system is installed to assist in maintaining required steam generator water chemistry by providing a means for removal of foreign matter which concentrates in the evaporator section of the steam generator. The system is fed by three independent blowdown lines (one per steam generator) which tie into a common blowdown flash tank. Online chemistry monitoring instrumentation is connected to each blowdown sample line. The instrumentation provides a means by which the various levels of pH, cation conductivity, specific conductivity, dissolved oxygen, sodium, and chloride can be monitored. Blowdown condensate from the flashtank is dumped to the discharge canal. (FPL 2017b, Section 10.2.4.3)

A secondary wet layup system is provided to recirculate water through the condenser, condensate system, and feedwater system, including the shell side of the feedwater heaters, to prevent stratification and add chemicals to prevent any excursions of water quality in the secondary system during extended unit shutdowns. Maintaining a water solid condition during recirculation would minimize the presence of harmful gases to wetted surfaces. The secondary system wet layup system consists of two closed loops which circulate the contents of the secondary system. Cleanup of the secondary system is provided through the condensate filter/ demineralizers. Chemicals are added to each loop via a common chemical feed pot. (FPL 2017b, Section 10.2.4.4)

A steam generator wet layup system is provided to recirculate water through the secondary side of the steam generators to prevent stratification and to provide a means for adding chemicals to prevent excursions of water quality in the steam generators during extended unit shutdowns. The steam generator wet layup system consists of three independent loops, one for each steam generator. The normal flow path in each loop is to take suction from the main feedwater line and return to the steam generator via the blowdown line. The flow may be reversed by changing the valve line up to take suction from the blowdown line and return to the steam generator via the feedwater line. The three loops are connected by a common header to provide versatility in the system. A chemical addition tank is common to all three loops. A nitrogen addition connection is included for maintaining a nitrogen blanket in the portion of the system not filled with water. (FPL 2017b, Section 10.2.4.5)

A feedwater recirculation system is provided to operate during normal plant shutdown or startup to provide the flow paths required to create a closed loop between the feedwater system and the condenser for wet layup and flushing of the secondary system. Circulation is provided by a condensate pump. Poor quality feedwater can be dumped from the feedwater recirculation line directly to the discharge canal. (FPL 2017b, Section 10.2.4.6)

2.2.3.1 Water Supply

PTN uses approximately 690 gpm from the Miami-Dade public water supply system. The Newton treatment plant, which is part of Miami-Dade's Rex Utilities system, supplies PTN. Plant uses include process (primarily demineralizer water makeup), potable, and fire protection water. PTN discharges treated waste-process waters into the CCS (described below) and sanitary wastewater to septic tanks and an injection well after treatment. (FPL 2000b, Section 3.1.2)

Fire protection water protects plant equipment in the event of a fire, to ensure safe plant shutdown, and minimizes the risk of a radioactive release to the environment. Fire protection consists of fire water supply including sprinklers, halon suppression, fire dampers, reactor coolant pump oil collection, alternate shutdown, safe shutdown, and fire detection and protection. (FPL 2000a, Section 2.3.3.14)

The fire water supply system is a common system shared by Units 3 and 4. The system consists of a 500,000-gallon raw water tank (RWT) I and a 750,000-gallon RWT II as fire water supply sources. The water supply for the fire water storage tanks is the Dade County Water and Sewer Authority. The fire water supply line from each RWT is cross-connected such that either tank can supply either of the two fire water pumps. The yard loop is equipped with sectionalizing isolation valves such that any portion of the loop may be isolated without impairing operation of the rest of the system. Fire hydrant spacing on the yard loop is nominally 200 feet, not to exceed 250 feet. The hose stations are situated such that all areas of the plant are within 20 feet of the hose end. The fire water pumps are installed in accordance with National Fire Protection Association 20 guidelines, and sized such that either pump is capable of delivering 100 percent of the system demand.

The PTN fire protection program meets the requirements of 10 CFR 50.48(c), and is a risk-informed, performance-based program based on National Fire Protection Association Standard 805 (FPL 2017b, Section 9.6.1). The fire protection program is focused on protecting the safety of the public, the environment, and plant personnel from a plant fire, and its potential effect on safe reactor operations. The fire protection program is based on the concept of defense-in-depth. (FPL 2017b, Section 9.6.1.1.1)

2.2.3.2 Cooling Canals

The CCS is an IWW facility. PTN uses the CCS (IWW facility) of zero-discharging recirculating canals to cool heated effluent and to recirculate water for reuse. The NRC defines "cooling pond" as a manmade impoundment that does not impede the flow of a navigable system, and categorizes the CCS as a cooling pond. There are no cooling towers associated with the Turkey Point (nuclear) recirculating heat dissipation system. (FPL 2000b, Section 3.1.2)

The cooling canals occupy an area approximately 2 miles wide by 5 miles long (5,900 acres) (PTN 2014a) (Figure 3.1-1). The Turkey Point (nuclear) units use this system like a radiator, discharging heated condenser water at one end and withdrawing cooled water at the other end for reuse (FPL 2000b, Section 3.1.2). As shown in Figure 2.2-3 and Figure 3.1-1, the discharge canal receives heated water from the plant and distributes flow into 32 feeder canals. Water in the feeder canals flows south into a single collector canal that distributes water to seven return canals. Water in the return canals flows north to the intakes. (PTN 2014a) Flows attributable to nuclear Units 3 and 4 amount to approximately 1.3 million gpm (Figure 2.2-2). (FPL 2000b, Section 3.1.2)

The cooling canals receive inflow and outflow from the Biscayne Aquifer because of the exceptional porosity of the underlying rock. Turkey Point does not directly discharge to fresh or marine surface waters; however, because the canals are not lined, groundwater does interact with water in the canals. Makeup water for the canals comes from treated process water, rainfall, stormwater runoff, and groundwater infiltration to replace evaporative and seepage losses. (FPL 2014a, Section 2.3.3.1.2)

Prior to 2010, the CCS operated as a seagrass-based biological system. This ecosystem helped to maintain good water quality and low nutrient concentrations. Salinity levels have been subject to seasonal variation, peaking at the end of the dry season, and falling at the end of the wet season. Between 2000 and late 2009, the peak seasonal salinities steadily increased. By 2010, seagrass meadows were dying off. By 2012, few seagrass beds remained. The system-wide seagrass die-off and subsequent decomposition of the seagrasses released a significant volume of previously bound and sequestered nutrients over a multi-year period. The increase of nutrient levels facilitated seasonal algae blooms, resulting in high turbidity and generally degraded water quality.

In 2014, the Florida Department of Environmental Protection (FDEP) issued an administrative order (AO) requiring FPL to prepare and submit for review and approval a salinity management plan to retract the hypersaline groundwater plume (State of Florida 2016). Compliance history is discussed in detail in Section 3.6.1.4.5. Monitoring activities since 2010 have focused on data to address salinity and hypersaline groundwater. In compliance with the 2016 consent order (CO) (FDEP 2016b), a nutrient management strategy was developed to re-establish the submerged vegetation community. Re-establishing the submerged vegetation will reduce nutrients, likely result in a reduction of algal species, and establish a more balanced water quality. The plan identified operation of a recovery well system (RWS) established on the western boundary of the CCS to reduce salinity and minimize the inflow of groundwater from western face and bottom seepage. Annual sediment maintenance is expected to establish and maintain thermal efficiency to reduce evaporation and maintain low and stable salinity.

In 2014, FPL filed a petition with the FDEP to modify the conditions of certification for PTN to include the construction and operation of up to six new production wells to withdraw 14 MGD of Upper Floridan Aquifer water for use in the CCS for salinity management purposes. In 2015, FDEP issued a final order authorizing the requested modifications. The order was adopted in 2016 with approval of the modification of conditions. (State of Florida 2016)

In 2015, FPL used controlled sources from the L-31E Canal, marine wells, and flow from Floridan Aquifer wells to reduce salinity. The marine wells are discussed in Section 3.6.3.2. The marine wells may be utilized in response to extraordinary circumstances or upset recovery. FPL has developed a full-time Floridan Aquifer water resource of 14 MGD, which is now providing makeup flow to the cooling canals (FPL 2016a). These actions, combined with normal rainfall, have decreased salinity levels (State of Florida 2016).

The PTN National Pollutant Discharge Elimination System (NPDES) permit (PTN 2005) identifies the facility as a "no discharge" facility and authorizes discharges to groundwater, but does not authorize discharges to surface waters of the State. Consistent with U.S. Environmental Protection Agency (EPA) and state determinations, the CCS is not "waters of the U.S." or "waters of the State" (FPL 2000b, Section 4.2). Furthermore, the permit authorizes discharge to the CCS (PTN 2005). FPL is not required to prepare cooling water intake [316(b)] studies for PTN (FPL 2000b, Section 4.2).

An interceptor ditch was constructed with the CCS and is located just west of and adjacent to the CCS, east of the L-31E Canal and levee (PTN 2014a). The interceptor ditch has no direct surface connection to the cooling canals or other surface waters (FPL 2000b, Section 3.1.2). The purpose of the interceptor ditch is to restrict movement of saline groundwater from the cooling water system westward of Levee 31E adjacent to the CCS to those amounts which would occur without the existence of the CCS (EEI 2017).

Monitoring data are required to be collected, including groundwater levels and water quality field and analytical parameters, from five wells. In addition, surface water levels are required to be monitored in the L-31E Canal, the interceptor ditch, and the westernmost CCS canal. When water levels in the CCS get too high and/or natural freshwater seaward gradients are non-existent, the water level in the interceptor ditch is lowered by pumping water from the ditch. This lowering of the interceptor ditch water levels facilitates a seaward gradient between the L-31E Canal and the CCS or, depending upon CCS water levels, intercepts saline groundwater moving westward from the CCS. This effort restricts inland movement of cooling canal water in the upper zones of the aquifer. (EEI 2017)

Monitoring stations currently report data at 1-hour intervals and typically transmit by telemetry to a database every day. FPL also manually records water levels during the dry season at least once every week and at least twice per month during the wet season to evaluate hydraulic gradients and determine if the pumps need to be operated. FPL also uses the automated data to determine if there is a need to visit the sites more frequently to manually check water levels. (EEI 2017)

2.2.4 Meteorological Monitoring Program

PTN utilizes two towers to monitor meteorological conditions. The primary tower is the South Dade 60-meter meteorological tower, located southwest of the plant, which collects wind speed, wind direction, and air temperature at both 10-meter and 60-meter elevations (see Figure 3.1-1). The data at these two elevations allow for characterization of both lower and upper meteorological conditions and for calculation of vertical temperature differences that provide the preferred means for determining atmospheric stability classes because they are effective indicators of worst-case stability conditions. The secondary tower is the land utilization (LU) 10-meter meteorological tower, located just south of the plant, which collects data at an elevation of 10 meters, including temperature, wind speed, wind direction, and sigma theta values. (FPL 2017b, Section 2.6)

2.2.4.1 General Description—Onsite Meteorological Measurements Program

The meteorological data collected for NRC reporting are taken from the South Dade tower. The LU 10-meter data are used as backup data, if needed. The meteorological instrumentation on both towers is summarized in Table 2.2-1. (FPL 2014a, Section 6.4.2.6) The monitoring system is equipped with lightning protection and redundant power supplies (FPL 2014a, Section 6.4.2)

The actual height of the sensors for wind direction and speed at the 10-meter elevation of the South Dade tower (height from bottom of concrete pad base) is 38.0 feet. Ground-level releases include all release points or areas that are lower than 2.5 times the height of adjacent solid structures. Because the ground-level release scenario provides a bounding case, and none of the release heights are higher than 2.5 times the height of the associated reactor containment shield building, elevated releases were not considered. Meteorological parameters measured for these releases are consistent with NRC Regulatory Guide 1.23, Revision 1, Section 2. (FPL 2014a, Section 6.4.2.6)

Ambient temperature is monitored both at the 10-meter and the 60-meter levels. The actual height of temperature sensors at the 10-meter elevation of the South Dade tower (height from bottom of concrete pad base) is 34 feet above ground level. Vertical differential temperature (i.e., ΔT) is calculated as the difference between the temperatures measured at the 10-meter and 60-meter levels. Precipitation is measured using a tipping bucket precipitation gauge mounted at ground level but away from the tower shelter to prevent any interference in precipitation capture. The precipitation gauge is located 24.5 feet southeast from the base of the 60-meter tower. Solar radiation is measured approximately 23 feet southeast from the base of the 60-meter tower at 4 feet above ground. On the LU tower, wind speed, wind direction, and wind direction standard deviation (i.e., sigma theta for atmospheric stability class determination) are obtained at the 10-meter level. (FPL 2014a, Section 6.4.2.6)

Climatronics cup sets and bi-vane are used for wind measurements. Climatronics temperature sensors are used for ambient temperature and ΔT calculations. A Climatronics 8-inch rain gauge (tipping bucket) is located approximately 24.5 feet southeast from base of the South Dade tower. (FPL 2014a, Section 6.4.2.6.1)

The system accuracies of the meteorological data collection system are compared to the regulatory requirements, and the findings are summarized in Table 2.2-2. As shown in Table 2.2-2, the system accuracies meet the regulatory guidance in NRC Regulatory Guide 1.23, Revision 1, and ANS/ANSI 3.11. (FPL 2014a, Section 6.4.2.7.5)

Calibration and maintenance of the onsite meteorological monitoring system is in accordance with NRC Regulatory Guide 1.23, Revision 1, Section C.5, Regulatory Position, Instrument Maintenance and Servicing Schedules, and ANS/ANSI 3.11, Section 7, System Performance. The existing meteorological monitoring system is calibrated semiannually at both the primary and backup towers, and channel checks are performed daily to achieve maximum data recovery. System operability is also checked by using the system's three radio frequencies, one of which is exclusive to the land utilization building. Two other radio frequencies are exclusive to the Units 3 and 4 plant computers to remotely monitor the system status. More frequent calibrations and/or replacement intervals for individual components may be conducted on the basis of the operational history of the component type. (FPL 2014a, Section 6.4.2.6.2)

Data collected by the meteorological system are representative of the overall site meteorology. Instrumentation surveillance and data validation in accordance with the applicable regulatory and industry guidance has routinely been performed to ensure data quality as well as to achieve the acceptable annualized data recovery rate of 90 percent. (FPL 2014a, Section 6.4.2)

2.2.4.2 Meteorological Towers

PTN Unit 3 began operation in 1972, and Unit 4 in 1973. Renewed OLs for both units were issued by the NRC in 2002. The onsite meteorological measurement program includes the South Dade 60-meter guyed meteorological tower that serves as the primary data collection system and the LU 10-meter tower with engineered guy wires that serves as a backup to the primary system. The 10-meter tower is used for emergency situations at PTN. The South Dade tower was rebuilt in 1994. The backup meteorological system is an independent system installed and maintained for the purpose of providing redundant site-specific meteorological information (10-meter wind speed, wind direction, and sigma theta) representative of the local environment. (FPL 2014a, Section 6.4.2)

2.2.4.3 Operational Monitoring

The onsite meteorological measurement program for both the primary and backup towers was upgraded in 2007 to support the new PTN distributed control system (DCS) installation. Existing data loggers and radio communication equipment were replaced with improved instrumentation to enhance the maintainability and reliability of the system. The upgraded system included meteorological tower communication hardware and computer software. (FPL 2014a, Section 6.4.2)

The PTN meteorological monitoring program is conducted in accordance with the applicable regulatory guidance. Checks performed on meteorological data include missing or invalid data (out-of-range values), daily average difference between the primary and backup tower, periods of daytime stable and nighttime unstable conditions, and date(s) and time(s).

The quality of the adjusted data is reviewed, and suspected data are flagged. Any data adjustments or corrections are documented in a corrective action program and archived. In addition, visual scanning of the 10-meter wind speed and direction data will be routinely performed for abnormal values or inconsistency. (FPL 2014a, Sections 6.4.2 and 6.4.3) The meteorological data recovery rate is greater than the 90 percent suggested in the guidance. For the last 5 years, the recovery rates have ranged from 94.54 percent in 2016 to 99.94 percent in 2013.

2.2.5 Power Transmission System

Based on NRC Regulatory Guide 4.2 (NRC 2013b, Section 2.2), transmission lines subject to evaluation of environmental impacts for license renewal are those that connect the nuclear power plant to the switchyard where electricity is fed into the regional power distribution system and power lines that feed the plant from the grid during outages. The locations of in-scope transmission lines are shown in Figure 2.2-4. PTN is connected to the 230-kV switchyard through an approximately 590-foot long transmission line (FPL 2017b, Section 8.2.1).

The Miami-Dade Comprehensive Development Master Plan (CDMP) identifies historic districts and archaeological zones that merit local designation and as possible candidates for submission to the National Register of Historic Places (NRHP). The plan also identifies the general location of probable archaeological sites recommended for investigation to determine eligibility for inclusion on the state master file. The in-scope transmission lines are located within the site. Section 3.8 describes the historic and cultural resources on the site. (FPL 2000b, Section 2.14)

FPL provides protection to migratory birds through a corporate avian protection plan. This plan adheres to the Avian Power Line Interaction Committee and U.S. Fish and Wildlife Service (USFWS) guidelines regarding birds and electrical energy production. The avian protection plan provides guidance for reporting bird mortalities, dealing with bird injuries, nest-management procedures, permitting issues, construction design standards to minimize collision and electrocution, staff training, and mortality risk assessment. (NRC 2016a, Section 4.3.1.6) FPL construction and design standards include the use of bird discouragers, perch guards, and insulator shields to limit the potential for electrocution (NRC 2016a, Section 5.3.1.2).

NUREG-1437 suggests that occupational safety and health hazard issues are generic to all types of electricity generating stations, including nuclear power plants, and are of small significance if the workers adhere to safety standards and use protective equipment (NRC 2013a, Section 3.9.5.1). The PTN industrial safety program incorporates electrical safety and identifies required personal protective equipment when applicable.

In addition, electrical shock assessment has been performed in accordance with the National Electric Safety Code (NESC). All the PTN circuits from the plant main transformers to the switchyard meet NESC requirements. Therefore, pursuant to 10 CFR 51.53(c)(3)(ii)(H), the impact of the potential for electrical shock is small and mitigation is not warranted. (FPL 2000b, Section 4.13.3)

2.2.6 Radioactive Waste Management System

The waste disposal system provides equipment necessary to collect, process, and prepare for disposal of potentially radioactive liquid, gaseous, and solid wastes produced as a result of reactor operation (FPL 2017b, Section 1.2.4). The system is capable of processing all wastes generated during continuous operation of the RCS assuming that fission products escape from one percent of the fuel elements into the reactor coolant (FPL 2017b, Section 11.1.2). The waste disposal system has been designed as a waste process system, which includes demineralizers, monitor tanks, condensate tank, and associated pumps (FPL 2017b, Section 1.4.1). Filter cartridges and the spent resins from the demineralizers are packaged and stored on site until shipment off site for disposal. Low-level waste (LLW) may be stored in the LLW storage facility while awaiting shipment off site for disposal. (FPL 2017b, Section 1.3.9)

All waste handling and storage facilities are contained and equipment designed so that accidental releases directly to the atmosphere are monitored and will not exceed the guidelines of 10 CFR 50.67 (FPL 2017b, Section 1.3.8). Liquid, gaseous, and solid waste facilities are designed so that discharge of effluents and offsite shipments are in accordance with applicable governmental regulations (FPL 2017b, Section 1.3.9). PTN does not have any onsite radioactive waste disposal facilities.

In accordance with NRC Regulatory Guide 1.21 (NRC 2009), annual radioactive effluent release reports are prepared and provided to the NRC (PTN 2012a; PTN 2013a; PTN 2014b; PTN 2015a; PTN 2016a; PTN 2017a). The annual reports identify the amount of waste to include spent resin, filters, sludge, evaporator bottoms, etc.; dry compressible waste, irradiated components, control rods, etc.; and other non-compressed waste. No irradiated fuel shipments or irradiated component shipments were made from the site during the last 6 years. Common solid waste from PTN was shipped jointly. Solid waste shipments were made by truck to the following processing plants during the last 6 years:

- Energy Solutions, Bear Creek Road Facility (Oak Ridge, TN) (PTN 2016a; PTN 2017a)
- Energy Solutions, Gallaher Road Facility (Kingston, TN) (PTN 2016a; PTN 2017a)
- Energy Solutions, Clive (Clive, UT) (PTN 2016a)
- Energy Solutions (Memphis, TN) (PTN 2016a)
- Alaron Nuclear Services (Wampum, PA) (PTN 2015a)
- Barnwell Processing Facility (Barnwell, SC) (PTN 2016a)
- Manufacturing Sciences Corporation (Oak Ridge, TN) (PTN 2013a)
- Studsvik Processing Facility (Erwin, TN) (PTN 2014b)
- Waste Control Specialists (Andrews, TX) (PTN 2016a)

2.2.6.1 Liquid Radioactive Waste Management

Radioactive fluids entering the waste disposal system are collected in sumps and tanks until determination of subsequent treatment can be made. They are sampled and analyzed to determine the quantity of radioactivity, with an isotopic identification if necessary. Before discharge, radioactive fluids are processed as required by 10 CFR 20 and then, once the requirements are met, released into the CCS. The system design and operation are characteristically directed toward minimizing releases to unrestricted areas. Discharge streams are appropriately monitored and safety features are incorporated to preclude releases in excess of 10 CFR Part 20 guidelines. (FPL 2017b, Section 1.3.9)

Liquids flow to the reactor coolant drain tank and are discharged directly to the chemical and volume control system (CVCS) holdup tanks by the reactor coolant drain tank pumps which are operated automatically by a level controller in the tank. These pumps also return water from the refueling canal and cavity to the refueling water storage tank. Each containment includes one reactor coolant drain tank and two reactor coolant drain tank pumps. (FPL 2017b, Section 11.1.2)

Waste liquids are collected by various drains and sumps. The liquid drains flow by gravity, or are pumped, to the waste holdup tank (WHT). The activity level of waste liquid from the laundry area will usually be low enough to permit discharge from the site without processing. The liquid is pumped to one of the waste monitor tanks or monitor tanks where its activity can be determined for record before it is discharged through a radiation monitor. The liquid waste in the molybdate holding tank is typically pumped directly to the waste monitor tanks. (FPL 2017b, Section 11.1.2)

The liquids requiring cleanup before release are processed by the waste disposal demineralizer. The liquid from the waste disposal demineralizer is routed directly to one of three radwaste facility waste monitor tanks or one of two monitor tanks. (FPL 2017b, Section 11.1.2)

When one of the waste monitor tanks is filled, it is isolated, recirculated, and sampled for analysis while one of the other two tanks is in service. If analysis confirms the activity level is suitable for discharge, the liquid is pumped through a flow meter and a radiation monitor and then released to the cooling canals of the IWW facility. Otherwise, it can be returned to a WHT for reprocessing. (FPL 2017b, Section 11.1.2)

The filters and spent resins from demineralizers are processed, temporarily stored, and disposed of in accordance with applicable regulations currently in force. Packaged LLW may be stored on site in the LLW storage facility while awaiting transport to an offsite disposal area. (FPL 2017b, Section 1.2.4)

2.2.6.2 Gaseous Radioactive Waste Management

Gaseous wastes are collected and stored until their radioactivity level is low enough to permit discharge to the environment at concentrations below 10 CFR Part 20 guidelines (FPL 2017b, Section 1.2.4). Radioactive gases are pumped by compressors through a manifold to one of the gas decay tanks where they are held for a suitable period of time for decay. Cover gases in the nitrogen blanketing system are reused to minimize gaseous wastes. During normal operation, gases are discharged intermittently at a controlled rate from these tanks through the monitored plant vent. (FPL 2017b, Section 1.3.9)

During plant operation, gaseous wastes originate from (1) degassing reactor coolant discharge to the CVCS; (2) displacement of cover gases as liquids accumulate in various tanks; (3) miscellaneous equipment vents and relief valves; and (4) sampling operations and gas analysis for hydrogen and oxygen in cover gases (FPL 2017b, Section 11.1.2).

Most of the gas received by the waste disposal system during normal operation is cover gas displaced from the CVCS holdup tanks as they fill with liquid. Because this gas must be replaced when the tanks are emptied during processing, facilities are provided to return gas from the decay tanks to the holdup tanks. To prevent hydrogen concentration from exceeding the combustible limit during this type of operation, components discharging to the vent header system are restricted to those containing no air or aerated liquids, and the vent header itself is designed to operate at a slight positive pressure (1.0 psig minimum to 4.0 psig maximum) to prevent in-leakage. On the other hand, out-leakage from the system is minimized by using Saunders patent diaphragm valves, bellows seals, self-contained pressure regulators, and soft-seated packless valves throughout the radioactive portions of the system. (FPL 2017b, Section 11.1.2)

Gases vented to the vent header flow to the waste gas compressor suction header. One of the two compressors is in continuous operation with the second unit instrumented to act as backup for peak load conditions or failure of the first compressor. From the compressors, gas flows to one of the gas decay tanks. Gas held in the decay tanks can either be returned to the CVCS holdup tanks, or discharged to the atmosphere if it has decayed sufficiently for release. (FPL 2017b, Section 11.1.2)

Before a tank can be emptied to the environment, it must be sampled and analyzed to determine the activity to be released. Once the activity has been recorded, the gas can be discharged to the plant vent at a controlled rate through a radiation monitor. Samples are taken manually by opening an isolation valve from the gas decay tank discharge to the gas analyzer and collecting the gas in one of the sampling system gas sample vessels. If sampling has shown that sufficient decay has occurred, the isolation valve in the line from the tank to the gas analyzer is closed, the isolation valve in the plant vent discharge line is opened, and the tank contents are released through the plant vent. During release, a trip valve in the discharge line is closed automatically by loss of air flow from auxiliary building exhaust fans. In the event of a high activity level in the discharge line, the plant vent isolation valve RCV-014 will either be closed automatically or manually. (FPL 2017b, Section 11.1.2)

During operation, a gas sample is drawn from the particular gas decay tank being filled at the time, and analyzed to determine its hydrogen and oxygen content. The hydrogen analysis is for surveillance, because the concentration range can vary considerably from tank to tank. Also, the capability exists for manual grab sample analysis of cover gases from tanks discharging to the waste gas vent header. (FPL 2017b, Section 11.1.2)

2.2.6.3 Solid Radioactive Waste Management

Solid wastes can consist of spent resins, spent filters, and miscellaneous materials. The waste disposal system is designed to package all solid wastes in high integrity containers (HICs) for removal to disposal facilities. The HICs are designed to be placed into transfer casks for shipment off site for disposal. The HICs are also designed to be stored in the LLW storage facility while awaiting shipment off site for disposal. (FPL 2017b, Section 11.1.2)

The spent resins from the CVCS demineralizers are normally deposited in the spent resin storage tank. After resin in the spent resin storage tank has been agitated by bubbling nitrogen through the tank to the vent header, water is pumped through the tank at a controlled rate to sluice the slurry to the container area. There it is received in shielded containers and dewatered for disposal. (FPL 2017b, Section 11.1.2)

Provisions for dry bulk packaging of liquid waste system spent resins also exist. Spent resin is pumped as a water-resin slurry into a disposable container, which has connections for a dewatering line. The sluice water is removed by using a dewatering pump, which is piped to the WHT through the floor drains. (FPL 2017b, Section 11.1.2)

Shielding is provided for each container as necessary to reduce the work area dose rates. The basis for all dose rate calculations is for one cycle of core operation with 1 percent defective fuel in each unit. (FPL 2017b, Section 11.1.2)

An LLW storage facility is to be utilized to provide interim LLW storage capabilities for PTN. Conservatively, Units 3 and 4 could produce up to a combined total of 840 cubic feet (ft^3) of Class B/C low-level radioactive waste (LLRW) per year. This amount would fill approximately seven Type 8-120 HICs per year. The LLW storage facility is designed to safely store 5 years of LLW (36 HICs) within an array of concrete shields inside the precast panel concrete building. The storage of LLRW waste is licensed under the general license provided to power reactor licensees under 10 CFR Part 50. (FPL 2017b, Section 1.4.1)

PTN operations, particularly maintain and outage activities, have the potential to generate low-level mixed waste (LLMW). FPL has procedures in place to characterize and manage LLMW in accordance with EPA and NRC regulations and disposal of any LLMW would be at licensed/ permitted facilities. Radwaste and hazardous waste shipments for 2012–2016 have not included LLMW (PTN 2013a, PTN 2014b, PTN 2015a, PTN 2016a, PTN 2017a).

2.2.6.4 Radwaste Storage—License Renewal Term

Solid radioactive wastes include solids recovered from the RCSs, solids in contact with the liquids or gases associated with the reactor coolant process systems, and solids used in support of the RCS operation. The largest volume of solid radioactive waste is LLRW, which includes bead resin, spent filters, and dry active waste (DAW) from outages and routine maintenance. PTN has developed long-term plans that ensure radwaste generated during the license renewal term would be sent directly for disposal, stored on site in existing structures, or shipped to an offsite licensed facility for processing and disposal (FPL 2010).

LLRW is classified as Class A, Class B, or Class C (minor volumes are classified as greater than Class C). Class A includes both DAW and processed waste (e.g., dewatered resins). Classes B and C normally include processed waste and irradiated hardware. The majority of LLRW generated at PTN would be Class A waste and can be shipped to licensed processors, such as the Energy Solutions facility in Oak Ridge, Tennessee, for reduction and repackaging, and then shipped to a Class A disposal facility such as the Energy Solutions facility in Clive, Utah. Class B and C wastes constitute a low percentage by volume of the total LLRW generated. The LLRW storage facility at PTN can currently store approximately 5 years of Class B and C wastes.

Class B and C wastes can be shipped to the Energy Solutions facility in Oak Ridge, Tennessee, where they can then be shipped to the Waste Control Specialist facility in Texas, which is licensed for disposal of Class A, B, and C wastes. Disposal of waste greater than Class C is the responsibility of the federal government. The storage of LLRW waste is licensed under the general license provided to power reactor licensees under 10 CFR Part 50. (FPL 2017b)

PTN radioactive waste shipments are packaged in accordance with NRC [10 CFR Part 71] and U.S. Department of Transportation (USDOT) [49 CFR Parts 173 and 178] requirements. The type and quantities of solid radioactive waste generated at and shipped from PTN vary from year to year, depending on plant activities. PTN may also receive PTN-generated material from an offsite processing facility back to the plant site for reuse or storage. (FPL 2010)

2.2.6.5 Spent Fuel Storage

NUREG-2157, *Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel,* generically determines the environmental impacts of continued storage, including those impacts identified in the remand by the Court of Appeals in the *New York v. NRC* decision, and provides a regulatory basis for a revision to 10 CFR 51.23 that addresses the environmental impacts of continued storage for use in future NRC environmental reviews. In this context, "the environmental impacts of continued storage" means those impacts that could occur as a result of the storage of spent nuclear fuel at at-reactor and away-from-reactor sites after a reactor's licensed life for operation and until a permanent repository becomes available. NUREG-2157 evaluates potential environmental impacts to a broad range of resources. Cumulative impacts are also analyzed. (NRC 2014a, page iii)

The spent fuel storage pit is designed for the underwater storage of spent fuel assemblies and control rods after their removal from the reactor (FPL 2017b, Section 9.5.4.2). The spent fuel pit, located in the auxiliary building, is designed for the underwater storage of up to 1,535 fuel assemblies in the spent fuel pit (approximately nine full cores), including 131 spent or fresh fuel assemblies in the cask area rack and miscellaneous fuel handling tools. The cask area of the spent fuel pit is designed for the installation of a fuel transfer cask to allow fuel transfer operations. (FPL 2017b, Section 9.5.2.2)

Radiation levels in the spent fuel storage area of the auxiliary building are controlled within limits during normal storage operations by maintaining a prescribed water level in the spent fuel pit to provide shielding. During reactor refueling, adequate shielding for radiation protection is provided by conducting all spent fuel transfer and storage operations underwater. (FPL 2017b, Section 9.5.2.2)

The reactor is refueled with equipment designed to handle spent fuel underwater from the time it leaves the reactor vessel until it is placed in a cask for transport to the onsite ISFSI or shipment off site (FPL 2017b, Section 1.2.5). An ISFSI has been constructed on the PTN site to provide Unit 3 and Unit 4 spent fuel capacity through the current end of extended plant lives and to provide the storage required to facilitate decommissioning of the plant. The ISFSI provides the capability to store PTN spent nuclear fuel, high-level radioactive waste, and reactor-related greater-than-Class C waste into dry storage casks. The ISFSI is licensed under the general license provided to power reactor licensees under 10 CFR 72.210. (FPL 2017b, Section 1.2.10) The ISFSI will need to be expanded to accommodate the greater accumulation of spent fuel due to the additional operating years if the DOE has not begun taking ownership of commercial spent fuel by the time the additional storage is needed at PTN. ISFSI expansion is not a refurbishment activity.

2.2.7 Nonradioactive Waste Management System

The Resource Conservation and Recovery Act (RCRA) regulates the disposal of solid waste. The FDEP is the agency responsible for regulating and administering this regulation. PTN is classified as a small quantity generator of hazardous wastes (EPA 2017d). Nonradioactive hazardous and nonhazardous waste quantities over the most recent 5 years are provided in Table 2.2-3. FPL does not anticipate changes in nonradioactive waste generation attributable to the proposed PTN SLR.

FPL uses a contact stabilization treatment plant for sanitary waste. The facility is located west of the power block area and consists of a sewage lift station, two flow equalization tanks, two aerobic digesters, two aeration tanks, a secondary clarifier system, two tertiary filters, a filter backwash system, a flow meter, two air blowers, a chlorine contact tank, a gas chlorine disinfection system, and an anoxic denitrification chamber. Treatment consists of anoxic/denitrification flow equalization, biological treatment using activated sludge, tertiary filtration, and chlorination. FPL disposes of treated wastewater in a 10-inch diameter, 50-foot deep underground injection well located adjacent to the treatment facility and reports average daily flow, carbonaceous biological oxygen demand (5-day), total suspended solids, fecal coliform bacteria, pH, total residual chlorine, and nitrate (as N) to the FDEP. FPL disposes of residuals (wet sludge) at the Miami-Dade Water and Sewer Department's (MDWASD) South District Wastewater Treatment Facility. (FPL 2000b, Section 3.1.3)

The Miami-Dade County Department of Solid Waste Management is responsible for solid waste collection, transport, and disposal in unincorporated portions of the county and eight municipalities. The Miami-Dade County Solid Waste Management solid waste disposal system consists of a resource recovery waste-to-energy facility and two landfills: North Dade Landfill (a trash-only facility) and South Dade Landfill (a garbage and trash facility), which are supported by three regional waste transfer stations. An approved solid waste contractor collects and transports the solid waste generated at PTN for disposal at county facilities. (FPL 2008, Section 2.2.8.10)

FPL addresses the management of PTN's hazardous waste, universal waste, and oily waste through its administrative procedures. These procedures establish responsibilities and controls for managing waste generated, pollution prevention, and the control and storage of chemicals. A Hazardous Material Coordinator ensures the proper sampling, packaging, storage, shipping analysis, and disposal of hazardous materials generated at PTN and is supported by corporate environmental services. FPL utilizes permitted and licensed vendors to transport and recycle or dispose of the wastes. Vendors and suppliers are managed and vetted at the corporate level.

PTN maintains the following waste-related permits:

- FDEP NPDES IWW Facility Permit No. FL0001562
- FDEP Sewage Treatment Facility Domestic Wastewater Facility Permit No. FLAO13612-002-DW3P
- FDEP Sanitary Wastewater Disposal Well Domestic Wastewater Facility Permit No. 0127512-002-UO
- Miami-Dade County Department of Environmental Resources Management (MDC DERM) Sewage Treatment Facility Domestic Wastewater Permit No. DWO-00010
- MDC DERM Industrial Waste Permit No. IW-000003 (onsite disposal of inert debris)
- MDC DERM Industrial Waste Permit No. IW-000016 (hazardous materials and hazardous waste generation)
- MDC DERM Industrial Waste Permit No. IW5-006229 (fleet vehicle maintenance facility)

On January 18, 2008, FPL submitted a site certification application (SCA) to the FDEP for an uprate of Units 3 and 4 to provide additional capacity (FPL 2008). The SCA process provides a certification that encompasses all licenses and permits needed for affected Florida state, regional, and local agencies. It also includes any regulatory activity that would be applicable under these agencies' regulations for PTN (FDEP 2017a). On April 1, 2016, the State of Florida issued final conditions of certification to FPL, authorizing operation and maintenance of PTN and associated facilities as modified by the design and operating conditions of the EPU (State of Florida 2016), and the final conditions of certification issued are binding and subject to the requirements listed.

Table 2.2-1
Meteorological Instrumentation

Parameter	South Dade 60-Meter Meteorological Tower	LU 10-Meter Meteorological Tower
Wind speed	10, 60 meter	10 meter
Wind direction	10, 60 meter	10 meter
Temperature	10, 60 meter	none
Vertical temperature difference	(10-60) meter	none
Sigma theta	10, 60 meter	10 meter
Precipitation	1.37[(a)] meter	1.37 meter
Solar radiometer	1.2[(b)]meter	none
Barometric pressure	[(c)]	none
Humidity	none	none

(FPL 2014a)

a. Located approximately 24.5 feet southeast from base of 60-meter tower.
b. Located approximately 23 feet southeast from the base of the 60-meter tower.
c. Located outside the equipment shelter on the southern wall.

Table 2.2-2
Meteorological System Configuration (Sheet 1 of 3)

Sensed Parameter	Sensor Type	Range	System Accuracy	System[(a)] Accuracy NRC RG 1.23, Revision 1	System[(b)] Accuracy ANSI/ANS-3.11-2005	Starting Thresholds	Starting[(a)] Threshold NRC RG 1.23, Revision 1	Measurement Resolution	Measurement[(a)] Resolution NRC RG 1.23, Revision 1	Measurement[(b)] Resolution ANSI/ ANS-3.11-2005	Elevation (relative to tower)
South Dade Tower Instruments											
Wind Speed	3 Cup Anemometer	0 to 100 mph (0 to 45 m/s)	0.5 mph (±0.22 m/s) or ±1.0% of true air speed (whichever is greater)	±0.45 mph (±0.2 m/s) or 5% of observed wind speed	±0.45 mph (0.2 m/s) or 5% of observed wind speed	0.5 mph (0.22 m/s)	1 mph (<0.45 m/s)	–	0.1 mph or 0.1 m/s	0.1 mph or 0.1 m/s	10 m, 60 m
Wind Direction	Wind Vane	0 to 360 degrees – mechanical	±5 degrees	±5°	5° azimuth	0.5 mph (0.22 m/s)	1 mph (<0.45 m/s)	<1 degree	1.0 degree	1.0° azimuth	10 m, 60 m
Ambient Temperature	Epoxy Coated Thermistor	-40.0° to +120.0°F (-40.0° to 49°C)	±0.27°F (±0.15°C)	±0.9°F (±0.5°C)	±0.9°F (0.5°C)	–	–	–	0.1°F or 0.1°C	0.1°F or 0.1°C	10 m
Differential Temperature[(a)]	N/A	–	–	±0.18°F (±0.1°C)	±0.18°F (±0.1°C)	–	–	–	0.1°F or 0.1°C	0.1°F or 0.1°C	60m-10m
Precipitation[(b)]	Tipping Bucket	–	+/-3% (Rates of 1 to 6 inches per hour)	±10% for a volume equivalent to 0.1 in (2.54 mm) of precipitation at a rate <2 in/h (<50 mm/h)	±10% for a volume equivalent to 0.1 in (2.54 mm) of precipitation at a rate <2 in/h (<50 mm/h)	–	–	–	0.1 in or 0.25 mm	0.1 in or 0.25 mm	Tower base

Table 2.2-2
Meteorological System Configuration (Sheet 2 of 3)

Sensed Parameter	Sensor Type	Range	System Accuracy	System[(a)] Accuracy NRC RG 1.23, Revision 1	System[(b)] Accuracy ANSI/ANS-3.11-2005	Starting Thresholds	Starting[(a)] Threshold NRC RG 1.23, Revision 1	Measurement Resolution	Measurement[(a)] Resolution NRC RG 1.23, Revision 1	Measurement[(b)] Resolution ANSI/ ANS-3.11-2005	Elevation (relative to tower)
Solar Radiometer	Pyranometer	0.3-3um	±0.008 Langley/min[(c)]	–	–	–	–	–	–	–	Tower base
Barometric Pressure	–	–	Consistent with current state-of-the-art	–	3 hPa	–	–	–	–	0.1 hPa	Instrument Building
Sigma-Theta[(d)]	N/A	N/A	N/A	–	–	N/A	–	1 degree	–	1.0 degrees azimuth	10 m, 60 m
Humidity	N/A	N/A	N/A	±4%	N/A	N/A	N/A	N/A	0.1%	N/A	N/A
LU Tower Instruments											
Wind Speed	3 Cup Anemometer	0 to 100 mph (0 to 45 m/s)	0.5 mph (±0.22 m/s) or ±1.0% of true air speed (whichever is greater)	±0.45 mph (±0.2 m/s) or 5% of observed wind speed	±0.45 mph (0.2 m/s) or 5% of observed wind speed	0.5 mph (0.22 m/s)	1 mph (<0.45 m/s)	–	0.1 mph or 0.1 m/s	0.1 mph or 0.1 m/s	10 m
Wind Direction	Wind Vane	0 to 360 degrees	±5°	±5°	5° azimuth	0.5 mph (0.22 m/s)	1 mph (<0.45 m/s)	<1 degree	1.0 degree	1.0 degree azimuth	10 m
Precipitation[(b)]	Tipping Bucket	–	+/-3% (Rates of 1 to 6 inches per hour)	±10% for a volume equivalent to 0.1 in (2.54 mm) of precipitation at a rate <2 in/h (<50 mm/h)	±10% for a volume equivalent to 0.1 in (2.54 mm) of precipitation at a rate <2 in/h (<50 mm/h)	–	–	–	0.1 in or 0.25 mm	0.1 in or 0.25 mm	Tower base

Table 2.2-2
Meteorological System Configuration (Sheet 3 of 3)

Sensed Parameter	Sensor Type	Range	System Accuracy	System[(a)] Accuracy NRC RG 1.23, Revision 1	System[(b)] Accuracy ANSI/ANS-3.11-2005	Starting Thresholds	Starting[(a)] Threshold NRC RG 1.23, Revision 1	Measurement Resolution	Measurement[(a)] Resolution NRC RG 1.23, Revision 1	Measurement[(b)] Resolution ANSI/ ANS-3.11-2005	Elevation (relative to tower)
Sigma-Theta	N/A	N/A	N/A	–	–	N/A	–	1 degree	–	1.0 degrees azimuth	10 m

(FPL 2014a)

a. The differential temperature value is a calculated value based on arithmetic differences in the ambient temperature measurements at 60-meter and 10-meter locations.
b. Water is collected and drained each time an internal bucket fills with 0.01 inches of water.
c. As measured at the output of primary equipment rack.
d. The sigma theta value is a calculated value based on the wind direction variation measurements, and, therefore, has the same resolution as the wind direction measurements.

Table 2.2-3
Nonradioactive Waste Quantities at PTN (Sheet 1 of 7)

Waste	Weight/Volume	Units
2016		
Acetic acid solution	8	pounds
Aerosol cans	94	pounds
Amines, liquid, corrosive	700	pounds
Ammonia solutions	6	pounds
Batteries, dry, containing potassium hydroxide solid	530	pounds
Batteries, wet, filled with acid	2,100	pounds
Corrosive liquid, acidic, inorganic	131	pounds
Corrosive liquid, acidic, organic	12	pounds
Corrosive liquid, basic, inorganic	150	pounds
Corrosive liquid, basic, organic	156	pounds
Corrosive liquids, oxidizing	7	pounds
Dimethylamine solution	43	pounds
Flammable liquids	1,365	pounds
Flammable liquids, corrosive	14	pounds
Fluorescent lamps for recycling, non-regulated	2,345	pounds
Hazardous waste (paint booth filters)	200	pounds
Hydrazine aqueous solution	8	pounds
Hydrogen peroxide, aqueous solutions	6	pounds
Lithium batteries	40	pounds
Mercury	15	pounds
Mercury contained in manufactured articles	13	pounds
Non-RCRA, non-DOT regulated (used oil)	3,243	gallons
Non-RCRA, non-DOT regulated materials - liquids (non-hazardous loose pack)	220	pounds

Table 2.2-3
Nonradioactive Waste Quantities at PTN (Sheet 2 of 7)

Waste	Weight/Volume	Units
Non-RCRA, non-DOT regulated - liquids (non-hazardous resin water)	10,000	gallons
Non-regulated material	15	gallons
Non-regulated material (Aqua-Kure)	1,200	pounds
Non-regulated material (bulk solid boric acid)	1,800	pounds
Non-regulated material (hydraulic oil)	4,500	pounds
Non-regulated material (oil filters)	600	pounds
Non-regulated material (oily rags and absorbents)	220	gallons
Non-regulated material (oily rags and absorbents)	4,300	pounds
Non-regulated material (oily water)	600	pounds
Paint-related material (paint waste)	20	pounds
Propane cylinder	10	pounds
Sodium hydroxide solution	24	pounds
Sulfuric acid	178	pounds
Toxic liquids, organic	396	pounds
Toxic solids, organic	18	pounds
2015		
UN1160, waste dimethylamine solution	7	pounds
UN1263, waste paint related material	2,000	pounds
UN1479, waste oxidizing solid	12	pounds
UN1824, waste sodium hydroxide solution	14	pounds
UN1950, waste aerosols	300	pounds
UN1993, waste flammable liquids	2,350	pounds
UN2031, waste nitric acid	24	pounds
UN2031, waste sulfuric acid	16	pounds
UN2491, waste ethanolamine solutions	2,100	pounds

Table 2.2-3
Nonradioactive Waste Quantities at PTN (Sheet 3 of 7)

Waste	Weight/Volume	Units
UN2733, waste amines, flammable, corrosive	90	pounds
UN2735, waste polyamines, liquid, corrosive	45	pounds
UN2789, waste acetic acid, glacial	20	pounds
UN2794, waste batteries, wet, filled with acid	2,471	pounds
UN2810, toxic liquids, organic	20	pounds
UN2811, waste toxic solids, organic	15	pounds
UN3028, batteries, dry, containing potassium hydroxide solid	65	pounds
UN3264, waste corrosive liquid, acidic, inorganic	215	pounds
UN3506, waste mercury contained in manufactured articles	17	pounds
NA2212, asbestos	9	pounds
NA3077, hazardous waste, solid	60,000	pounds
NA3077, hazardous waste, solid	49	yards
NA3082, hazardous waste, liquid	170	pounds
Non-hazardous material (anti-freeze/coolant)	110	gallons
Non-hazardous material (oily water)	677	gallons
Non-hazardous material (rags & absorbent material)	1,375	gallons
Non-hazardous material (soils)	1,750	pounds
Non-RCRA, non-DOT regulated materials - liquids	11,475	pounds
Non-RCRA, non-DOT regulated materials - liquids (ethylene glycol)	1,275	pounds
Non-RCRA, non-DOT regulated materials - liquids (water, amino acids)	1,000	pounds
Non-RCRA, non-DOT regulated materials - solids	11,400	pounds
Non-RCRA, non-DOT regulated materials - solids	24	yards
Non-regulated material	900	pounds

Table 2.2-3
Nonradioactive Waste Quantities at PTN (Sheet 4 of 7)

Waste	Weight/Volume	Units
Non-regulated material (hydraulic oil)	990	gallons
Non-regulated material (hydraulic oil)	11,200	pounds
Non-regulated material (oil filters)	165	gallons
Non-regulated material (oil filters)	1,200	pounds
Non-regulated material (oily rags, oily absorbents)	2,600	pounds
Non-regulated material (oily water)	1,600	pounds
Non-regulated material (polyethylene glycol, titanium dioxide)	600	pounds
Fluorescent lamps for recycling, non-regulated (universal waste)	500	pounds
Used oil (non-DOT regulated)	1,200	gallons
2014		
UN1263, waste paint related material including paint thinning, drying, removing, or reducing compound	1,600	pounds
UN1750, corrosive solids (sodium hydroxide solid (dry, flake, bead or granular))	1,200	pounds
UN1950, waste aerosols, flammable	25	pounds
UN1956, compressed gases (carbon monoxide)	15	pounds
UN1956, compressed gases (fluorinated hydrocarbons, nitrogen)	35	pounds
UN1956, compressed gases (hydrogen)	9	pounds
UN2031, waste nitric acid other than red fuming, with not more than 20 percent nitric acid mixture	10	pounds
UN2031, waste nitric acid other than red fuming, with at least 65% but not more than 70% nitric acid	15	pounds
UN2672, waste ammonia solution	250	pounds
UN2735, waste amines, liquid, corrosive	250	pounds
UN2924 waste flammable liquids, corrosive	10	pounds
UN3264, waste corrosive liquid, acidic, inorganic	5	pounds

Table 2.2-3
Nonradioactive Waste Quantities at PTN (Sheet 5 of 7)

Waste	Weight/Volume	Units
UN3264, waste corrosive liquid, acidic, inorganic (ammonium hydroxide containing less than 10% ammonia)	5	pounds
UN3264, waste corrosive liquid, acidic, inorganic (hydrochloric acid solution, sulfuric acid, spent)	200	pounds
UN3265, waste corrosive liquid, acidic, organic (methanesulfonic acid)	45	pounds
UN3266, waste corrosive liquid, basic, inorganic	10	pounds
UN3267, waste corrosive liquid, basic, organic (toly triazole, sodium salt)	285	pounds
UN3267, waste corrosive liquid, basic, organic (triethanolamine)	40	pounds
UN3287, toxic liquid, inorganic (sodium fluoride solution)	10	pounds
NA3077, hazardous waste, solid (chromium)	225	pounds
NA3077, hazardous waste, solid (mercury)	150	pounds
NA3082, hazardous waste, liquid	10	pounds
NA3082, hazardous waste, liquid (chromium)	100	pounds
NA3082, hazardous waste, liquid (hydrazine)	300	pounds
NA3082, hazardous waste, liquid (1,1,2-thrichloro-1,2,2-trifluoroethane)	25	pounds
Non-DOT regulated material	320	pounds
Non-hazardous material	2,100	pounds
Non-hazardous material (grease)	45	pounds
Non-hazardous material (oily water)	770	gallons
Non-hazardous material (rags and absorbent material)	2,205	gallons
Non-hazardous material (soils)	165	gallons
Non-RCRA liquid	100	pounds
Non-regulated material	495	gallons
Non-regulated material	1,150	pounds

Table 2.2-3
Nonradioactive Waste Quantities at PTN (Sheet 6 of 7)

Waste	Weight/Volume	Units
Non-regulated material (contaminated rocks with oil)	330	gallons
Non-regulated material (desiccant)	400	pounds
Non-regulated material (non-hazardous liquids)	2,050	pounds
Non-regulated material (oily rags and absorbents)	1,210	gallons
Non-regulated material (silica)	225	pounds
Used oil (non-DOT regulated)	3,380	gallons
2013		
UN1066, nitrogen, compressed	10	pounds
UN1263, waste paint related material including paint thinning, drying, removing, or reducing compound	5,600	pounds
UN1950, waste aerosols, flammable	5	pounds
UN1978, waste propane	10	pounds
UN2735, waste amines, liquid, corrosive	10	pounds
UN2794, waste batteries, wet, filled with acid	75	pounds
UN3108, waste organic peroxide type E, solid (dibenzoyl peroxide, <=52% as a paste)	15	pounds
NA3077, hazardous waste, solid (chromium)	3,100	pounds
NA3077, hazardous waste, solid (mercury)	225	pounds
NA3082, hazardous waste, liquid (chromium)	400	pounds
NA3082, hazardous waste, liquid (1,1,2-thrichloro-1,2,2-trifluoroethane)	80	pounds
Non-regulated material (non-hazardous liquids)	760	pounds
Block tank insulation friable	1	unit
2012		
UN1263, waste paint related material including paint thinning, drying, removing, or reducing compound	3,585	pounds
UN1950, waste aerosols, flammable	57	pounds

Table 2.2-3
Nonradioactive Waste Quantities at PTN (Sheet 7 of 7)

Waste	Weight/Volume	Units
UN2922, waste corrosive liquids, toxic (phenol liquid)	40	pounds
UN3077, environmentally hazardous substances, solid	10	pounds
UN3446, nitrotoluenes, solid	5	pounds
NA3077, hazardous waste, solid (chromium)	3,120	pounds
NA3077, hazardous waste, solid (xylene, acetone)	150	pounds
NA3082, hazardous waste, liquid	60	pounds
NA3082, hazardous waste, liquid (chromium)	400	pounds
Non-hazardous material (oily water)	1,287	gallons
Non-hazardous material (rags & absorbent material)	2,090	gallons
Non-hazardous material (used oil filters)	110	gallons
Non-regulated material	3,740	pounds
Non-regulated material (non-hazardous liquids)	2,600	pounds
Spent mercury-containing devices for recycling	300	pounds
Used oil (non-DOT regulated)	5,978	gallons

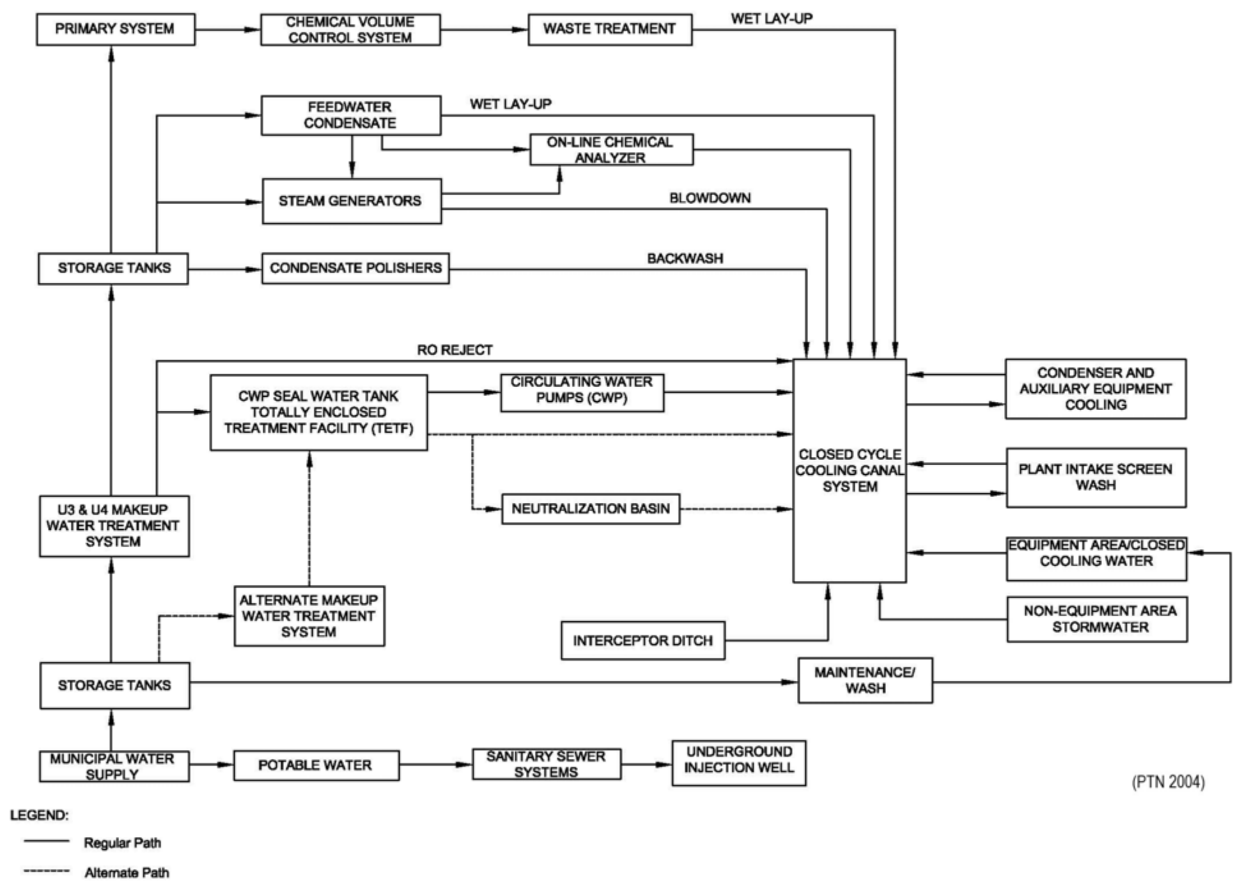

Figure 2.2-1
Plant Water Use Schematic

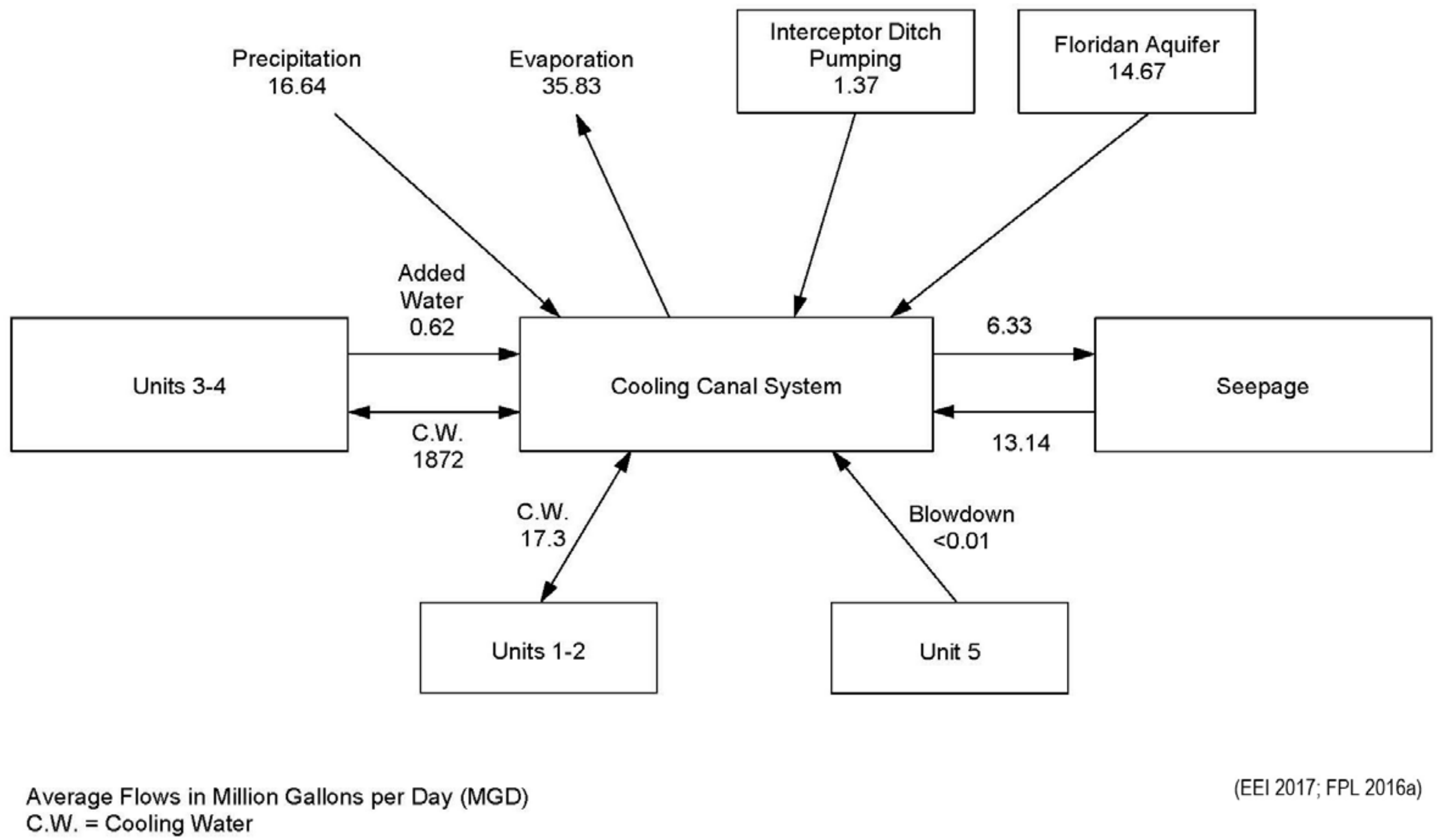

Figure 2.2-2
Turkey Point Typical Water Budget

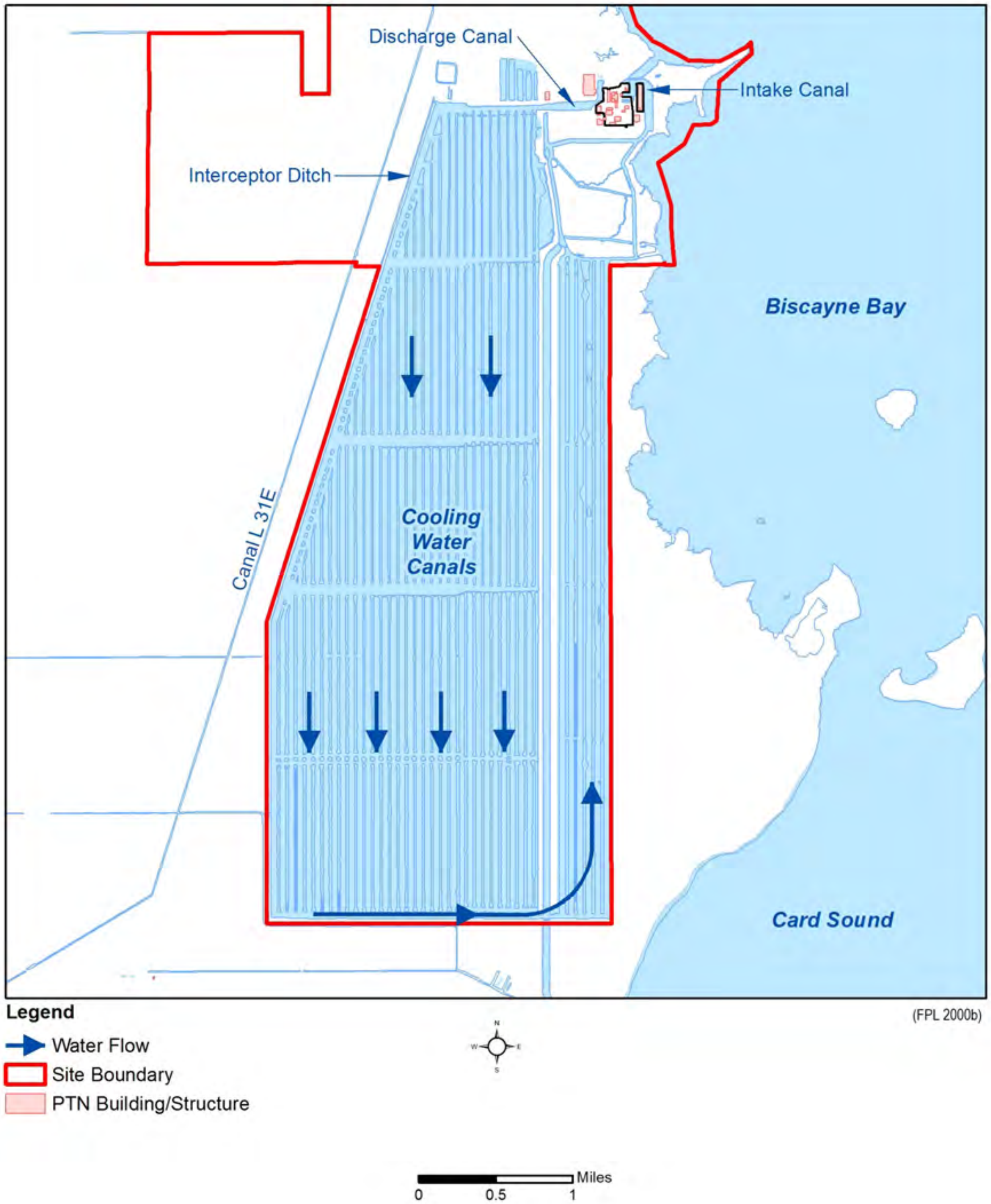

Figure 2.2-3
Turkey Point Cooling Water Canal System Flow

Figure 2.2-4
In-Scope Transmission Lines at Turkey Point

2.3 Refurbishment Activities

In accordance with 10 CFR 51.53(c)(2), the ER must contain a description of the applicant's plan to modify the facility or its administrative control procedures as described in accordance with 10 CFR 54.21. Therefore, this ER must describe in detail any planned refurbishment activities. If refurbishment is planned at a facility, the ER would analyze the environmental impacts of the proposed activity [10 CFR 51.53(c)(3)(ii)].

The incremental aging management activities implemented to allow operation of a nuclear power plant beyond the original 40-year license term were assumed to fall under one of two broad categories. One of these categories involves refurbishment actions, which usually occur infrequently and possibly only once in the life of the plant for any given item. (NRC 2013a, Section 2.1.1)

NRC requirements for the renewal of OLs for nuclear power plants include preparation of an integrated plant assessment (IPA) [10 CFR 54.21]. The IPA must identify systems, structures, and components (SSCs) subject to an aging management review. The objective of the IPA is to determine whether the detrimental effects of aging could preclude certain SSCs from performing in accordance with the current licensing basis during the additional 20 years of operation requested in the subsequent license renewal application (SLRA). An example of an SSC that is subject to aging is the reactor vessel. At PTN, the steam generators have been previously replaced.

FPL's IPA has not identified any structures, systems, and/or components that would require refurbishment.

2.4 Programs and Activities for Managing the Effects of Aging

The incremental aging management activities implemented to allow operation of a nuclear power plant beyond the original 40-year license term and 20-year license extension were assumed to fall under one of two broad categories: (1) SMITTR actions, most of which are repeated at regular intervals, and (2) categories involving refurbishment actions, which usually occur infrequently and possibly only once in the life of the plant for any given item . . . . (FPL 2017a, Section 2.1.1)

The programs for managing the effects of aging on certain structures and components within the scope of license renewal at the site are described in the body of the SLRA (see Appendix B of the PTN SLRA). The evaluation of structures and components required by 10 CFR 54.21 identified the activities necessary to manage the effects of aging on structures and components during the period of extended operation beyond the initial license renewal term. Other than implementation of the programs and activities identified in the IPA, there are no planned modifications of FPL's administrative control procedures associated with license renewal.

2.5 Employment

The 2017 non-outage workforce at the site consists of 679 persons (Table 2.5-1) but the operational staff employment of both units was reported to run as high as 800 staff persons in 2010 (FPL 2010). PTN currently has 366 contract workers on site in addition to the total number of permanent PTN plant employees.

There are no plans to add additional permanent employees to support plant operations during the extended license renewal period, and as discussed in Section 2.3, no license renewal-related refurbishment activities have been identified. Neither are there plans to add additional permanent operational staff to support any SMITTR activities at the plant during the SLR period. Refueling cycles usually last approximately 25 to 35 days per unit. There were a reported 1,200 workers present for the most recent PTN refueling cycle. Refueling and maintenance outages for PTN are on a staggered 18-month schedule per unit.

Table 2.5-1
PTN Permanent Employee Residence Information, 2017 (Sheet 1 of 3)

State, County, and City/Towns	Permanent Full-time Employees[a] [b]	County Total
FLORIDA		
Broward		**49**
Cooper City	5	
Coral Springs	1	
Davie	7	
Fort Lauderdale	3	
Hollywood	3	
Lauderhill	1	
Miramar	5	
Parkland	2	
Pembroke Pine	14	
Plantation	1	
Southwest Ranches	2	
Sunrise	3	
Weston	2	
Charlotte		**1**
Port Charlotte	1	
Citrus		**1**
Hernando	1	
Lake		**1**
Clermont	1	
Martin		**1**
Palm City	1	
Miami-Dade		**577**
Coconut Grove	1	

Table 2.5-1
PTN Permanent Employee Residence Information, 2017 (Sheet 2 of 3)

State, County, and City/Towns	Permanent Full-time Employees[(a) (b)]	County Total
Coral Gables	3	
Cutler Bay	37	
Cutler Ridge	1	
Doral	2	
Florida City	3	
Hialeah	3	
Homestead	254	
Leisure City	2	
Miami	246	
Miami Beach	1	
Miami Gardens	1	
Naranja	2	
North Bay Village	1	
Palmetto Bay	10	
Pinecrest	1	
Princeton	4	
South Miami	2	
Village of Palmetto	1	
West Miami	2	
Monroe		**40**
Key Largo	34	
Tavernier	6	
Okeechobee		**1**
Okeechobee	1	

Table 2.5-1
PTN Permanent Employee Residence Information, 2017 (Sheet 3 of 3)

State, County, and City/Towns	Permanent Full-time Employees[(a)] [(b)]	County Total
Orange		**1**
Maitland	1	
Palm Beach		**4**
Boca Raton	1	
Jupiter	1	
Palm Beach Gardens	1	
Royal Palm Beach	1	
St. Lucie		**1**
Fort Pierce	1	
Taylor		**1**
Perry	1	
GEORGIA		
Cobb		**1**
Marietta	1	
Total	679	**679**

a. PTN has 366 contract workers currently on site in addition to the total number of permanent PTN Unit 3 and 4 plant employees. Contract employee settlement patterns generally follow the county settlement patterns indicated by permanent PTN staff, with 291 workers located in Miami-Dade County, FL. There were 17 contract workers identified as living out of state. The worker number does not include contract staff necessary for support of PTN refueling.
b. There were a reported 1,200 workers present for the most recent PTN refueling cycle.

2.6 Alternatives to the Proposed Action

The proposed action as described in Section 2.1 is to renew the PTN OLs for an additional 20 years. Because the option is to renew or not renew the PTN OLs, the only fundamental alternative to the proposed action is the no-action alternative, which would result in allowing the PTN OLs to expire. However, the no-action alternative does not provide a means for meeting current and future regional electricity needs. Because PTN provides base-load generation for the FPL service area, the 1,632 MWe of generation loss (FPL 2017a) would need to be replaced with a reliable source of equivalent capacity and energy. Therefore, unless replacement for the loss of the PTN base-load generation is considered under the no-action alternative, that alternative would not satisfy the purpose and need for the proposed action. FPL considered a range of replacement power alternatives from which to select those alternatives to be further analyzed for replacement of FPL base-load generation.

2.6.1 Alternatives Evaluation Process

To meet the applicant's requirement to identify reasonable alternatives to the proposed action of continued operation of PTN during the SLR period, FPL screened the alternatives presented in the GEIS. FPL developed the following set of criteria to review energy source alternatives under the no-action alternative:

- The purpose of the SLR (proposed action) is the continued production of 1,632-MWe of base-load generation. Based on 2014-2016 average capacity factors for PTN of 90.4 percent for Unit 3 and 93.5 percent for Unit 4 (NEI 2017a), PTN's annual generation is 13,154,016 megawatt-hours (MWhs).

- Alternatives or combinations of alternatives evaluated in this ER would need to provide equivalent capacity and energy.

- Alternatives considered must maintain a balance between generation and electrical demand within the service area of Miami-Dade and Broward counties.

- Alternatives considered must be fully operational by 2032 considering development of the technology, permitting, construction of the facility, and connection to the grid.

- Alternatives must be electricity-generating sources that are technically feasible and commercially viable.

2.6.2 Alternatives Considered

Although, as discussed below, the current 10-year plan was used as a source, FPL conducted an alternatives screening process based on the above criteria. FPL considered the full range of alternatives discussed in the GEIS (NRC 2013a) to determine the alternatives suitable for replacement or PTN generation.

The screening of alternatives for consideration under the no-action alternative and comparison of environmental impacts with the proposed action is a separate and independent exercise from the process FPL implements to prepare its annual 10-year power plant site plan. However, the generation options for meeting FPL's customer's power demands presented in the *Ten Year Power Plant Site Plan 2017–2026* (FPL 2017a) was considered in screening replacement generation alternatives for PTN.

The generation sources listed below were selected as reasonable replacement alternatives based on their ability to provide reliable power. Although FPL would actually seek to replace 1,632 MWe with an equivalent amount MWe of generation, this analysis focuses on the energy (MWh) aspect of the replacement generation for purposes of assessing environmental impacts.

- Natural gas-fired plant alternative (natural gas-fired combined cycle [NGCC] turbine) located at the existing Turkey Point site that provides generation equivalent to PTN's 1,632 MWe with an annual generation of approximately 13,154,016 MWhs.

- New nuclear plant at the Turkey Point site with net electricity generation equivalent to PTN's 1,632 MWe with an annual generation of approximately 13,154,016 MWhs.

- Combination of alternatives consisting of an NGCC plant and solar photovoltaic (PV) facilities that provides generation equivalent to PTN's 1,632 MWe with an annual generation of approximately 13,154,016 MWhs. The NGCC plant would be located at the Turkey Point site. Four solar PV facilities would be constructed. One would be located on FPL-owned land on or near the Turkey Point site, and the other three facilities would be located in Miami-Dade or Broward County.

The alternatives selected as reasonable replacement base-load generation alternatives are discussed in Section 7.2.1.

FPL determined the following discrete alternatives were not considered reasonable replacements in comparison to renewal of the PTN OLs:

- Purchased power
- Plant reactivation and extended service life
- Conservation and demand side management (DSM)
- Wind
- Solar facility
- Geothermal
- Hydropower
- Municipal solid waste (MSW) and landfill gas-fired facilities
- Biomass and wood waste
- Agriculture-derived biomass fuels
- Ocean wave and current energy
- Fuel cells

- Petroleum liquids
- Coal-fired plants

The alternatives not selected as reliable generation alternatives for replacing the PTN generation are discussed in Section 7.2.2.

3.0 AFFECTED ENVIRONMENT

PTN (nuclear pressurized water reactors) is located on approximately 9,460 acres of FPL-owned land in Miami-Dade County, Florida. Along with PTN, the Turkey Point site currently includes three additional power plants. Units 1 and 2 are retired as natural-gas/oil steam-generating units that have been converted to synchronous condenser mode to help stabilize and optimize grid performance, but do not generate power. Unit 5 is a natural-gas combined-cycle steam-generating unit. (NRC 2016a, Section 2.0; FPL 2017a) In addition to the nuclear and fossil-fuel units, the site features a 5,900-acre system of closed recirculating cooling canals that four of the five units use for heat rejection. Unit 5 does not use the cooling canals for heat rejection but does use the CCS for stormwater discharge and cooling water blowdown. (FPL 2017b, Section 2.10.4; FPL 1999)

3.1 Location and Features

PTN is located on the southeastern coast of Florida in unincorporated southeastern Miami-Dade County. The site borders Biscayne Bay and Card Sound (NRC 2016a, Section 2.1). PTN's location is Sections 27, 28, 29, 31, 32, 33, and 34, Township 57 South, Range 40 East, at latitude 25° 26' 04" North and longitude 80° 19' 52" West (FPL 2017b, Section 2.2). Located approximately 25 miles north-northeast of PTN in Miami-Dade County, the city of Miami is the largest population center in the region with an estimated population of 424,632 during the period 2011–2015, as shown in Table 3.11-1. Figure 3.1-1 shows the Turkey Point property site boundary, PTN facility structures, switchyard, and EAB. Topographic features adjacent to PTN and within the property boundary are shown in Figure 3.1-2.

3.1.1 Vicinity and Region

The vicinity of PTN is defined as the area within a 6-mile radius of a center point established equidistant between the Unit 3 and Unit 4 containment structures. As seen in Figure 3.1-3, the vicinity includes portions of the unincorporated community Homestead Air Reserve Base (ARB) and the incorporated cities of Florida City and Homestead, all located in Miami-Dade County. Florida City is located approximately 9 miles west of PTN and had an estimated population of 12,024 during the period 2011–2015, up from 11,245 in 2010 and 7,843 in 2000 (Table 3.11-1). The city of Homestead is located approximately 9 miles west-northwest of PTN and had an estimated population of 64,676 during the period 2011–2015, up from 60,509 in 2010 and 31,909 in 2000. Homestead ARB is a census-designated place located approximately 6 miles northwest of PTN and had an estimated population of 1,141 during the period 2011–2015, up from 964 in 2010 and 446 in 2000. (USCB 2017a).

The surface of the land in the Turkey Point area is flat and slopes gently from an elevation of sea level at the shoreline up to an elevation of about 10 feet approximately 9 miles inland. The entire Miami-Dade County topography is generally flat with the highest elevation on a ridge in the Miami area, which parallels the shoreline. This ridge reaches an elevation of about 20 feet at its high point. The land in and around Turkey Point is composed of mangrove swamps that extend inland from the shoreline approximately 4 miles. Open fields extend westward from the edge of the swamp. (FPL 2017b, Section 2.3).

The region of PTN is defined as the area within a 50-mile radius of a center point established equidistant between the Unit 3 and Unit 4 containment structures. As seen in Figure 3.1-4, all of Miami-Dade County is within 50 miles of PTN; portions of Broward and Monroe counties and a small portion of Collier County are also within the region. As described in Table 3.11-2, Miami-Dade County reported an estimated population of 2,693,117 in 2015, up from 2,496,457 in 2010 and 2,253,362 in 2000 (USCB 2017b). Miami-Dade County and Broward County have large continuous population centers that run north-south parallel to the coastline. In 2015, there were 40 communities within the region reporting a population estimated greater than 25,000 and seven communities of which had a population greater than 100,000 (Table 3.11-1).

The 50-mile region has a highly developed roadway network associated with the populated areas along the coastline. Road access to Turkey Point is via East Palm Drive (SW 344 Street), which is a two-lane road for approximately half of its length from the plant to Florida City. East Palm Drive intersects U.S. Highway 1 (US-1) in Florida City, approximately 9 miles from PTN. (FPL 2000b, Section 2.11.2) Other major roads and highways in the region include Interstate 95 (I-95) and Interstate 75 (I-75), running north from the city of Miami. Florida's turnpike is a multilane divided toll road that traverses much of Florida. The Homestead extension of Florida's turnpike terminates at US-1 north of Florida City. (NRC 2016a, Section 2.5.2.3) There are no ports or rail systems located within the vicinity. The nearest rail line, part of the FEC Railway, is located approximately 10 miles west of PTN. Biscayne Bay, which lies directly east of the site, is the nearest navigable waterway. The Intracoastal Waterway, a 3,000-mile waterway along the Atlantic and Gulf coasts of the United States, is also adjacent to the site. The Port of Miami is located approximately 26 miles from PTN. (NRC 2016a, Sections 2.2.1.3, 2.2.1.6 and 2.2.3.1)

There are three private airports and three private heliports within 10 miles of PTN (AirNav 2017). The 2,938-acre Homestead ARB is situated approximately 5 miles northwest of PTN and is primarily devoted to military uses. The U.S. Air Force plans provide for future mixed economic uses that could include commercial development as well as residential or recreational uses, but would not include use of the airport as a civilian commercial airport. (NRC 2016a, Section 2.2.1.6) Along with the FPL helistop and the FPL Turkey Point heliport (NRC 2016a, Section 2.5.2.3), the other airfields located within 10 miles include the Motorsports Complex VIP Heliport (5 miles west), Motorsports Complex EMS Heliport (5.2 miles west), Ocean Reef Club Airport (8.3 miles south-southeast), South Dade Community Health Center Heliport (9.2 miles north), and Burrs Strip Airport (10.3 miles north-northwest). The Miami International Airport (MIA), the nearest full-service commercial airport, is located approximately 25 miles north of PTN. (AirNav 2017)

Nearby industrial uses include the RMC Florida Group Ltd. active limestone mine, located 6 miles west of PTN. There is an abandoned quarry located 6 miles north of PTN. (NRC 2016a, Section 2.2.1.6)

3.1.2 Station Features

The principal structures of PTN are identified in Section 2.2 (Figure 3.1-1). FPL owns the land contained within the Turkey Point site boundary, subject to certain encumbrances. No oil or gas wells or mines are currently located within the site boundary, and no future mining operations or investigations related to mining operations are anticipated. (NRC 2016a, Section 2.2.1.1)

The EAB, depicted in Figure 3.1-1, is located within the Turkey Point site property boundary. The portion of the Turkey Point access road (Palm Drive) that is located in the owner-controlled area is controlled by FPL. FPL also controls onsite areas located outside the protected area (PA) fence line but inside the site boundary; access can be limited by FPL for any reason. FPL control includes the cooling canals in the CCS. The PTN PA is the area within the nuclear perimeter fencing, and restricted areas include the two nuclear units and their associated structures. (FPL 2017b, Section 2.13.1, Section 2.2, Section 11.2, and Figure 2.2-4) In addition to the Units 3 and 4 nuclear reactors and the turbine building, intake and discharge, auxiliary building, switchyard, ISFSI, etc., FPL operates Units 1 and 2 (synchronous condenser mode), and Unit 5, which is a combined-cycle unit (employing four natural gas turbines and one heat-recovery steam-powered generator). (FPL 2017b, Section 2.10.4; FPL 2014b)

The area immediately surrounding the site is low, swampy, and sparsely populated. The nearest residence to PTN, as defined in the PTN annual radiological environmental operating report (AREOR), is located approximately 1.7 miles west-northwest of the PTN generating station area. This is identified as the FPL daycare center and shooting range near the entrance to Turkey Point. The Homestead Bayfront Park complex, located 1.9 miles north of the plant, has occasional overnight recreational occupancy. (PTN 2017b)

3.1.3 Federal, Native American, State, and Local Lands

Along with populated urban areas, much of the region consists of open water and publicly owned lands dedicated to conservation and preservation of natural resources (Figure 3.1-5 and Figure 3.1-6).

As described in Table 3.1-1, within a 6-mile radius, PTN is adjacent to waters and coastal lands that are part of the Biscayne National Park (and approximately 2 miles south of the Biscayne National Park visitors' center). PTN is within 2 miles of the Model Lands Basin, a South Florida Water Management District (SFWMD) conservation area. A portion of the Biscayne Bay Aquatic Preserve is located immediately east of PTN, and a separate portion of the preserve, along with the Florida Keys National Marine Sanctuary, is located adjacent to the south-southeastern border of the Turkey Point site boundary. The SFWMD-owned L-31E Canal runs along the western side of the PTN controlled area. The Turkey Point site is also located just east of the 13,000-acre Everglades Mitigation Bank, an FPL-owned and operated wetland restoration project. The Homestead Bayfront Park, a city park, is approximately 2 miles north-northwest of PTN. (NRC 2016a, Section 2.2.1) Locally owned facilities, the Homestead Sport Complex and the Homestead-Miami Speedway, are located approximately 6 miles west and 5 miles west-northwest, respectively, from PTN (USDA 2017a). Within the vicinity of PTN are two Miami-Dade County-owned conservation land parcels, including the National Bulk Carrier Site (4 miles north-northwest) and the Mangrove Preserve (6 miles north). The Biscayne Coastal Wetlands, owned by the SFWMD, are located 5 miles north-northwest of PTN. (FNAI 2017a)

The Homestead ARB is located approximately 5 miles from the PTN site and occupies a land area of approximately 800 acres. As seen in Figure 3.1-6, there is a U.S. Navy installation located approximately 7 miles southwest of the site. This installation contains no personnel and is currently being used for a motor pool. (FPL 2017b, Section 2.5.2)

Indian reservations within the region include the Miccosukee Indian Reservation, with the closest reservation parcel located approximately 24 miles north-northwest of PTN. The Seminole Tribe of Florida Hollywood Reservation is located approximately 42 miles north of PTN. (USCB 2017c)

3.1.4 Federal and Non-Federal Related Project Activities

As previously discussed in Chapter 3, at the Turkey Point site, FPL operates Units 1 and 2 (synchronous condenser mode) and Unit 5, which is a combined-cycle unit (employing four natural gas turbines and one heat recovery steam powered generator). No major changes to operations or plans for future expansion of these units are anticipated. In a separate action, the NRC is considering FPL's combined operating license (COL) application for construction and operation of two proposed new nuclear reactor units (Units 6 and 7) at the Turkey Point site.

The broader Everglades ecosystem, which includes Biscayne National Park, has been in decline, and many of the species found in the park's fragile ecosystems are in danger of extinction or regional extirpation. The Comprehensive Everglades Restoration Plan (CERP) is a major restoration initiative that aims to restore the quantity, quality, timing, and distribution of fresh water in an effort to reverse decades of environmental decline. The Biscayne Bay Coastal Wetlands project is an effort under the comprehensive plan that will rehydrate wetlands and reduce point-source discharge into Biscayne Bay. The CERP is essential to revitalizing habitat within Everglades and Biscayne national parks. The plan is a major initiative of the U.S. Department of Interior and a wide range of other agencies, including the U.S. Army Corps of Engineers (USACE). At a cost of more than $10.5 billion and with more than a 35-year timeline, it is the largest hydrologic restoration project ever undertaken in the United States. (NRC 2016a, Section 2.2.1.6)

Table 3.1-1
Federal, State, and Local Lands Totally or Partially within a 6-Mile Radius of PTN

Name[a]	Management	Distance[b]	Direction	Nearest Place	County
Biscayne Bay Aquatic Preserve[c]	State	0	E/SSE	Homestead	Miami-Dade
Biscayne Coastal Wetlands	State	5	NNW	Homestead ARB	Miami-Dade
Biscayne National Park[c]	Federal	0	NE	Homestead ARB	Miami-Dade
Everglades Mitigation Bank[c]	Local	0	SW	Homestead	Miami-Dade
Florida Keys National Marine Sanctuary[c]	Federal	0	SSE	Homestead	Miami-Dade
Homestead ARB	Federal	5	NW	Homestead ARB	Miami-Dade
Homestead Bayfront Park	Local	2	NNW	Homestead	Miami-Dade
Homestead-Miami Speedway	Local	5	WNW	Homestead	Miami-Dade
Homestead Sport Complex	Local	6	W	Homestead	Miami-Dade
Mangrove Preserve	Local	6	N	Homestead ARB	Miami-Dade
Model Lands Basin[d]	Local	2	WNW	Homestead	Miami-Dade
National Bulk Carrier Site	Local	4	NNW	Homestead ARB	Miami-Dade

(FDEP 2017b; FNAI 2017a; MDC 2017a; USCB 2017c; USDA 2017a)

a. List is based on best available public information and includes lands totally or partially located within a 6-mile radius of PTN.
b. Distances are approximate (rounded to the nearest mile and calculated based on PTN location and land centroid data).
c. Biscayne Bay Aquatic Preserve, Biscayne National Park, Florida Keys National Marine Sanctuary, and Everglades Mitigation Bank are immediately adjacent to the site, resulting in the reported distance of zero.
d. The distance reported for Model Lands Basin are rounded and based on the closest point of their property boundary to PTN.

Figure 3.1-1
PTN Plant Layout

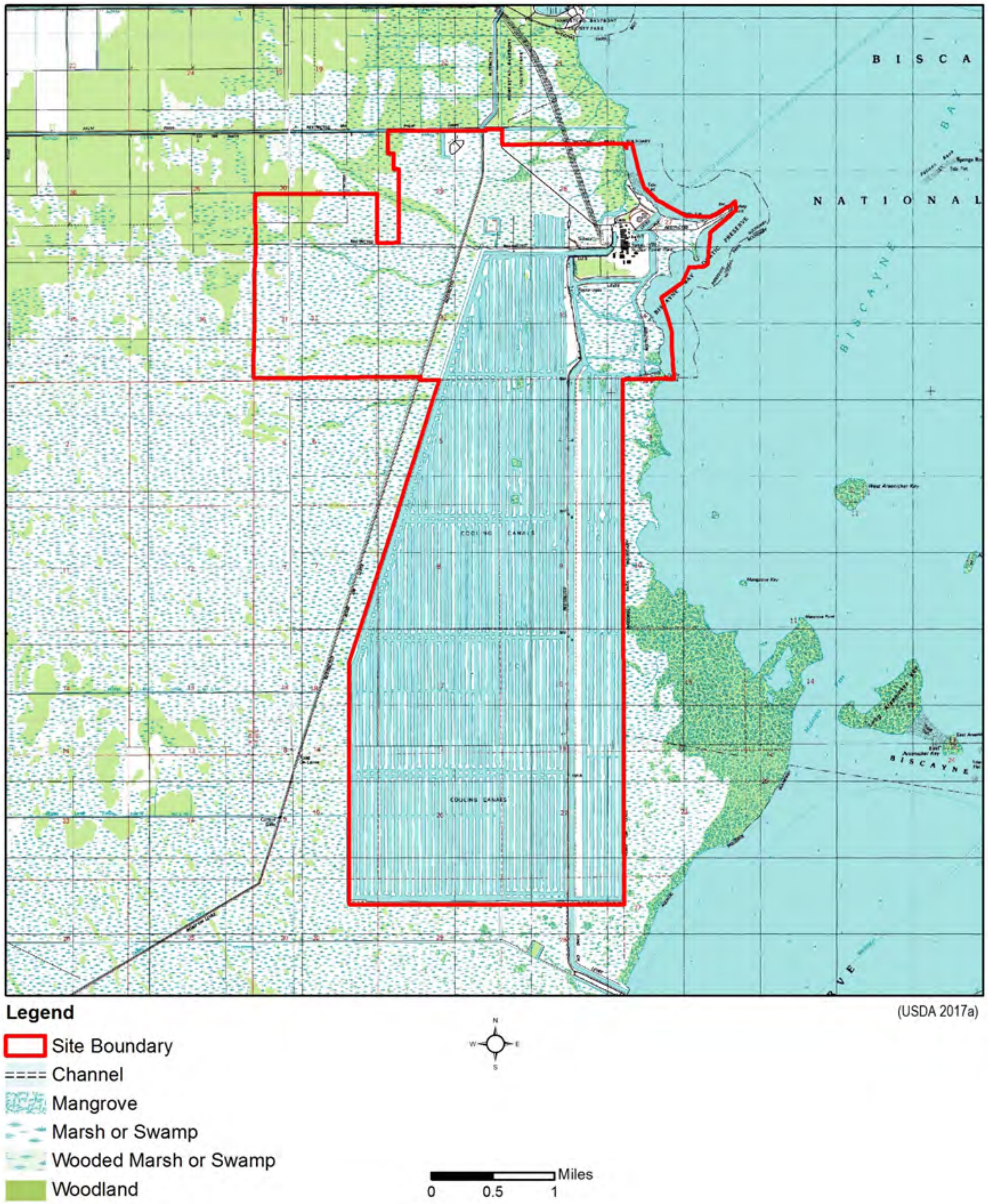

Figure 3.1-2
Turkey Point Property Site and Area Topography

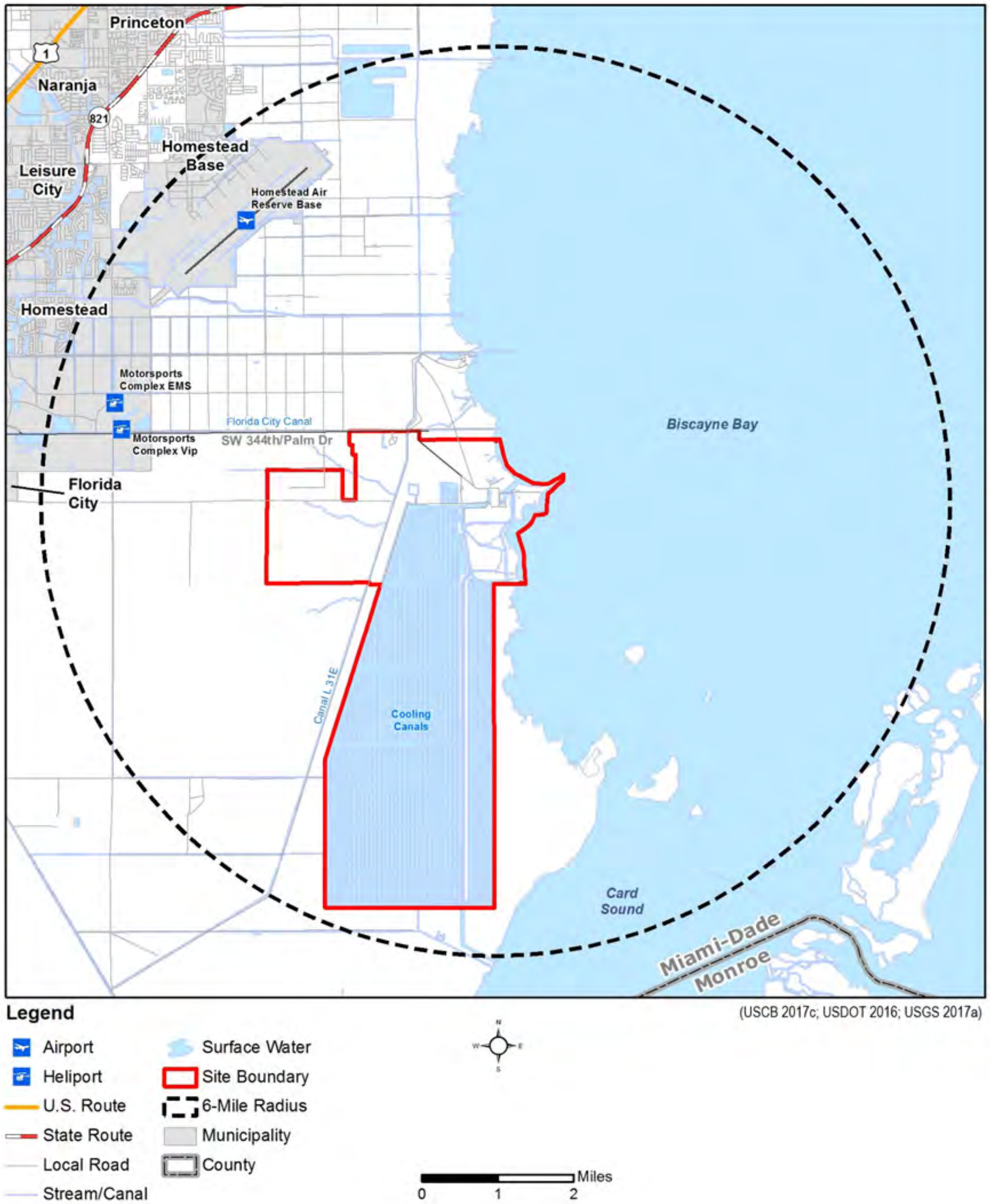

Figure 3.1-3
6-Mile Radius of PTN

Figure 3.1-4
50-Mile Radius of PTN

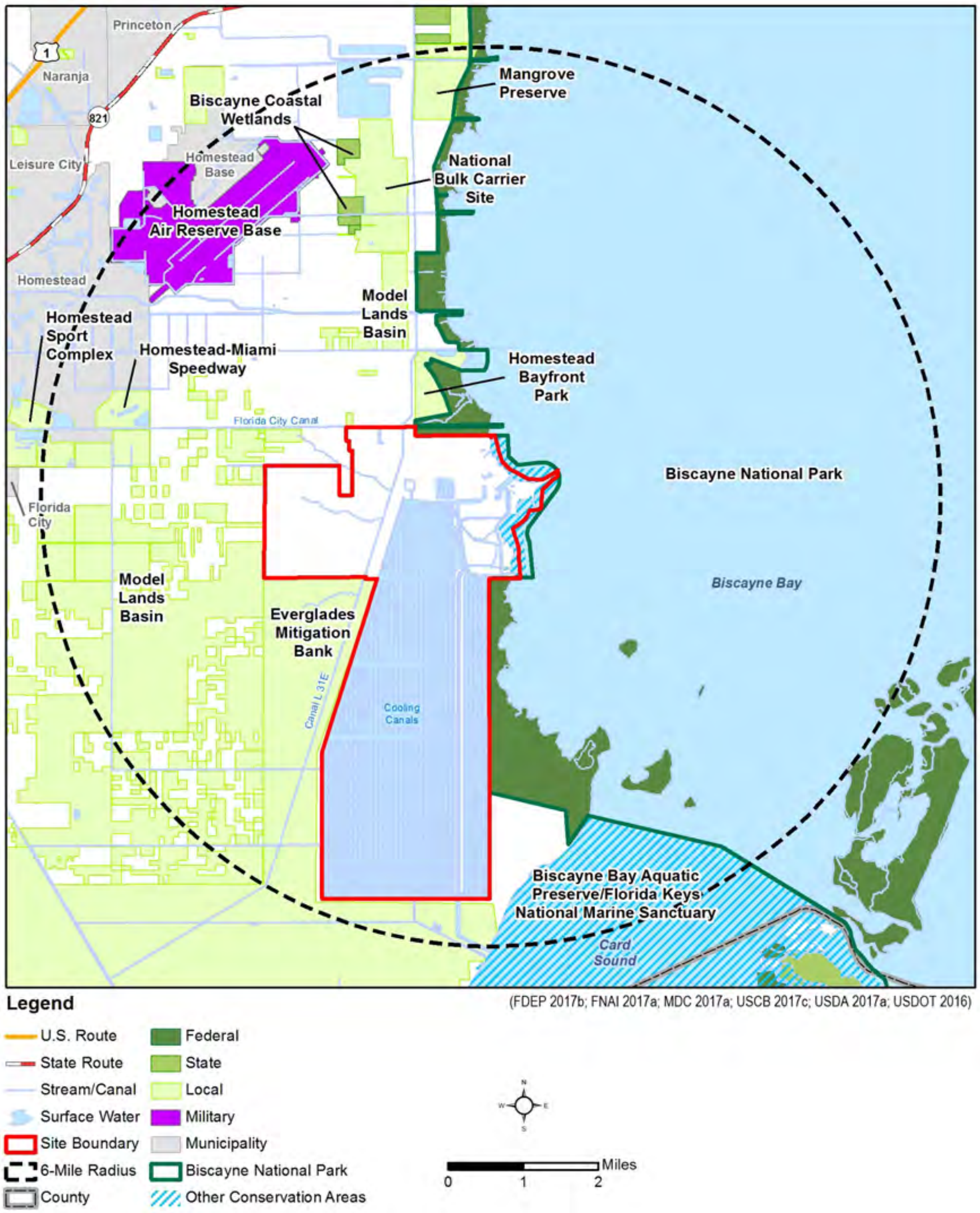

Figure 3.1-5
Federal, State, and Local Lands, 6-Mile Radius of PTN

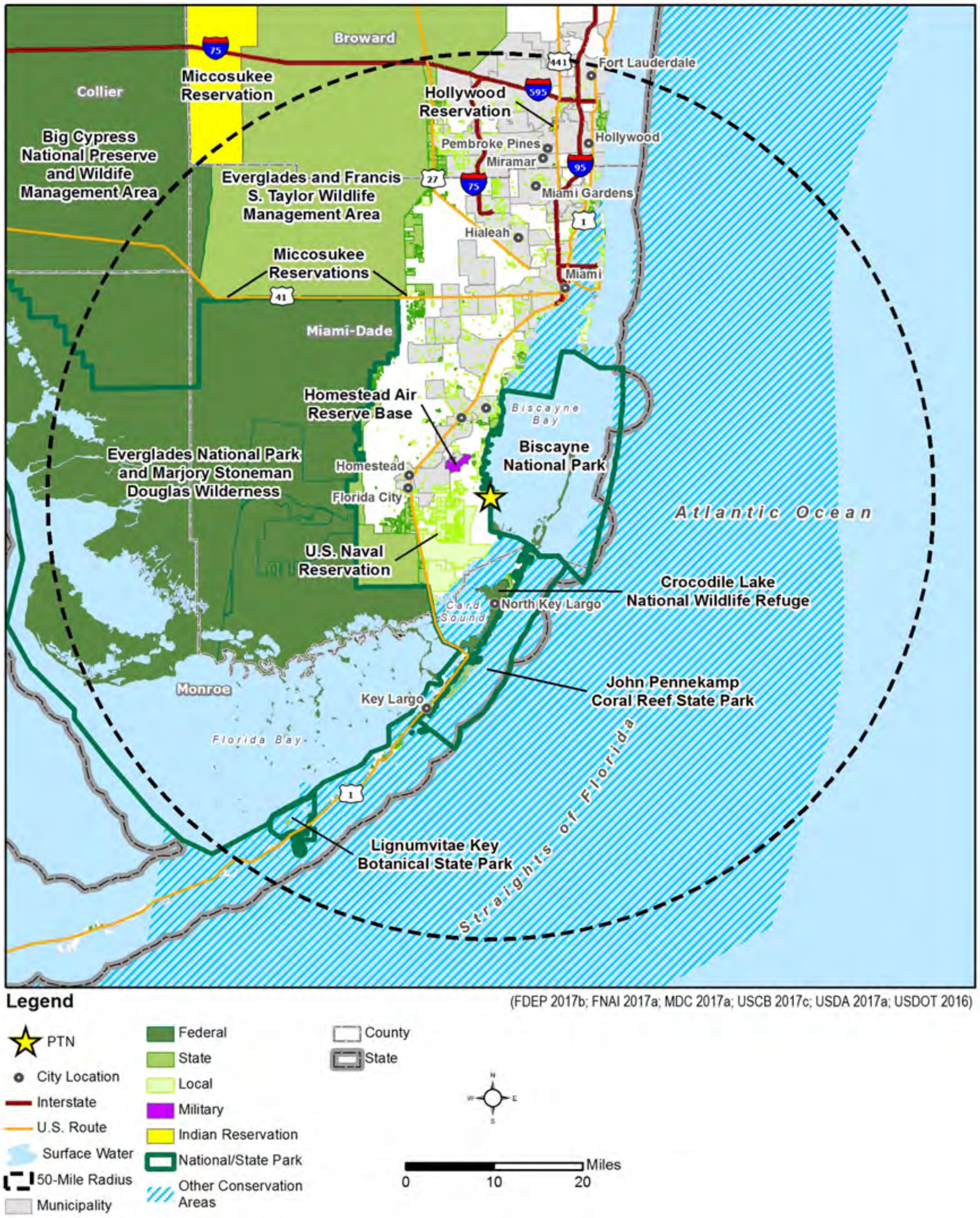

Figure 3.1-6
Federal, State, and Local Lands, 50-Mile Radius of PTN

3.2 Land Use and Visual Resources

Land use descriptions are focused on Miami-Dade County in Florida because there are no refurbishment or offsite construction activities anticipated and approximately 85 percent of the permanent PTN workforce lives in this county. This section assesses onsite and offsite land use and visual resources.

3.2.1 Onsite Land Use

PTN is located on approximately 9,460 acres of FPL-owned land approximately 9 miles west-northwest of the city of Homestead, Florida. The site is located in the southeastern corner of Miami-Dade County in southern Florida on the shore of Biscayne Bay, approximately 25 miles south-southeast of Miami, Florida. FPL owns all of the property within the Turkey Point property boundary, including the exclusion area. Portions of the property are subject to certain encumbrances. The portion of the Turkey Point access road (Palm Drive) that is located in the owner-controlled area is controlled by FPL. (NRC 2016a, Section 2.2.1.1)

As shown in Table 3.2-1 and illustrated in Figure 3.2-1, the largest land use and land cover categories within the Turkey Point property boundary are wetlands and open water, which together compose approximately 93 percent of the site. Specifically, these categories consist of emergent herbaceous wetlands (58.43 percent), woody wetlands (6.97 percent), and open water (27.66 percent). The areas within the Turkey Point property boundary that have been developed to support plant operations are the next largest land use category, with approximately 5.68 percent of the site classified as developed. The remaining four land use and land cover classification categories found onsite compose approximately 1.26 percent of the site. (MRLC 2017)

All of Miami-Dade County is zoned, including the unincorporated portions. The Turkey Point site is zoned IU-3 and GU by Miami-Dade County. The PTN generating station area (Section 3.1.2) is zoned IU-3 for industrial districts—unlimited manufacturing. The remainder of the site is zoned GU, which denotes an interim district. In an interim district, zoning-assigned uses depend on the character of the neighborhood; otherwise, EU-2 standards apply (single-family 5-acre estate district). (MCIT 2017)

3.2.2 Offsite Land Use

As shown in Table 3.11-2 and Table 3.11-3, Miami-Dade County's population has increased between 2010 and 2015, and total county population is projected to increase through 2053.

As described in Section 3.1, the vicinity (6-mile radius of PTN) surrounding Turkey Point is completely within Miami-Dade County in southern Florida. The land use and land cover categories located within the vicinity of PTN are illustrated in Figure 3.2-2. Biscayne Bay, located immediately adjacent to Turkey Point, is the predominant natural feature in the vicinity, and as noted in Table 3.2-2, open water is the largest land use and land cover category, covering approximately 40 percent. The next largest land use and land cover category in the vicinity is wetland areas (51 percent), which are classified as woody wetlands (15.42 percent) and emergent herbaceous wetlands (35.38 percent). As seen in Figure 3.1-3, the vicinity includes portions of the unincorporated community Homestead ARB and the incorporated cities Florida City and Homestead, all located in Miami-Dade County. Developed land is the third largest land use and land cover category identified in the vicinity, with approximately 5 percent classified. These three categories, presented in greater detail in Table 3.2-2, compose the majority (approximately 96 percent) of the land use and land cover types that occur within the vicinity. (MRLC 2017)

Miami-Dade County occupies approximately 1,214,575 acres of land, of which 81,303 acres (6.7 percent) are farmland. The 2012 Census of Agriculture reports that the county had a total of 2,954 farms, with an average farm size of 28 acres. Approximately 2,732 farms produced crops, with primary crops reported as "vegetables harvested for sale" (29,703 acres), orchards (21,977 acres), and "sugarcane for sugar" (689 acres). Livestock is also an important agricultural product in Miami-Dade County, with livestock commodities such as cattle and calves (106 farms), hogs and pigs (15 farms), layers (153 farms), and sheep and lambs (53 farms) reported. Other agricultural uses of farmland within the county included woodlands (3,337 acres; 69 farms), permanent pasture and rangeland (7,922 acres; 192 farms), and pastureland (8,814 acres; 235 farms). (USDA 2017b)

The State of Florida requires that each local government adopt a comprehensive plan. Chapter 163 of the Florida statute sets forth minimum criteria and lists required elements of a comprehensive plan. The Miami-Dade County CDMP is organized into twelve elements, the first nine of which are required by the statute (MDC 2017b):

1. Land Use Element
2. Transportation Element
3. Housing Element
4. Conservation, Aquifer Recharge and Drainage Element
5. Water, Sewer and Solid Waste Element
6. Recreation and Open Space Element
7. Coastal Management Element
8. Intergovernmental Coordination Element
9. Capital Improvements Element
10. Educational Element
11. Economic Element
12. Community Health and Design Element

Miami-Dade County encompasses nearly 2,000 square miles of land, with more than 420 square miles of developed urban areas. The pattern of land use and urban growth has remained essentially unchanged in Miami-Dade County since the original CDMP was released in 1975. The CDMP land use element growth policy manages the urban area expansion rate to be proportional to population and economic growth. Urban area expansion is also managed to promote locations that optimize the efficiency of public services and conserve valuable natural resources. (MDC 2017b)

The purpose of the housing element is to provide a framework for developing plans and programs by local governments to assist in the provision of suitable housing for current and future residents of Miami-Dade County. This element establishes goals, objectives, and policies aimed at guiding both the public and private efforts to deliver housing to the public. It provides for adequate sites for future housing, particularly housing for extremely low-, very low-, low-, and moderate-income families. (MDC 2017b)

3.2.3 Visual Resources

As discussed in Section 3.1, PTN is located in an unincorporated area in southeastern Miami-Dade County, Florida. The containment structures for Units 3 and 4 are the tallest structures on the site at approximately 210 feet tall (FPL 2000a, page 64). Figure 3.1-1 shows the building site layout and the site property boundary in association with Biscayne Bay. Although the topography surrounding the site is relatively flat and sparsely populated with trees, there is sufficient vegetation to screen existing Units 3 and 4 from roadways and recreational areas on land. SW 344th Street/Palm Drive and SW 328th Street/North Canal Street provide the best opportunities for the public to view the existing units from roadways. However, trees and scrub growth aid in screening the units from the roadways. Because of the vegetation, Biscayne National Park and Homestead Bayfront Park do not offer views of the existing units from most areas. Beyond the 6-mile radius, on land, the existing units are not visible. However, from the water in Biscayne Bay, the existing units can be clearly seen. At night, light from PTN is visible from several locations surrounding the site, such as the Homestead-Miami Speedway and Biscayne Bay. (NRC 2016a, Section 2.5.2.4)

Table 3.2-1
Land Use/Land Cover, Turkey Point Property

Category	Acres	Percent
Open water	2,615.13	27.66
Developed	537.08	5.68
Open space	135.44	1.43
Low intensity	153.67	1.63
Medium intensity	161.90	1.71
High intensity	86.07	0.91
Barren land (rock/sand/clay)	18.01	0.19
Evergreen forest	62.94	0.67
Shrub/scrub	4.00	0.04
Grassland/herbaceous	34.03	0.36
Woody wetlands	658.51	6.97
Emergent herbaceous wetlands	5,523.82	58.43
Total[a]	**9,453.52**	**100.00**

(MRLC 2017)

a. The acreages presented in this table are based on the Multi-Resolution Land Characteristics Consortium land use/land cover data. These data are presented in a raster (pixel-based) format and, because of their square geography, they do not exactly match the Turkey Point property boundary. This geography variation creates a small difference between the total acreage reported in Table 3.2-1 compared to the Turkey Point property acreage stated throughout the ER.

Table 3.2-2
Land Use/Land Cover, 6-Mile Radius of PTN

Category	Acres	Percent
Open water	28,555.70	40.32
Developed	3,274.54	4.62
Open space	1,480.48	2.09
Low intensity	866.89	1.22
Medium intensity	571.11	0.81
High intensity	356.05	0.50
Barren land (rock/sand/clay)	165.24	0.23
Evergreen forest	68.05	0.10
Shrub/scrub	106.97	0.15
Grassland/herbaceous	80.73	0.11
Cultivated crops	2,598.46	3.67
Woody wetlands	10,924.47	15.42
Emergent herbaceous wetlands	25,056.76	35.38
Total	**70,830.92**	**100.00**

(MRLC 2017)

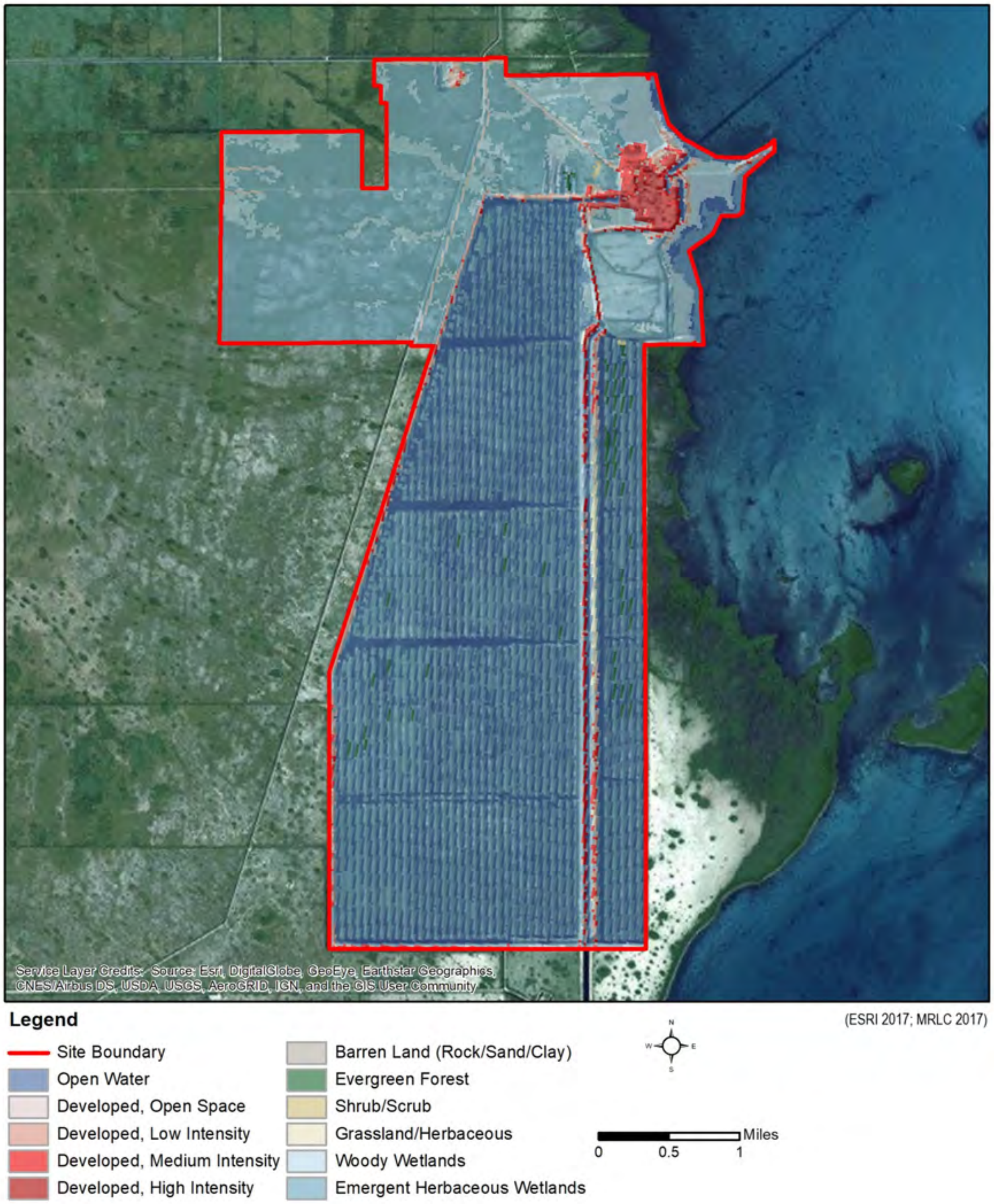

Figure 3.2-1
Land Use/Land Cover, Turkey Point Property

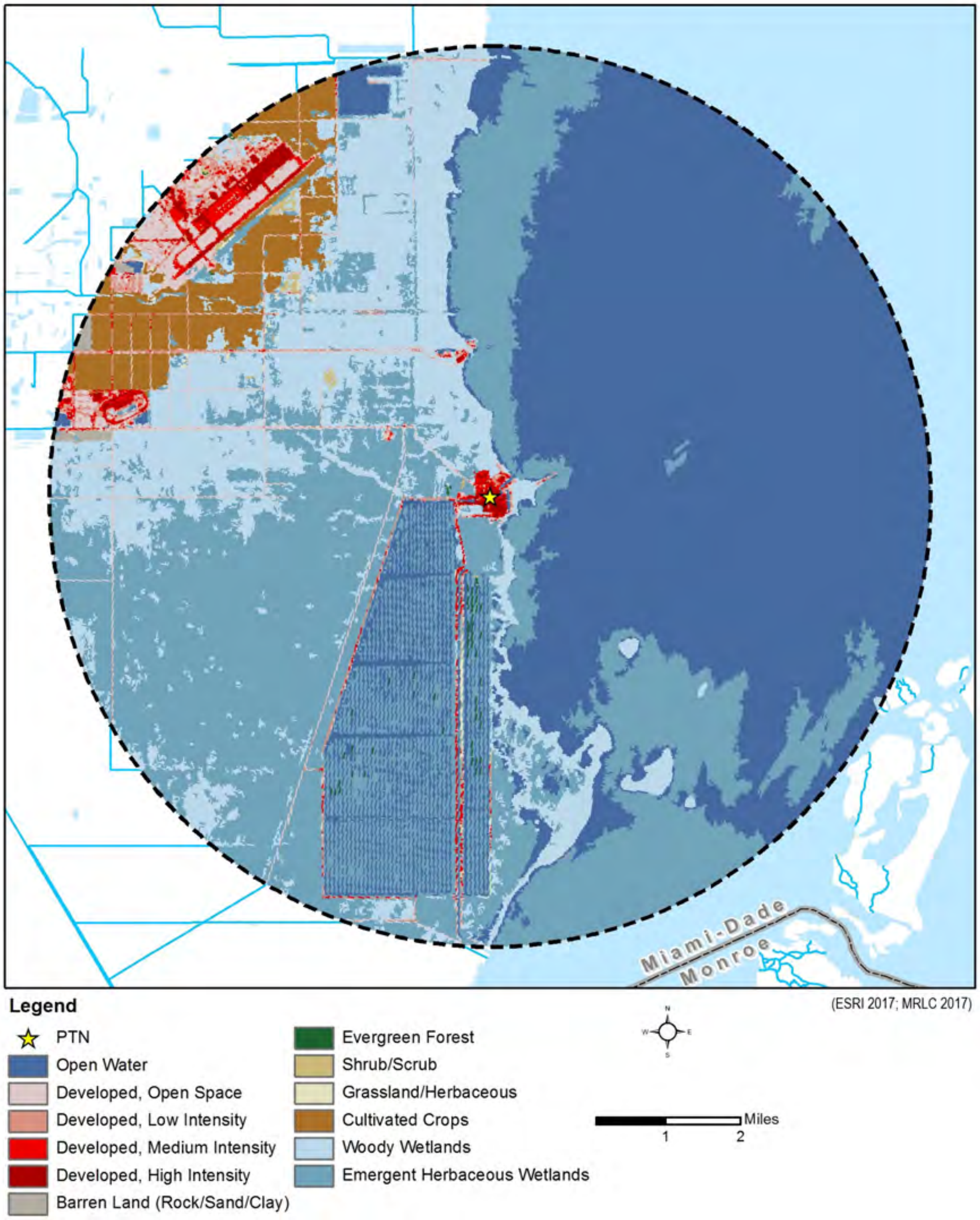

Figure 3.2-2
Land Use/Land Cover, 6-Mile Radius of PTN

3.3 Meteorology and Air Quality

The meteorology, climate, and air quality of the Turkey Point site have been evaluated during previous NRC licensing reviews, including, but not limited to, the PTN OLs (NRC 1972, Section II.E.2), the PTN first license renewal (FPL 2000b, Section 2.13; NRC 2002a, Section 2.2.4), the PTN EPU license amendment request (FPL 2010, Section 7.1.4; 77 FR 20059), and most recently during the Turkey Point Units 6 and 7 COL review (FPL 2014a, Section 2.7; NRC 2016a, Section 2.9).

3.3.1 General Climate

The Turkey Point site is located in Miami-Dade County, on the lower eastern coast of Florida close to the Atlantic Ocean, with Biscayne Bay and Card Sound along the eastern border (Figure 3.1-3). The general climate at this location is classified as subtropical maritime (or humid subtropical) and is characterized by long and warm summers, with abundant rainfall, followed by mild, dry winters. The chief factors that govern the climate are latitude, land and water distribution, prevailing winds, storms, pressure systems, and ocean currents. The wet season, which is hot and humid, lasts from May to October, when it gives way to the dry season. The dry season features mild temperatures with some invasions of colder air, which is when winter rainfall occurs with the passing of a cold front. (FPL 2014a, Section 2.7)

The Azores-Bermuda high-pressure system exerts a powerful influence on the weather during the winter months. Within high-pressure systems, air is subsiding, and as a consequence, precipitation cannot take place. The Azores-Bermuda high remains over the Sahara Desert throughout the year, but extends over Florida during the winter. As the water around the peninsula warms in the spring, the high-pressure system over Florida weakens and the summer rains begin. In some years, the influence of the Azores-Bermuda high-pressure system is greater than others, so even in the Turkey Point site area, rain may fall in the winter. Because of the clockwise circulation around the western extent of the Azores-Bermuda high pressure and the proximity of the Atlantic Ocean, maritime tropical air mass characteristics prevail much of the year. Together, these factors govern late spring, summer, and early fall temperature and precipitation patterns. Florida does not experience the potential for high air pollution because it does not contain heavy industry or the climate and topographical conditions that cause air stagnation. (FPL 2014a, Section 2.7)

The El Niño-Southern Oscillation is a physical phenomenon that occurs in the equatorial Pacific Ocean where the water temperature oscillates between being unusually warm (El Niño) and unusually cold (La Niña). El Niño and La Niña are among the strongest drivers of the climate of North America, with impacts that vary across different regions. These oceanic events shift the position of the jet streams across the continent, which steer the fronts and weather systems. The southeastern United States experiences particularly strong long-term weather shifts, with Florida experiencing the greatest impacts. El Niño typically brings 30 to 40 percent more rainfall and cooler temperatures to Florida in the winter, while La Niña brings a warmer and much drier than normal winter and spring. La Niña is frequently a trigger to periodic drought in Florida. (FPL 2014a, Section 2.7)

The marine influence of the Atlantic Ocean is evidenced by the low daily range of temperature and the rapid warming of cold air masses that pass to the east of the state. The regional area is subject to winds from the east and southeast about half of the time, and in several specific respects has a climate whose features differ from farther inland. One of the features is the annual precipitation for the area. During the early morning hours, more rainfall occurs along the beach areas than at MIA, while during the afternoon, the reverse situation is true. MIA lies approximately 9 miles inland. Monthly precipitation exhibits a cyclical pattern, with the predominant maximum occurring in the summer months and the minimum occurring during the winter months. (FPL 2014a, Section 2.7)

The region is subject to sea/land breeze circulations, local winds that are driven by the differential heating of the air over the ocean and over the land surface. In southern Florida, the existence and intensity of the sea breeze depends largely on seasonal and latitudinal factors as well as on the time of day. Sea/land breeze circulations influence local temperature, humidity, wind speed, stability, wind direction, and precipitation. The most notable sea breeze impacts are a shift in wind to the onshore direction, an increase in wind speed, a decrease in temperature, and an increase in humidity. (FPL 2014a, Section 2.7)

An even more striking difference appears in the annual number of days with temperatures reaching 90°F or higher, with inland stations having four times more than the beach areas. Minimum temperature contrasts are also particularly marked under proper conditions, with the difference between inland locations and the beach areas frequently reaching to 15 degrees or more, especially in the winter. Freezing temperatures occur occasionally in the inland suburban areas and farming districts, but rarely near the ocean. (FPL 2014a, Section 2.7)

3.3.2 Meteorology

As discussed in Section 3.3, the climatological conditions for the Turkey Point region and site have been recently evaluated during the Turkey Point Units 6 and 7 COL review by FPL and the NRC. For the proposed SLR of PTN, FPL completed a review of the most recent meteorological information available from public sources and from FPL monitoring to confirm the conclusions of those previous reviews remain valid. A summary of FPL's evaluation is provided below.

The closest first-order National Weather Service (NWS) station is at MIA, about 25 miles north of the site. Therefore, regional climatological statistics in the following subsections are derived from local climatological data collected at MIA and available from the National Climatic Data Center (NCDC). The NRC has concluded that this station represents the general climate at the Turkey Point site (NRC 2016a, Section 2.9.1). The Turkey Point site is flat with no topographical features that should cause the climate to deviate significantly from this general regional climate (NRC 2016a, Section 2.9.1).

The meteorological data evaluated in the Turkey Point Units 6 and 7 COL review included data obtained from the PTN meteorological monitoring system. More recent data are summarized for important parameters in the discussions below and supporting tables.

3.3.2.1 Wind Direction and Speed

NCDC information summarizing normal, means, and extremes from the MIA NWS station can be used to define the regional long-term wind conditions for the Miami area (Table 3.3-1). The 48-year period of record data shows the annual prevailing wind direction (i.e., the direction from which the wind blows most often) is from 120 degrees (i.e., from the southeast). Monthly prevailing winds are from the southeast or east during much of the year. During October the mean prevailing wind is northeasterly, while January winds are northwesterly. (NCDC 2016)

The mean wind speed over the period from January 1981 through December 2010 was 8.4 miles per hour (mph) (NCDC 2016). A maximum 3-second wind speed of 104 mph was recorded in February 1998 during a severe weather event associated with a tornado that touched down near the northern edge of MIA (NWS 1998). Monthly and annual mean wind data and gust conditions are summarized in Table 3.3-1 (NCDC 2016).

The Turkey Point site meteorological monitoring system has recorded measurements indicating that the wind direction distribution at the 10-meter level generally follows an easterly orientation on an annual basis. The prevailing wind (i.e., the direction from which the wind blows most often) is from the east, with approximately 41 percent of the winds blowing from the eastern-northeastern through eastern-southeastern sectors. Conversely, winds from the western-northwestern through western-southwestern sectors occur approximately 7 percent of the time. (FPL 2014a, Section 2.7.4.3)

Seasonally, winds from the southeastern quadrant predominate during the spring and summer seasons (March through August). During the winter season, the prevailing wind direction shifts to the north-northwest because of increased frequency of cold frontal passages. Winds from the northeastern quadrant predominate during the fall season (September through November). (FPL 2014a, Section 2.7.4.3)

Mean monthly wind speeds at the Turkey Point site, provided in Table 3.3-2, are based on data from the onsite meteorological monitoring system from 2012 to 2016, lower level (10 meters). The average wind speed on an annual basis is 8.6 mph, indicating the site wind speeds are similar to conditions at MIA. The onsite monitoring data indicate the wind at Turkey Point is from the southeast at approximately 110 degrees much of the time during the year. The wind is from the northwest in January with a strong northerly component in December and is generally easterly in the fall. Annual wind rose diagrams for the period 2012–2016 are provided in Figures 3.3-1, 3.3-2, 3.3-3, 3.3-4, and 3.3-5. Figure 3.3-6 illustrates the combined averages for wind speed and direction over the most recent 5-year period (2012–2016).

Tabulated data and wind roses for the PTN onsite meteorological station (10-meter level) for the period 2012–2016 indicate the site conditions are generally consistent with the conditions at MIA.

As a historic comparison, the 1972 PTN final environmental statement (FES) stated the winds were from the east or southeast much of the year except in January and December, with the lowest monthly wind speeds during the summer months (June through August) and highest during the spring (February through April) (NRC 1972, Table III-1). That information is generally consistent with the information summarized above and in Tables 3.3-1 and 3.3-2.

3.3.2.2 Temperature

FPL and the NRC have recently reviewed temperature information for the site (FPL 2014a, Section 2.7; NRC 2016a, Section 2.9). FPL obtained more recent information available from MIA and the PTN meteorological monitoring facilities as an update for this SLR ER review.

The NRC's review during the Turkey Point 6 and 7 COL application environmental review in NUREG-2176 concluded that temperatures are more variable in the winter than in the summer because of the strong differences in source regions from which the seasonal air mass originates. Daytime maximum temperatures range from about 77°F in January to about 91°F in July and August; nighttime minimum temperatures range from about 60°F in January to about 77°F in July and August. At the Turkey Point site, these maximum and minimum averages are moderated due to the ocean's moderating influence. (NRC 2016a, Section 2.9.1) Based on observations at 13 NWS and cooperative observing stations and the climatological record for the MIA NWS station provided in the COL application ER, the temperature extremes at the site are between 25°F and 97°F. The mean monthly maximum temperature is 83°F, and the mean monthly minimum is 66°F. (NRC 2016a, Section 2.9.1.2)

NCDC temperature statistics for the MIA NWS station are summarized in Table 3.3-3 as an update to the NRC's Turkey Point Units 6 and 7 COL review. The average monthly temperatures at MIA (69-year period of record from 1947 to 2016) are provided in Table 3.3-3 to allow comparison with the recent mean monthly ambient temperatures at the Turkey Point site. The 2016 local climate data summary of the 69-year period of record for MIA shows that the mean daily maximum temperature of 75.8°F in January increases to 90°F during August before slowly declining in the fall. The Miami region experiences normal temperatures above 90°F for 79.9 days per year between March and November. The highest recorded temperature of record of 98°F has occurred in each of the months of June, July, and August. (NCDC 2016)

The mean daily minimum temperature at MIA is above 70°F from May through October and is at its lowest in January with a mean daily minimum of 59.8°F. Record low temperatures less than 32°F have been recorded during December and January (NCDC 2016), although only 0.1 days per year typically have temperatures below freezing. The lowest temperature of record at MIA was 30°F, occurring in December 1989 and January 1985. Monthly and annual daily mean temperature data and temperature extremes for MIA are summarized in Table 3.3-3. (NCDC 2016)

The monthly average temperatures, and record minimum and maximum temperatures (°F) recorded by the PTN meteorological monitoring system for the past 5 years (2012–2016) are provided in Table 3.3-4. Review of data collected from the PTN meteorological tower monitoring stations from 2012 through 2016 indicates that the mean monthly temperature at the site is highest in August (83.4°F) and decreases to its lowest in January (68.5°F). The Turkey Point site can experience temperatures above 90°F from April through October. The highest daily temperature 2012–2016 at the site was 92.1°F on July 24, 2015. Temperatures less than freezing were not recorded at the site during the period 2012–2016. The lowest temperature (36.7°F) during the past 5 years was recorded in February 2015.

As a historical comparison, the 1972 NRC FES for PTN stated the air temperatures in June through September usually stay between 70 and 90°F. In October through March, temperatures are often in the 50s and 60s with January and February being the coldest months (February 1968 recorded temperatures in the 60s about 50 percent of the time and in the 50s about 30 percent of the time). Temperatures seldom go below 50°F and almost never drop to freezing. (NRC 1972, Section II.E.2)

Tabulated temperature data summarized from the PTN onsite meteorological station (10-meter level) for the period 2012–2016 indicate the site temperature conditions and extremes are consistent with the conditions at MIA. Further, the data summarized above and in Tables 3.3-3 and 3.3-4 indicate temperature conditions are generally similar to those when the PTN units were originally licensed.

3.3.2.3 Precipitation

FPL discussed the results of its review of precipitation and other meteorological information for several nearby public monitoring stations in the Turkey Point Units 6 and 7 COL application ER (FPL 2014a, Section 2.7).

The NRC's review of the Turkey Point Units 6 and 7 COL application presented in NUREG-2176 concluded that the majority (about 53 percent) of the annual rainfall is associated with thunderstorms that frequently occur from June through September. On average during this period, thunderstorms occur between 12 and 16 days per month. Average precipitation ranges from about 2 inches per month in January and February and peaks at about 8.5 inches per month in August. The only observation of frozen precipitation near the Turkey Point site was a trace (0.05 in.) observed at Homestead, Florida, on January 19, 1977. The Turkey Point site is flat with no topographical features that should cause the climate to deviate significantly from this general regional climate. (NRC 2016a, Section 2.9.1)

NCDC information available for the MIA NWS station provides a more recent summary of the long-term precipitation statistics for the area (Table 3.3-5). The 2016 NCDC summary of precipitation records of normal rainfall totals for MIA indicates that precipitation of 0.01 inches or more occurs on average for 135 days per year. The normal maximum monthly precipitation (for the 30-year period from 1981 to 2010) typically occurs during the summer through early fall (June through September). This 4-month period accounts for approximately 56 percent (34.91 inches) of the total annual precipitation (61.90 inches). With the exception of July (6.50 inches), the normal monthly rainfall during this 4-month period is greater than 8 inches. The maximum overall normal monthly total rainfall typically occurs during September (9.86 inches). Over the longer-term, 69-year period of record, MIA received an average precipitation of 60.76 inches per year. (NCDC 2016).

Precipitation extremes (i.e., rainfall) at MIA are also presented in Table 3.3-5. The maximum 24-hour precipitation total recorded at MIA, 16.21 inches, occurred in April 1979. The maximum monthly rainfall total (24.40 inches) occurred in September 1960. The minimum monthly rainfall total (0.01 inches) occurred in February 1944.

Precipitation measurements are collected at ground level at the PTN South Dade meteorology monitoring station on an hourly basis. A tabulated summary of precipitation statistics from data recorded at the site during the period 2012–2016 is provided in Table 3.3-6. The average annual total rainfall over the past 5 years has been less than that recorded at MIA for the same period. However, the seasonal rainfall trends are similar. The precipitation at Turkey Point over the most recent 5 years has generally peaked during the summer months (especially July through September) with the highest monthly average being in September (7.21 inches). Similar to MIA, the Turkey Point site has recently received lower amounts of precipitation from November through March, with the least falling in January (1.95 inches). Turkey Point received a maximum December precipitation of 13.47 inches during 2015, when MIA received a December monthly record 9.82 inches of precipitation for the 74-year MIA period of record.

Although the total annual average precipitation at the Turkey Point site has recently been less than that recorded at MIA, these precipitation amounts are still within the range of annual extremes that have occurred at MIA (i.e., MIA annual precipitation amounts have ranged from a low of 42.63 inches in 1989 to 86.94 inches in 2012) (NCDC 2016).

Therefore, the tabulated precipitation data summarized from the PTN onsite meteorological station (ground level) for the period 2012–2016, when compared with historical data for MIA, indicate the site precipitation conditions and extremes remain generally consistent with the conditions at MIA.

For a historical comparison, the 1972 PTN FES stated that measurable rainfall occurs about 125 days per year and totaled 78.1 inches in 1968. Thunderstorms appear on an average of 77 times per year. Relative humidity ranges from an average of 56 percent in the months of January to April to an average of 88 percent in September and October. (NRC 1972, Section II.E.2)

3.3.2.4 Snow and Glaze

Snow has never been reported at MIA. However, snow was reported on January 19, 1977, in Homestead, Florida, where the southeastern municipal limit is approximately 4.5 miles west of the Turkey Point plant property. The total snowfall noted in the data records was estimated to be 0.05 inches. However, notes made by the station observer indicate that the snow melted before reaching the ground. This was during one of the worst mid-1970s cold waves, and snow fell that day in several parts of Dade County, Florida, but not at the NWS office at the Miami Airport, which is why the official records do not report snow. (FPL 2014a, Section 2.7.1.3.3)

The local climate data for MIA indicate a trace of snow in May 1998. It is important to note that the snowfall data reported comprise all forms of frozen precipitation, including hail. A review of data records for MIA on May 6, 1998, indicates that the minimum temperature for this day was 70°F. As a result, the trace amount reported at MIA was determined to be hail. (FPL 2014a, Section 2.7.1.3.3)

3.3.2.5 Relative Humidity and Fog

Relative humidity and fog conditions for the Turkey Point site were evaluated for the Turkey Point Units 6 and 7 COL environmental review. The PTN meteorological system does not measure any parameters related to atmospheric moisture. Consequently, the (NRC) review team determined that the relative humidity data for MIA are representative of the Turkey Point site. This review concluded that the relative humidities for 0700 local standard time (LST) approximate the daily maximum values. Monthly average 0700 LST relative humidities range from about 85 percent in January to about 79 percent in April. Relative humidities for 1300 LST approximate the daily minimum relative humidity. Monthly average 1300 LST relative humidities range from a high of about 66 percent in September to a low of about 54 percent in April. Climatological statistics for MIA indicate that the Turkey Point site could expect heavy fog about 5 days per year. The likelihood of fog is greatest from December through February and least from May through September. (NRC 2016a, Section 2.9.1.3) NCDC data summarized in 2016 for the period of record (30 years for relative humidity data and 53 years for fog data) remain consistent with the NRC's conclusions (NCDC 2016).

3.3.2.6 Severe Weather

The 1972 PTN FES stated that the site usually experiences gale force winds (41 to 74 mph) at least once in any year and hurricane force winds (greater than 74 mph) on an average of once every 7 years (NRC 1972, Section II.E.2). The most recent NCDC data indicate severe weather conditions remain generally consistent with those presented at the time when the PTN units were first licensed.

3.3.2.6.1 Thunderstorms

The Turkey Point site can experience severe weather in the form of thunderstorms, tornadoes, and tropical storms. Thunderstorms are the most frequent severe weather events. They occur on average about 73 days per year at MIA. About three-fourths of the thunderstorms occur in the period of June through September. (NRC 2016a, Section 2.9.1.4)

Based on National Centers for Environmental Information (NCEI) records, Miami-Dade County, Florida, has recorded 153 thunderstorm wind events since 2003, most of which occurred in April, May, and June, although these types of events have occurred in every month of the year (NCEI 2017a). There have been 24 significant heavy rain events since 2003, which have been seasonally scattered between April through December. Two of these heavy rainfall events have involved the Homestead, Florida, vicinity. A tropical wave in November 2003 caused 1 to 4 inches of rain, but locally up to 6 inches of rain fell in Homestead. In December 2015, a cold front moved into southern Florida and stalled across the far southern end of the Florida peninsula and the upper Florida Keys, with several rounds of heavy rainfall during a 3-day period. Rainfall near 15 inches fell across Homestead, the Redlands, and western Kendall, with 4 to 8 inches reported across the remainder of Miami-Dade County. (NCEI 2017a)

3.3.2.6.2 Tornadoes

Tornadoes are the least frequent extreme weather events. Using tornado statistics from the period 1950–2003 and the methodology outlined in NUREG/CR-4461, *Tornado Climatography of the Contiguous United States*, the probability of a tornado striking the nuclear island at the Turkey Point site is about 2×10^{-4}/year. (NRC 2016a, Section 2.9.1.4)

Based on NCEI records, Miami-Dade County, Florida, has recorded 23 tornado events since 2003 with an intensity of F0/EF0 to F1/EF1. Similar to thunderstorms, tornadoes have occurred throughout the year, but most have occurred from June through September. The closest recent tornado (EF0) to the Turkey Point site occurred in December 2009 about 2 miles southwest of Homestead ARB in an unpopulated area when unstable atmospheric conditions were present ahead of a cold front moving south across Florida. (NCEI 2017b).

3.3.2.6.3 Hurricanes, Tropical Storms, and Tropical Depressions

Since January 1996, as recorded in National Oceanic and Atmospheric Administration (NOAA) records, there have been 10 hurricanes affecting Miami-Dade County, all of which occurred between 1996 and 2005. Hurricane Wilma was the most recent hurricane to hit southern Florida, achieving a Category 3 hurricane on October 24, 2005, on the southwestern Florida coast between Everglades City and Cape Romano, with maximum sustained winds of 125 mph and an estimated minimum central pressure of 950 millibars. Wilma exhibited a very large 55- to 65-mile-wide eye while crossing the state, and the eye covered large portions of southern Florida, including the eastern two-thirds of Collier County, extreme northwestern Miami-Dade County, the southern and eastern third of Hendry County, most of Broward County, and all of Palm Beach County. The eye also clipped the southeastern shore of Lake Okeechobee. The eye wall, the part of the storm with the strongest winds, affected virtually all of southern Florida. Around 10:30 a.m., an SFWMD meteorological station located at the southern end of Lake Okeechobee reported sustained winds of 103 mph. Wilma exited the east coast over northwestern Palm Beach County near Palm Beach Gardens around 11 a.m. as a Category 2 hurricane with maximum sustained winds of 105 mph. (NCEI 2017c)

Major Hurricane Matthew moved northwest across the Central Bahamas during the day on October 6, 2016, making its closest approach to the eastern coast of southern Florida during the early morning hours of October 7th. The hurricane brought tropical storm force gusts to Palm Beach, Broward, and Miami-Dade counties, resulting in scattered trees and power lines down that led to numerous power outages. High seas and storm surge also brought moderate beach erosion and pier damage in Broward and Palm Beach counties and minor beach erosion in Miami-Dade County. Inundation values (height above mean higher high water) were measured along the coast with Lake Worth Pier at 1.49 feet and Virginia Key at 1.083 feet. Rainfall generally ranged from 2 to 3 inches with no impacts from inland flooding. Sustained winds were between 25 and 35 mph with a peak gust of 50 mph measured. Most peak wind gusts across the area were in the 40- to 45-mph range. (NCEI 2017c)

The recent NRC review of hurricanes stated that 50 hurricanes have made landfall within 100 miles of Turkey Point since 1851, or about three every 10 years. Three of these tropical cyclones have had sustained wind speeds in excess of 155 mph that have tracked within 100 nautical miles of the Turkey Point site, the most recent being Hurricane Andrew in 1992. Hurricane Andrew was historic because it was the first time that a hurricane significantly affected a commercial nuclear power plant. The eye of the storm, featuring sustained winds of up to 145 mph and gusts of 175 mph, passed over the Turkey Point site and caused extensive onsite and offsite damage. However, there was no damage to the safety-related systems of Units 3 and 4 except for minor water intrusion and some damage to insulation and paint. (NRC 2016a, Section 2.9.1.4)

Miami-Dade County has been hit by the impacts of 21 tropical storm events since January 1996, five of which have occurred since 2008. Tropical Storm Bonnie made landfall in Miami-Dade County during the afternoon of July 23, 2010, with marginal tropical storm conditions along the coast of Biscayne Bay. Wind gusts of 30–40 knots were common across the southeastern coast metro area along with rainfall totals of 2–3.25 inches in Miami-Dade County. (NCEI 2017c)

Tropical Storm Isaac accounts for three of the tropical storm events recorded for Miami-Dade County since 2008. Isaac moved west-northwest across the Florida Straits south of the Florida Keys on August 26, 2012. The northern edge of the wind and rain area associated with Isaac affected the southern Florida peninsula throughout the day on the 26th. Isaac continued on a western-northwestern track into the Gulf of Mexico on the 27th with winds, rain, and flooding continuing over parts of southern Florida. Highest winds over land were recorded along and near the southeastern Florida coast, where the highest sustained winds ranged from 40 to 45 mph, with 25 to 35 mph sustained winds over most inland areas as well as over southwestern Florida. Highest wind gusts ranged from 50 to 60 mph over most land areas to as high as 65 mph along the Atlantic coast and just offshore. Three-day rainfall totals ending at 8 a.m. August 28th ranged from 5–7 inches across southeastern Florida to 3–5 inches over interior and southwestern Florida. The primary exception was over northern metro Broward County and much of Palm Beach County where 8–12 inches fell, with maximum amounts up to 15–18 inches from west of Boynton Beach to Wellington, The Acreage, Royal Palm Beach, and Loxahatchee. (NCEI 2017c)

Hurricane Sandy moved north across the northwestern Bahamas producing tropical storm force winds along the southeastern coast of Florida, including the adjacent Atlantic waters, with significant beach erosion. Hurricane Sandy began to affect the Miami-Dade County coast and its adjacent Atlantic waters with tropical storm force winds during the early morning of October 25, 2012, as it moved north across the northwestern Bahamas. Virginia Key reported a sustained wind of 40 mph shortly after 0500 LST with gusts to 50 mph. Sustained tropical storm force winds were observed at several coastal locations throughout the course of the day, with a peak gust of 67 mph observed at the Fowey Rocks C-Man Station at 1200 LST. A peak gust of 60 mph was also observed at PTN. As Hurricane Sandy continued to move north and then northeast over the Atlantic waters north of the Bahamas, large northeasterly swells generated by the storm pummeled the southeastern Florida coast through October 30th with beach erosion and coastal flooding reported along the northeastern shore of Miami-Dade County, including the communities of Sunny Isles, Bal Harbour, and Surfside. Large breaking waves estimated at around 10 feet were reported along the coast of Miami-Dade County. (NCEI 2017c)

3.3.2.7 Atmospheric Stability

Atmospheric stability is a derived meteorological parameter that describes the dispersion characteristics of the atmosphere. It can be determined for the lowest layer of the atmosphere by the difference in temperature between two heights separated by at least 30 meters. A seven-category atmospheric stability classification scheme based on temperature differences is set forth in NRC Regulatory Guide 1.23, Revision 1. When the temperature decreases rapidly (< -1.5 degrees Centigrade [°C] per 100 meters) with height, the atmosphere is unstable and atmospheric dispersion is greater. Conversely, when temperature increases with height, the atmosphere is stable and dispersion is more limited. Typically, the atmospheric stability is neutral to unstable during the day and neutral to stable at night. Cloudiness and high winds tend to decrease both stability and instability, thereby resulting in more nearly neutral conditions. (NRC 2016a, Section 2.9.1.5)

Measurements at the 10- and 60-meter levels of the PTN meteorological tower are used to determine atmospheric stability for the PTN site. On an annual basis, the atmosphere at the PTN site is stable about 53 percent of the time, neutral about 28 percent of the time, and unstable about 19 percent of the time. These percentages vary seasonally with more frequent unstable conditions in the spring and winter, and more frequent neutral conditions in the summer and fall. (NRC 2016a, Section 2.9.1.5)

Based on the 5-year average (2012–2016) onsite temperature difference data recorded at PTN, stable atmospheric conditions (E to G) occurred about 52.1 percent of the time and unstable conditions (A to C) occurred about 22.5 percent of the time. The remaining observations (about 25.4 percent) fell into the neutral (D) category. Stability class distributions at PTN covering the period 2012–2016 are presented in Table 3.3-7.

3.3.3 Air Quality

3.3.3.1 Clean Air Act Nonattainment Maintenance Areas

The Clean Air Act (CAA) was established in 1970 [42 U.S.C. § 7401 et seq.] to reduce air pollution nationwide. The EPA has developed primary and secondary National Ambient Air Quality Standards (NAAQS) under the provisions of the CAA. The EPA classifies the air quality within an air quality control region (AQCR) according to whether the region meets or exceeds federal primary and secondary NAAQS. An AQCR or a portion of an AQCR may be classified as being in attainment or nonattainment, or it may be unclassified for each of the six criteria pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter ($PM_{2.5}$, fine particulates, and PM_{10}, coarse particulates), ozone, and sulfur dioxide (SO_2).

Emissions from nonradiological air pollution sources, including the "criteria pollutants," (i.e., SO_2, PM_{10}, $PM_{2.5}$, CO, NO_2, Pb, and ozone) are controlled through compliance with federal, state, and local regulations. Attainment areas are areas where the ambient levels of criteria air pollutants are designated as being "better than," "unclassifiable/attainment," or "cannot be classified or better than national standards" (depending on the pollutant and other factors).

The PTN site is in southeastern Miami-Dade County, Florida, which is part of the Southeast Florida Intrastate AQCR. All of the counties (Broward, Miami-Dade, Indian River, Martin, Monroe, Okeechobee, Palm Beach, and St. Lucie) within this AQCR are in attainment of the NAAQSs [40 CFR 81.49; 40 CFR 81.310]. The nearest nonattainment area in the state of Florida is the Tampa-St. Petersburg-Clearwater area (2010 SO_2 standard; 2008 Pb standard), nearly 200 miles northwest of the PTN site (EPA 2017a). There is one Class I federal area within 100 miles of the PTN site where visibility is an important value. This is the Everglades National Park, located approximately 13 miles west of PTN [40 CFR 81.407] (Figure 3.1-6).

In addition to Class I federal areas, there are two national parks and a national wildlife refuge in the vicinity of the PTN plant property that are prevention of significant deterioration (PSD) Class II federal areas. Biscayne National Park is immediately north and east of the PTN plant property, while the Biscayne Bay Aquatic Preserve is northeast, east, and southeast of the property. Homestead Bayfront Park is a recreational park approximately 1.7 miles north of the PTN area. The Biscayne Trail is approximately 2 miles north of the plant area. The Everglades Mitigation Bank is southwest of the PTN plant property. (FPL 2014a, Section 2.7.2.1)

3.3.3.2 Air Emissions

The Turkey Point Title V facility is composed of two separate co-located power plants with five operating units: the fossil plant (Units 1, 2, and 5) and the nuclear plant (Units 3 and 4). The non-nuclear operations of PTN are permitted by a Title V air emissions permit (Permit No. 0250003-021-AV). The operations of the fossil plant are addressed in a separate Title V permit. Although PTN may periodically utilize backup and portable generator(s) during outages, nonradioactive gaseous effluents result primarily from testing of emergency generators and portable diesel engine-driven pumps. Because PTN utilizes a closed CCS for condenser cooling purposes, there are no cooling towers or associated particulate emissions.

As discussed in Chapter 9, PTN and ancillary facilities have received a site certification in accordance with the Florida Power Plant Siting Act (PPSA). This process provides a certification that encompasses all licenses and permits needed for affected Florida state, regional, and local agencies. The conditions of certification require FPL to comply with the provisions and limitations set forth in its Title V air operation permit. To protect Florida's ambient air quality standards and ensure that impacts from facilities that generate air emissions are maintained at acceptable levels, the FDEP governs the discharge of regulated pollutants by establishing specific conditions in the air permit. Permitted emission sources and conditions established in PTN Air Permit No. 025003-021-AV are shown in Table 3.3-8. As discussed in Chapter 9, there have been no notices of violations or non-compliances associated with PTN air emissions over the most recent 5 years (2012–2016).

Annual emissions for the most recent 5 years (2012–2016) are shown in Table 3.3-9. PTN (nuclear) and Turkey Point fossil have separate Title V permits, but a single annual operating report is submitted for both facilities that includes equipment from both facilities. The PTN emissions reported in Table 3.3-9 are based on FPL's annual operating report for air pollutant emitting facility submitted to the FDEP (FPL 2012; FPL 2013; FPL 2014c; FPL 2015; FPL 2016b). As discussed in Section 2.3, no license renewal-related refurbishment has been identified. In addition, FPL's review did not identify any future upgrade or replacement activities necessary for plant operations (e.g., diesel generators, diesel pumps) that would affect PTN current air emissions program. PTN is planning to replace the domestic wastewater pump soon (see Table 3.3-8), and that information will be incorporated in the anticipated 2018 Title V renewal application. Therefore, no increase or decrease of air emissions is expected over the SLR period.

FPL notified the NRC in June 2016 that Units 3 and 4 had completed the requirements of EA12-049 related to mitigation strategies for beyond-design-basis external events. FPL's notification identified specific diesel engine-powered equipment as part of its Diverse and Flexible Coping (FLEX) strategies that is not identified in the Units 3 and 4 Title V air permit. FPL will incorporate, as appropriate, an inventory of equipment in the anticipated 2018 renewal application of the Title V Insignificant Activities list. The FLEX equipment maintained at the PTN site and associated with annual testing is listed in Table 3.3-11. Based on the FDEP permitting requirements, these emission sources listed in Table 3.3-11 would most likely be classified as either insignificant or unregulated emissions units. The emission sources have been evaluated for permitting actions.

Studies have shown that the amount of ozone generated by even the largest transmission lines in operation (765 kV) would be insignificant (NRC 2013a, Section 4.3.1.1). As discussed in Section 2.2.5, PTN in-scope transmission lines are 230 kV. Therefore, the amount of ozone generated from the in-scope transmission lines is anticipated to be minimal.

3.3.4 Greenhouse Gas Emissions and Climate Change

Because PTN is not required to inventory and report greenhouse gases (GHGs), data do not exist for mobile sources such as visitors and delivery vehicles. Therefore, FPL calculated estimates of GHG gas emissions on those direct (stationary and portable combustion sources) and indirect (workforce commuting) plant activities from information that was readily available. Estimates from stationary and portable combustion sources are based on reported fuel usage. Estimates of workforce commuting are based on a current staffing of 679 employees as discussed in Section 2.5, an estimate of 4 percent workforce carpooling, and use of EPA's Greenhouse Gas Equivalency Calculator. (USCB 2015; EPA 2017b) Estimates of GHG emissions generated at PTN are presented in Table 3.3-10.

Although PTN has electrical equipment that contains perfluorocarbons, there have been no additions to this electrical equipment over the most recent 5 years (2012–2016). In addition, ozone-depleting substances such as chlorofluorocarbons and hydrochlorofluorocarbons are present at PTN and can potentially be emitted; however, estimating GHG emissions from these substances is complicated due their ability to deplete ozone, which is also a GHG, making their global warming potentials difficult to quantify. These ozone-depleting substances are regulated by the CAA under Title VI. As discussed in Section 9.5.2.3, FPL maintains a program to manage stationary refrigeration appliances at PTN to recycle, recapture, and reduce emissions of ozone depleting substances and is in compliance with Section 608 of the CAA. Therefore, FPL did not include potential emissions as result of leakage, servicing, repair, and disposal of refrigerant equipment at PTN.

Table 3.3-1
Recorded Wind Conditions at Miami International Airport

	Period of Record[a]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean speed (mph)	33	8.5	8.8	9.8	9.7	9.0	7.7	7.3	7.1	7.3	8.5	8.9	8.4	8.4
Prevailing direction (degrees from)	48	340	110	110	110	90	110	120	110	90	50	100	100	120
Max 3-second speed (mph)	20	42	104	52	52	63	55	56	78	51	92	44	40	104
Max speed year of occurrence		2016	1998	2011	2008	1998	2011	2009	2005	2004	2005	1998	1997	1998
Max 3-second speed direction (degrees from)	20	250	190	310	150	330	150	70	120	280	150	310	230	190

(NCDC 2016)

a. In years.

Table 3.3-2
PTN Wind Conditions

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean speed (mph)	8.5	8.8	9.5	9.5	9.3	8.2	7.3	7.8	7.3	9.4	9.5	8.7	8.7
Prevailing direction (degrees from)	350	100	100	100	100	120	110	120	100	70	80	90	110

Table 3.3-3
Recorded Temperatures at Miami International Airport

	Period of Record[a]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average monthly temperature (^{o}F)	69	67.8	69.2	72.3	75.6	79.2	81.8	83.2	83.4	82.3	78.9	73.7	69.8	76.4
Mean daily maximum (^{o}F)	69	75.8	77.2	79.9	82.9	86.0	88.3	89.7	90.0	88.5	85.1	80.6	77.2	83.4
Highest daily maximum (^{o}F)	74	88	89	93	96	96	98	98	98	97	95	91	89	98
Year of occurrence		1987	2008	2003	2015	2008	2009	1998	1990	1987	1980	2002	2009	2009
Mean daily minimum (^{o}F)	69	59.8	61.2	64.6	68.3	72.3	75.2	76.6	76.8	76.0	72.6	66.8	62.3	69.4
Lowest daily minimum (^{o}F)		30	32	32	46	53	60	69	68	68	51	39	30	30
Year of occurrence	74	1985	1947	1980	1971	1945	1984	2002	1950	1983	1943	1950	1989	1989

(NCDC 2016)

a. In years.

Table 3.3-4
Recorded Temperatures at PTN Met Tower

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Monthly average (^oF)[a]	68.5	69.4	71.8	75.8	78.3	81.4	82.8	83.4	82.0	79.2	73.7	73.3	76.7
Highest daily maximum (^oF)	81.3	82.2	85.4	91.5	89.3	91.0	92.1	90.0	90.1	90.8	85.1	84.2	92.1
Year of occurrence	2016	2014	2015	2015	2013	2016	2015	2012; 2014	2015	2014	2013	2016	2015
Lowest daily minimum (^oF)	37.8	36.7	42.3	53.5	59.8	69.5	72.0	71.1	69.6	60.3	50.2	45.2	36.7
Year of occurrence	2012	2015	2013	2012	2016	2015	2013	2013	2012	2012	2014	2012	2015

a. Calculated average of all temperature measurements for each month and of all measurements for the period 2012–2016.

Table 3.3-5
Recorded Precipitation at Miami International Airport

	Period of Record[a]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Normal monthly precipitation (inches)	30	1.62	2.25	3.00	3.14	5.34	9.67	6.50	8.88	9.86	6.33	3.27	2.04	61.9
Maximum monthly precipitation (inches)	74	7.57	8.07	10.57	17.29	18.54	22.36	13.51	16.88	24.40	21.64	13.84	9.82	24.40
Year occurred		2016	1983	1986	1979	1968	1968	1947	1943	1960	1991	1992	2015	Sept 1960
Maximum 24-hour precipitation (inches)	74	2.68	5.73	7.07	16.21	11.59	8.20	4.67	6.92	7.58	12.66	8.01	5.26	16.21
Year occurred		1973	1966	1949	1979	1977	1977	2003	1964	1960	2000	1992	2000	Apr 1979
Minimum monthly precipitation (inches)	74	0.04	0.01	0.02	0.05	0.44	1.81	1.77	1.65	2.63	0.72	0.09	0.12	0.01
Year occurred		1951	1944	1956	1981	1965	1945	1963	1954	1951	2002	1970	1988	Feb 1944

(NCDC 2016)

a. In years.

Table 3.3-6
Recorded Precipitation at PTN

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean monthly precipitation (inches)	1.95	2.55	1.38	6.17	4.60	4.31	6.70	6.46	7.21	4.98	2.57	4.48	53.35
Maximum monthly precipitation (inches)	4.74	5.42	2.14	11.69	7.72	7.14	10.24	9.21	8.95	8.33	5.71	13.47	13.47
Year occurred	2016	2012	2015	2012	2013	2014	2014	2012	2012	2014	2013	2015	2015
Minimum monthly precipitation (inches)	0.52	1.42	1.01	0.99	1.75	1.09	2.24	4.24	5.74	2.47	0.66	0.46	0.46
Year occurred	2013	2013	2016	2014	2014	2015	2016	2014	2013	2013	2016	2012	2012

Table 3.3-7
PTN Stability Class Distributions

Percent Frequency of Occurrence by Pasquill Stability Class[a]							
Year	**A**	**B**	**C**	**D**	**E**	**F**	**G**
2012	5.728	8.055	8.780	24.667	39.245	9.189	4.337
2013	8.110	8.258	7.950	25.186	40.206	7.150	3.141
2014	5.252	7.621	8.617	22.955	36.560	13.137	5.859
2015	7.502	7.076	7.583	27.707	37.499	8.894	3.740
2016	5.592	7.537	8.749	26.567	38.838	9.321	3.397
2012–2016	**6.437**	**7.709**	**8.336**	**25.416**	**38.470**	**9.538**	**4.095**

a. Classes are as follows (NRC 2007, Table 1):
Class A: Extremely unstable
Class B: Moderately unstable
Class C: Slightly unstable
Class D: Neutral
Class E: Slightly stable
Class F: Moderately stable
Class G: Extremely stable

Table 3.3-8
PTN Permitted Air Emission Sources (Sheet 1 of 2)

Emission Unit	Description	Capacity Rating	Permit Conditions
Regulated Emissions Units			
007	Two Caterpillar 325 HP – CII ACERT industrial back-up generators for the instrument air compressors generators	325 HP	NO_x + NMHC – 4.0 g/kW-hr CO–3.5 g/kW-hr PM–0.2 g/kW-hr 40 CFR Part 60, Subpart A NSPS 40 CFR Part 60 Subpart IIII, stationary internal combustion engines
	One John Deere 149 HP diesel engine-driven pump for the back-up service water feed system	149 HP	NO_x + NMHC – 4.0 g/kW-hr CO–5.0 g/kW-hr PM–0.3 g/kW-hr 40 CFR Part 60, Subpart A NSPS 40 CFR Part 60 Subpart IIII, stationary internal combustion engines
	One Isuzu 24 HP generator set for the land utilization meteorological tower	24 HP	NO_x + NMHC – 7.5 g/kW-hr CO–6.6 g/kW-hr PM–0.4 g/kW-hr 40 CFR Part 60, Subpart A NSPS General 40 CFR Part 60 Subpart IIII, stationary internal combustion engines
023	One John Deere 46 HP South Dade meteorological tower diesel No. 2 generator	46 HP	40 CFR Part 63, Subpart A, NESHAPS General 40 CFR Part 63, Subpart ZZZZ – NESHAPS (RICE)
024	Emergency diesel fire pump	340 HP	40 CFR Part 63, Subpart A, NESHAPS General 40 CFR Part 63, Subpart ZZZZ – NESHAPS (RICE)

Table 3.3-8
PTN Permitted Air Emission Sources (Sheet 2 of 2)

Emission Unit	Description	Capacity Rating	Permit Conditions
Unregulated Emissions Units			
005	General Motors 2,500 kW emergency generator	3,353 HP	
	General Motors 2,874 kW emergency generator	3,855 HP	
006	Caterpillar domestic wastewater plant diesel engine-driven pump	1,003 HP	
	Caterpillar standby diesel engine for back-up feed water pump	820 HP	
	Caterpillar security system diesel generator	896 HP	

(FDEP 2014a)

Table 3.3-9
PTN Annual Air Emissions Summary, 2012–2016

Annual Emissions (tons/year)							
Year	**SO_2**	**NO_X**	**CO**	**PM_{10}**	**PM_t**	**VOCs**	**HAPs**
2012	1.50016	15.57084	2.07345	1.76675	2.10875	0.80154	NA
2013	1.54	15.1944	1.8163	1.83246	2.22126	0.71184	NA
2014	1.83661	18.79188	2.429324	2.170291	2.602291	0.942423	NA
2015	2.104842	21.29713	2.693611	2.491216	2.997016	1.048054	NA
2016	1.685835	16.72928	2.025307	2.004105	2.425305	0.792366	NA

Table 3.3-10
Annual Greenhouse Gas Emissions Inventory Summary, 2012–2016

Carbon Dioxide Equivalent (CO_2e) Emissions, Metric Tons					
Emission Source	**2012**	**2013**	**2014**	**2015**	**2016**
Combustion sources[(a)]	520.1	450.4	561.5	712.0	485.4
Workforce commuting[(b)]	3,087.0	3,087.0	3,087.0	3,087.0	3,087.0
Total estimated GHGs	3,607.1	3,537.4	3,648.5	3,799.0	3.572.4

a. Fuel usage for combustion sources shown in FPL annual operating reports for air pollutant emitting facility for 2012–2016 indicated by the referenced sources of Table 3.3-9; EPA 2015, Table 1; 40 CFR Part 98, Table A-1 to Subpart A.

b. Workforce commuting calculations are based on:
1. Statistical information from USCB indicates that 4.0 percent of Florida workers in the transportation and warehouse and utilities industries carpool to work (USCB 2015). The number of current PTN employees is 679. Utilizing the 4.0 percent USCB carpool statistic, a value of 652 passenger vehicles per day was utilized.
2. The EPA's Greenhouse Gas Equivalencies Calculator the CO_2e/year to be 3,087 metric tons for 652 vehicles (EPA 2017b).
3. Carbon dioxide has a global warming potential (100-year time horizon) of "1" based on Table A-1 to Subpart A of 40 CFR Part 98.
4. 3,087 metric tons CO_2e/year × 1 (global warming potential).

Table 3.3-11
FLEX Equipment Emissions Units

FLEX Equipment Emission Source Description	Annual Operating Hours
(2) Volvo Penta Genset 480V Diesel Generators (40 GPH @ full load)	Approximately 14 hours/year for 3 diesel gen
(1) Godwin HL130M Spent Fuel Pit Diesel Makeup Pump (13 GPH @ full load)	Approximately 6.7 hours/year for 2 pumps
(1) Godwin 3393 Artesian Well Makeup Pump (13.8 GPH @ full load)	Approximately 4 hours/year for 2 pumps
(1) Baldor TG25ST 20 kW TSC Diesel Generator (2.12 GPH @ full load)	Approximately 25 min/year
(1) Baldor TG25ST 20 kW Nuclear Admin. Bldg. Phone/Data Diesel Generator (2.12 GPH @ full load)	Approximately 25 min/year
(10) Baldor DG6E or Equivalent 5 kW/6 kW Diesel Generators (Communications, Inverters, Lights) (7.7 GPH @ 50% load)	Approximately 40 min/year per generator

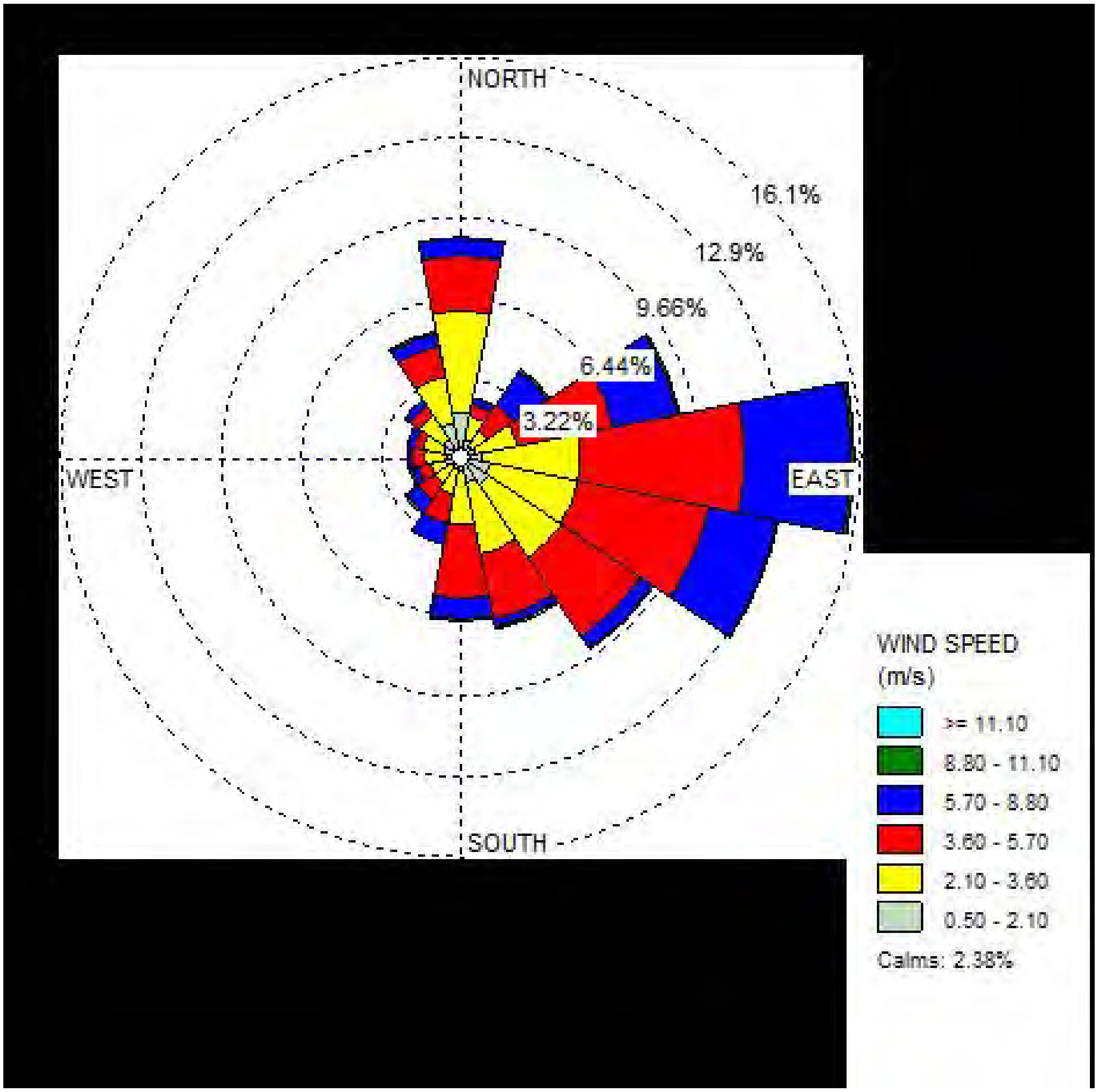

Figure 3.3-1
Turkey Point 2012 Wind Rose

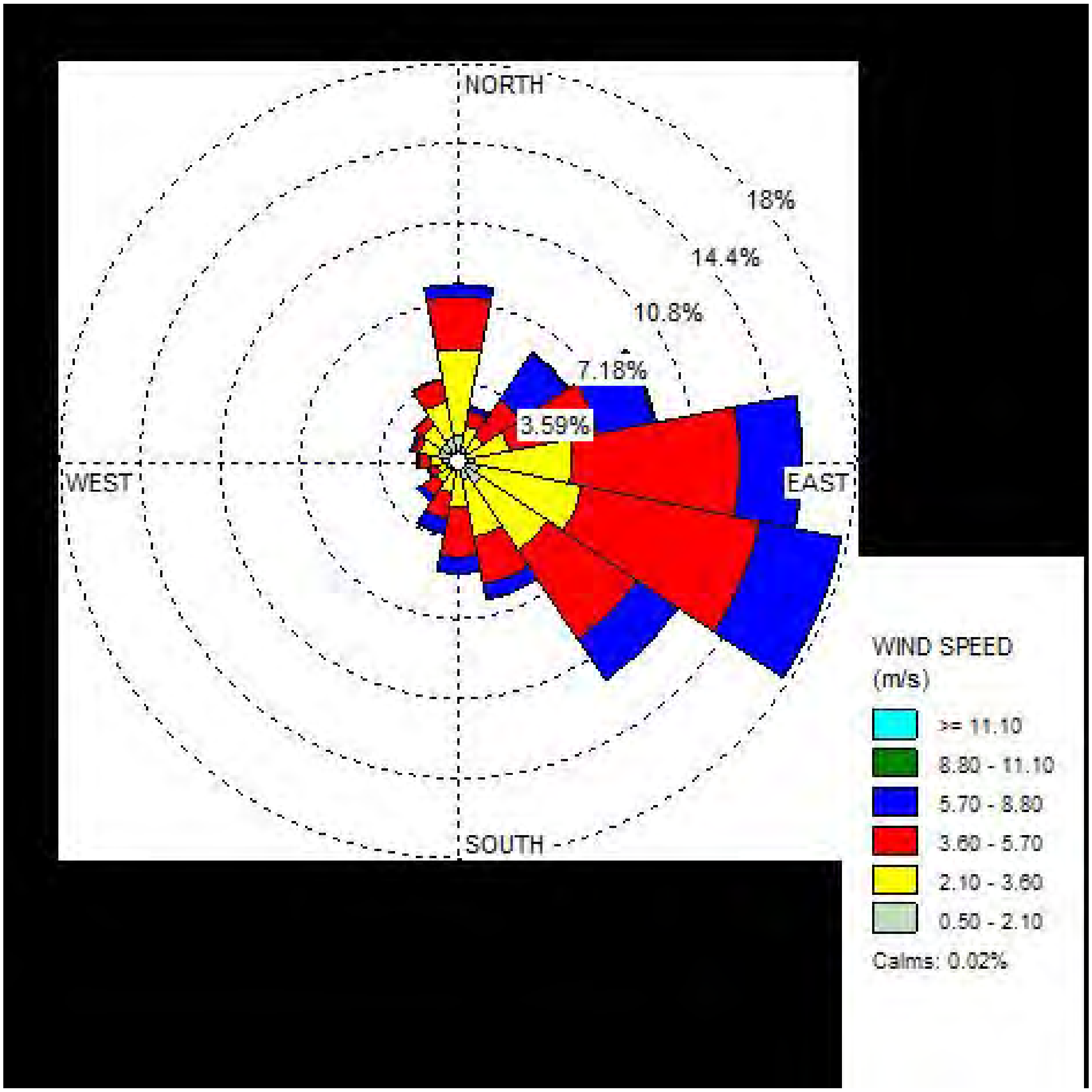

Figure 3.3-2
Turkey Point 2013 Wind Rose

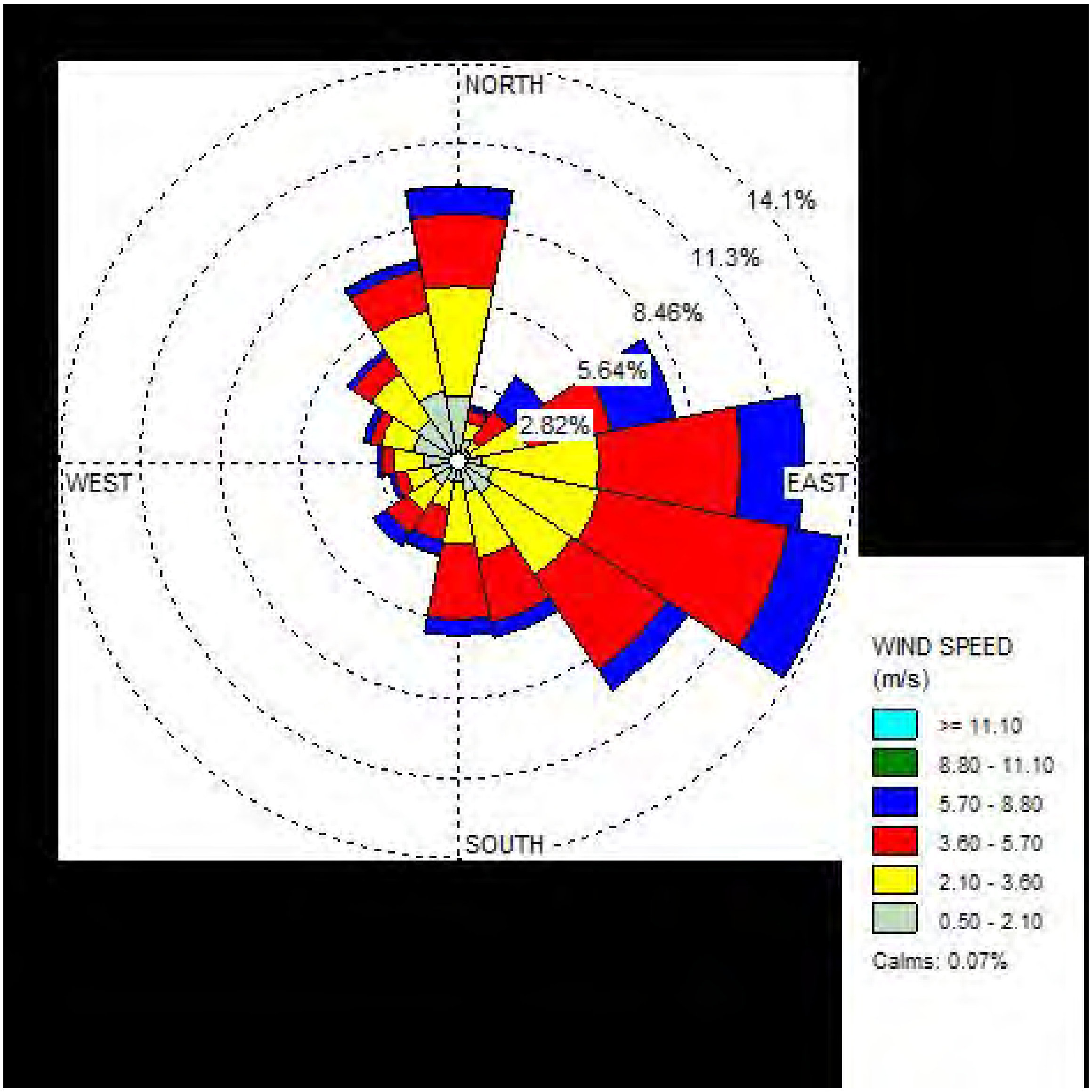

Figure 3.3-3
Turkey Point 2014 Wind Rose

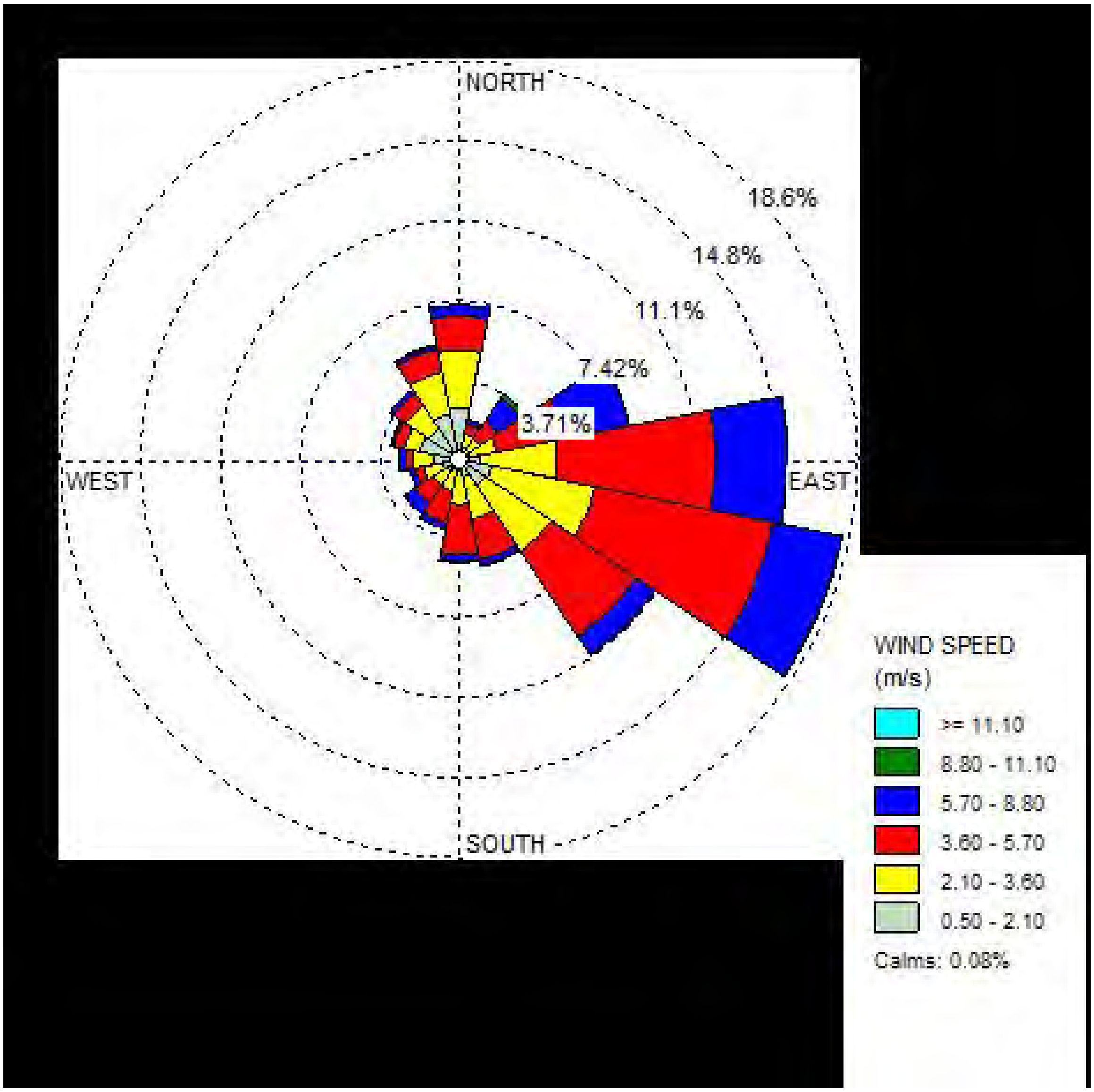

Figure 3.3-4
Turkey Point 2015 Wind Rose

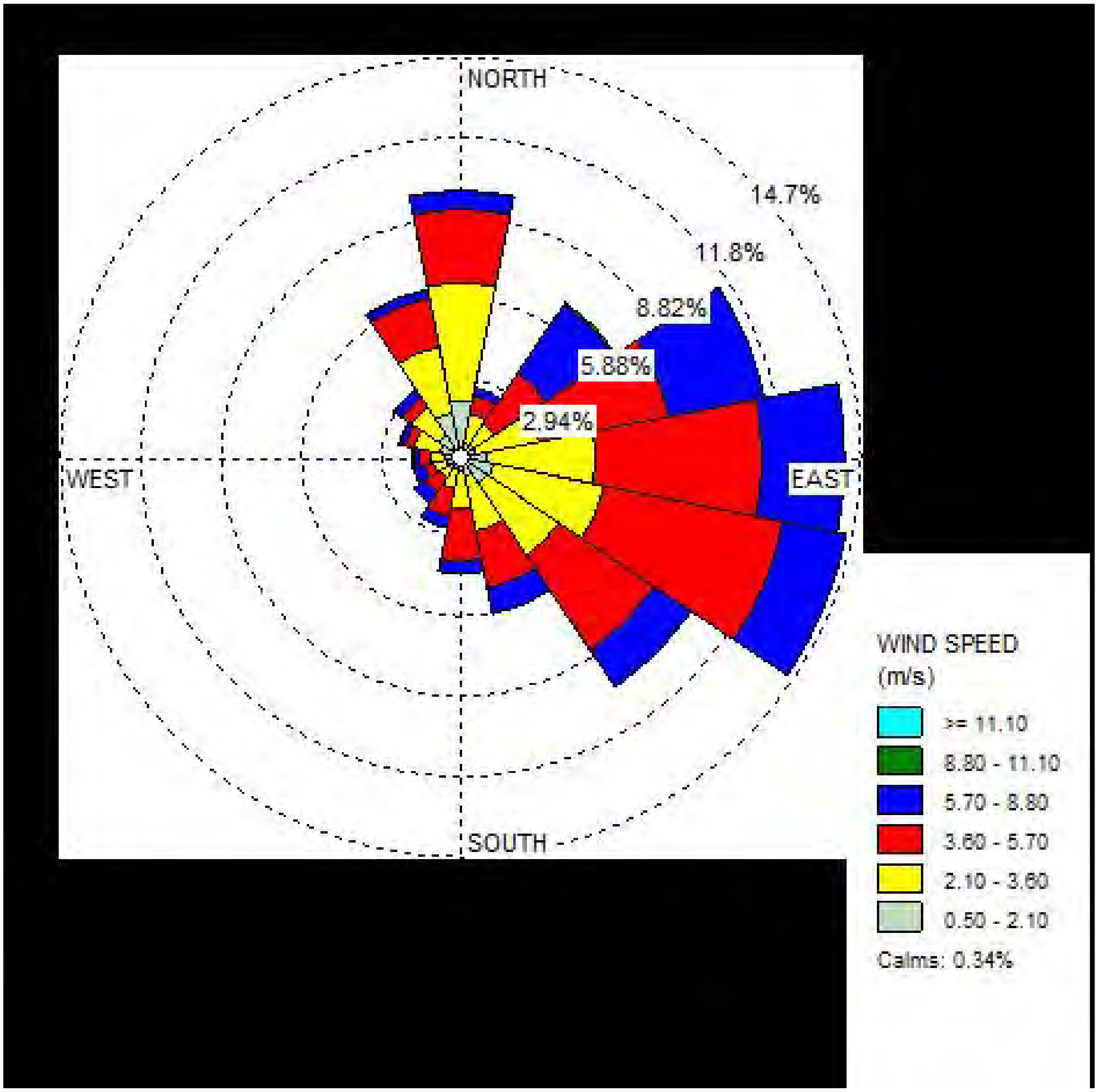

Figure 3.3-5
Turkey Point 2016 Wind Rose

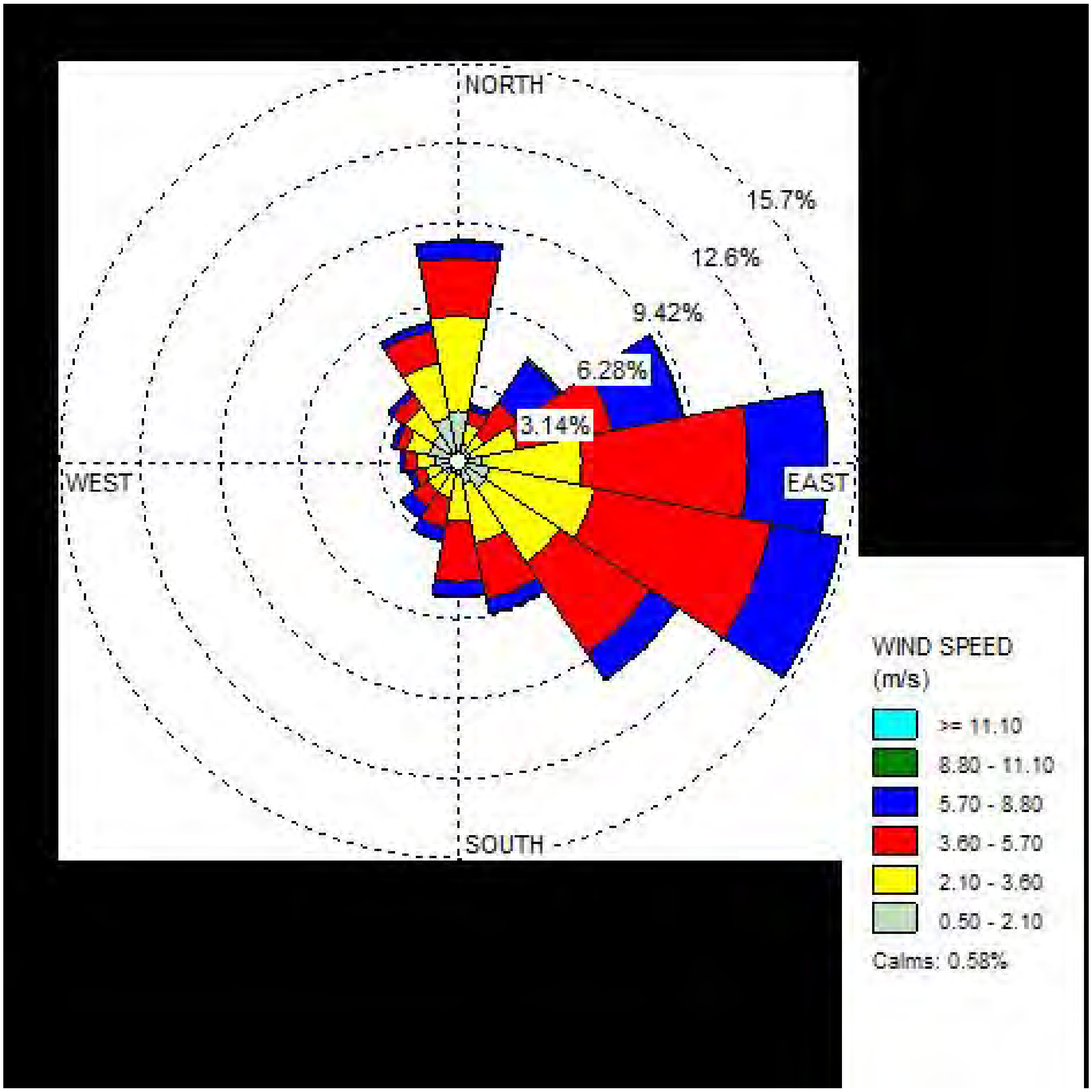

Figure 3.3-6
Turkey Point 2012–2016 Wind Rose

3.4 Noise

This section describes representative noise conditions at the PTN site located in rural Miami-Dade County and identifies any offsite locations that could be affected by the continued operation and maintenance of PTN.

An ambient noise monitoring survey was performed in June 2008 as part of the Turkey Point Units 6 and 7 COL application ER to assess the existing ambient noise in areas adjacent to the Turkey Point units. The purpose of the noise survey was to determine baseline noise impacts at and around the Turkey Point Units 6 and 7 plant area property boundary, and offsite receptors. The receptors of primary concern are the nearest residences to the northwest, the daycare facility to the west, and Homestead Bayfront Park to the north. (FPL 2014a, Section 2.7.7) Turkey Point Units 6 and 7 would be in close proximity to PTN; therefore, the noise study is also considered applicable to PTN. There has been no change in PTN noise generation since the 2008 ambient noise study, and conditions are not expected to change during the SLR period.

Additionally, Turkey Point Units 1 and 2 are currently operating in synchronous condenser mode, and noise levels from Units 1 and 2 are lower than when operating at base load, as assumed in the 2008 ambient study. Therefore, the 2008 ambient noise study is conservative and applicable for the Units 3 and 4 SLR.

The nearest residence to PTN, as defined in the PTN AREOR, is located approximately 1.7 miles west-northwest of the PTN generating station area. These are identified as the FPL daycare center and shooting range near the entrance to PTN. The Homestead Bayfront Park complex is located 1.9 miles north of the plant and has occasional overnight recreational occupancy. (PTN 2017b)

The field effort to collect baseline noise level data was conducted on June 3 and 4, 2008, during the daytime and nighttime. The survey consisted of measuring the background noise levels at eight locations both on site and off site spanning a 2-day period. Background measurements for Units 6 and 7 were collected while Units 1, 2, 3, 4, and 5 were operating at base load. (FPL 2014a, Section 2.7.7).

The baseline daytime sound pressure level (noise level equivalent [Leq]) measurements for the monitoring locations within and near the Turkey Point plant property boundary ranged from a low of 44 A-weighting logarithmic decibel scale (dBA) to a high of 68 dBA. The nighttime Leq measurements ranged from a low of 47 dBA to a high of 67 dBA. These monitoring sites are closest to Unit 5, which had an audible contribution. Also contributing to the observed sound levels were transient noise sources such as traffic, birds, insects, and wind. (FPL 2014a, Section 2.7.7)

The baseline daytime Leq measurements for the monitoring locations beyond the plant property boundary ranged from a low of 46 dBA to a high of 67 dBA. The contributing audible noise sources to the highest observed noise levels at the nearest residence were transient noises that included traffic, birds, insects, and wind. The nighttime Leq measurements beyond the plant property boundary ranged from a low of 41 dBA to a high of 56 dBA. The contributing audible noise sources to the highest observed noise levels were transient noises that included insects, wind noise, and traffic. The highest recorded noise level for onsite measurements was 68 dBA. (FPL 2014a, Section 2.7.7)

As discussed in the environmental review for PTN license amendment for EPU (FPL 2010, Attachment 7), two noise surveys were conducted to collect baseline noise level data during the daytime and nighttime on April 24, 2003, and during the night on January 1 and again on April 24, 2007. On April 24, 2007, all five units were operating. Data were collected at seven locations during these periods: five in the near-field and two at far-field locations located at the preschool 1.6 miles to the northwest and at the Homestead Bay front entrance 2 miles north of the plant. The daytime and nighttime noise levels that excluded short-term transient noise sources, such as traffic at monitoring sites near the Turkey Point boundary, were less than 50 dBA. (FPL 2010, Attachment 7)

Section 5.3.4 of NUREG-1555 notes that, based on U.S. Department of Housing and Urban Development (HUD) regulations for exterior noise standards [24 CFR 51.101(a)(8)], no further analysis is needed if the day-night average sound level (Ldn) is below 65 dBA. As reported in NUREG-1437, and referenced in NUREG-1555, noise levels below 65 dBA are considered of small significance. (NRC 2013a, Section 3.3.3)

While the Units 6 and 7 noise survey (NRC 2016a, Section 2.10.2) did not calculate Ldn, it did measure both daytime and nighttime averages (Leqs), which can be used to approximate the Ldn. After converting the values to Ldn, Ldn value is approximately 55.1 dBA, which is less than the 65 dBA acceptance limit (NRC 2016a, Section 2.10.2). In addition, there are no applicable state or local environmental noise regulations for unincorporated areas of Miami-Dade County, where Turkey Point is located.

Given the industrial nature of the plant and the number of years of operation, noise from a nuclear plant is generally nothing more than a continuous minor nuisance. However, noise levels may sometimes exceed the 55 dBA level the EPA uses as a threshold to protect against excess noise during outdoor activities. However, according to the EPA, this threshold does "not constitute a standard, specification, or regulation," but was intended to provide a basis for state and local governments establishing noise standards. Nevertheless, noise levels at the site boundary are expected to remain well below regulatory standards for offsite residents. (NRC 2013a) This conclusion would also apply to PTN.

Turkey Point Unit 5 steam blowout of the facility's heat recovery system and steam lines generates loud noise. This activity occurs intermittently. Turkey Point Unit 5 notifies area residences in advance of the onset and anticipated duration of the steam blowout of the facility's heat recovery system and steam lines (FDEP 2016a). Periodic use of the firing range is another onsite activity that creates occasional noise. The northern property boundary is approximately

3,903 feet from the PA fence line. Biscayne Bay is approximately 2,859 feet and 1,553 feet to the south and southeast, respectively, from the PA fenceline.

Because Turkey Point is located in a rural area, it is unlikely that noise levels from Turkey Point would affect offsite residences. This is further substantiated by the fact that during the most recent 5 years (2011–2016), there have been no noise complaints received by Turkey Point as it relates to PTN plant operational and outage activities. Therefore, no noise issues affecting offsite residences are anticipated during the SLR period because noise levels at PTN are expected to remain the same as under current operating conditions.

3.5 Geologic Environment

This section contains the information regarding the regional and site geologic settings, site soils, and seismic history of the plant site and area surrounding the site.

3.5.1 Regional Geology

The Turkey Point site lies within the Floridian Plateau, which is the partly submerged southeastern peninsula of the North American continental shelf (FPL 2017b, Section 2.9.2). The plateau, which separates the deeper Atlantic Ocean waters from the waters of the Gulf of Mexico, has been described as a large horst that may be bounded by high-angle fault scarps at the edge of the shelf. In the vicinity of the site, the edge of the shelf is located some 18 miles offshore to the east. The peninsula is underlain by a thick series of sedimentary rocks, which in the southern part of the state consists essentially of gently dipping or flat-lying limestones and associated formations. Beneath these sedimentary formations are igneous and metamorphic basement rocks that correspond to those that underlie most of the eastern North American continent. The sedimentary rocks overlying the basement complex range from 4,000 feet thick in the northern part of the state to more than 15,000 feet thick in southern Florida. The strata range in age from Paleozoic to recent. Deep borings indicate that in southern Florida, the rock in the uppermost 5,000 feet is predominantly calcareous and ranges in age from late Cretaceous to Pleistocene. Mesozoic limestones, chalk, and sandstones are underlain by Paleozoic shales and sandstones and Pre-Cambrian granitic basement. (FPL 2017b, Section 2.9.2)

Florida is characterized by very simple geologic structures. The predominant structure affecting the thickness and attitude of the sedimentary formations in southern Florida is the Ocala anticline of Tertiary age. This anticline is some 230 miles long and 70 miles wide, consisting of a gently dipping formation to the east and west of the axis of the structure with the slope becoming less pronounced with successively younger formations. The most recent Pleistocene formations are nearly horizontal. Pleistocene shorelines have been traced as far north as New Jersey, with elevations essentially the same as those in Florida. (FPL 2017b, Section 2.9.2)

It can, therefore, be concluded that no tilting or structural deformation associated with tectonic activity has occurred during the past half million years. The closest geologic structure north of the site is a gentle, low syncline near Fort Lauderdale, some 50 miles away. The great thickness of

Tertiary carbonates indicates that the region has been slowly subsiding for many millions of years. As evidenced by undeformed strata, faults are not common, and no fault or structural deformation is known or suspected in the bedrock in the site area. (FPL 2017b, Section 2.9.2)

3.5.1.1 Physiography

The Turkey Point site is located within the Southern Slope subprovince of the Southern Zone physiographic subregion of the Florida Platform within the Atlantic Coastal Plain physiographic province (Figure 3.5-1). Elevation of the ground surface in the 200-mile radius site region varies from 3 feet below mean sea level (msl) to 345 feet above msl. (FPL 2017b, Section 2.2) The area is practically flat, with elevations rising from sea level at the site to 10 feet above msl in the Homestead area 9 miles to the west of PTN. (FPL 2017b, Section 2.9.3) Figure 3.1-2 illustrates the topography of the Turkey Point property.

3.5.2 Site Geology

The predominant surface feature near Turkey Point is the Atlantic Coastal Ridge, which represents an area of bedrock outcrop of the Miami Limestone, formerly the Miami Oolite (FDEP 2017c). This Pleistocene deposit underlies the site and is generally low lying with some areas influenced by tides. Mangrove swamp soils that average 4 to 8 feet in thickness are present in these low-lying areas. Pockets of silt and clay overlay the surficial formations in these areas, separating the organic soils and the limestone bedrock. (FPL 2017b, Section 2.9.3)

Surficial deposits at the Turkey Point site consist of organic muck and the Miami Limestone. The organic muck is the dominant sediment type, whereas the Miami Limestone is exposed at the surface in the northwestern portion of the plant area. (FPL 2016c, Section 2.5.1.2.1)

The Miami Limestone, a deposit of highly permeable limestone, extends to about 20 feet below sea level. The limestone contains random zones of harder and softer limestone and heterogeneously distributed small voids and solution channels, many of which contain secondary deposits. Recrystallized calcite on the surfaces of many of the voids and solution channels is indicative of secondary deposition. This limestone lies unconformably upon the Fort Thompson Formation, which is a complex sequence of limestones and calcareous sandstones (FPL 2017b, Section 2.9.3). Figure 3.5-3 shows the distribution of surface deposits surrounding the site.

Local depressions are occasionally encountered in the surface of the limestone bedrock at the site. Such depressions are not sinkholes associated with collapse of an underground solution channel, but rather potholes, which are surficial erosion or solution features. These features probably developed during a former period of lower sea level when the rock surface was subjected to weathering and the effects of fresh water. (FPL 2017b, Section 2.9.3)

The upper 5 to 10 feet of the limestone beneath the Miami Limestone contains coral that may represent the Key Largo Formation, a coralline reef rock. This formation is contemporaneous in part with both the Fort Thompson Formation and the Miami Limestone. (FPL 2017b, Section 2.9.3)

Prior to deposition of the Miami Limestone, the surface of the Fort Thompson Formation was subjected to erosion and weathering. The Miami Oolite, therefore, fills in irregular depressions in (lies unconformably upon) the surface of the underlying formation. The Fort Thompson Formation is highly permeable and contains numerous small voids and cavities resulting from solution of the limestone by water movement. The results of solution activity evident in both the Miami Oolite and Fort Thompson formations are derived from solution by fresh groundwater at a former period of lower sea level. (FPL 2017b, Section 2.9.3)

The Fort Thompson Formation, together with the Miami Oolite, composes the bulk of the Biscayne Aquifer, a hydrogeologic unit described in Sections 3.6.2.1 and 3.6.2.2. At a depth of about 70 feet below sea level, the Fort Thompson Formation unconformably overlies the Tamiami Formation, which is a predominantly clayey and calcareous marl, locally indurated to limestone. The Tamiami Formation also contains beds of silty and shelly sands, and is less permeable than the overlying formation that composes the Biscayne Aquifer. The Tamiami and underlying Hawthorne and Tampa formations, all of which are Miocene in age, compose a relatively impermeable hydrogeologic unit called the Floridian aquiclude, which is roughly 500 to 700 feet thick in southern Florida (FPL 2017b, Section 2.9.3). A geologic column illustrating the formation and geologic units underlying the site is provided as Figures 3.5-2a and 3.5-2b.

3.5.2.1 Sinkhole Potential

PTN is located in an area designated by the FDEP as Area I sinkhole occurrence (FDEP 2017d). Area I locations are characterized by bare or thinly covered limestone. Sinkholes in these areas are few and generally shallow and broad and develop gradually. Cover materials range in thickness from less than a foot to about 25 feet and are generally very permeable with solution development similar to that of bare limestone exposed to weathering. Solution at the limestone surface and in joints near the surface decreases with depth, but the solution of limestone is the dominant process in landscape development. Area I reportedly has very few collapse sinkholes, and those that occur generally are very shallow and broad and develop slowly. (USGS 1985)

The FDEP maintains a database of sinkholes and subsidence reports in the state of Florida. According to the Subsidence Incident Report Database, the nearest subsidence event was reported in 2015 in Hollywood, Florida, approximately 38 miles north of PTN. It was described as a small sinkhole; however, the exact nature and cause of the sinkhole was not determined. (FDEP 2017d)

Based on this information, the sinkhole potential at the PTN site is considered very low with a very small chance of a collapse developing at the PTN facility.

3.5.3 Soils

3.5.3.1 Onsite Soils

Foundation engineering investigations were performed to evaluate the subsurface conditions. The investigations included drilling, sampling, field and laboratory testing, and engineering analyses. The subsurface soils at the site consist of a limerock fill, sand, and silt fill layer, underlain by limerock (FPL 2017b, Section 2.9.4.1).

Description	Elevation NAVD88 (feet MLW)
Very dense limerock, sand, and silt fill	16.34 to -6.67 (18 to -5)
Limestone, sand and silt	-6.67 to -11.66 (-5 to -10)
Fossiliferous limerock (Miami Limestone)	-11.66 to -36.66 (-10 to -35)

Field, geophysical, and laboratory data indicate that the sediment at the locations and the depths explored consists, from the ground surface to a depth ranging from 25 to 27 feet, of tan to light tan limerock fill with sand and silt. Underlying the fill material, fossiliferous limestone (Miami Limestone) was encountered. (FPL 2017b, Section 2.9.4.3) No anticipated mining operations or investigations related to mining operations are anticipated within the Turkey Point site boundaries during the SLR period.

The following soil units, which occur within the Turkey Point property boundary, are described in detail in Table 3.5-1 and shown in Figure 3.5-4 (USDA 2017c):

- Lauderhill muck, 0 to 1 percent slopes
- Pennsuco marl, 0 to 1 percent slopes
- Perrine marl, drained, 0 to 2 percent slopes
- Udorthents-Water complex, 15 to 60 percent slopes
- Perrine marl, 0 to 1 percent slopes
- Dania muck, 0 to 1 percent slopes
- Urban land
- Perrine marl, tidal, 0 to 1 percent slopes
- Pennsuco marl, tidal, 0 to 1 percent slopes
- Terra Ceia muck, 0 to 1 percent slopes

3.5.3.2 Erosion Potential

Because PTN has been operational since the early 1970s, stabilization measures are already in place to prevent erosion and sedimentation impacts to the site and vicinity. Based on information from the U.S. Department of Agriculture (USDA), all soil units listed in Table 3.5-1 that are subject to erosion have a slight-to-moderate erosion potential with the exception of the Udorthents-Water complex soils (15 to 60 percent slopes). (USDA 2017c) The soils are located in the area of the cooling canals and to the east of the barge-turning basin (Figure 3.5-4; Figure 3.1-1).

3.5.3.3 Prime Farmland Soils

USDA Natural Resources Conservation Service maps shows an area of prime farmland northwest of Turkey Point and on the most western northwestern corner of the Turkey Point undeveloped property. The location designated as prime farmlands is a small, isolated area. (USDA 2017c) Even if the area of the northwestern undeveloped property is designated prime farmland, Turkey Point would not be subject to the Farmland Protection Policy Act (FPPA) because the act does not include federal permitting or licensing for activities on private or nonfederal lands. Soil units designated as prime farmland are identified in Table 3.5-1.

3.5.4 Seismic History

Records show that there have been no more than seven shocks in the past 200 to 250 years with epicenters located in Florida. Two of these had epicentral intensities of no more than VI (Modified Mercali). Neither of these was felt in southern Florida. Five others were exceedingly small and may have been caused by explosions or submarine slides rather than earthquakes. Other shocks have had epicenters in Cuba. The closest to southern Florida was approximately 250 miles to the south at San Cristobal, Cuba. The largest shock nearest the area was the Charleston, South Carolina earthquake in 1886, with an epicentral intensity of X. (FPL 2017b, Section 2.11.2)

On the basis of historical or statistical seismic activity, Turkey Point is located in a seismically inactive area, far from any recorded damaging shocks. Even though several of the larger historical earthquakes may have been felt in southern Florida, the amount of ground motion caused by them was not great enough to cause damage to any moderately well-built structure. The Uniform Building Code (1964 edition, Volume 1, as approved by the International Conference of Building Officials) designates the area as Zone 0 on the map entitled "Map of the United States Showing Zones of Approximately Equal Seismic Probability." (FPL 2017b, Section 2.11.2) The U.S. Geological Survey's (USGS's) national seismic hazard map shows that the Turkey Point site is in a region that has a 2 percent in 50 years (once in 2,500 years) probability of exceeding a peak ground acceleration between 0 and 0.04 g (USGS 2015, Figure 1).

The epicentral locations of all earthquakes from 1762 through 2016 within a 400-kilometer radius of the site and magnitude greater than body-wave magnitude 3 (3 Mb) are listed in Table 3.5-2 and shown in Figure 3.5-5. (FPL 2016c, Table 2.5-202; USGS 2017b)

A comprehensive catalog of instrumental and historical earthquakes was compiled and analyzed. Based on the catalog, no earthquakes with estimated Mb greater than or equal to 3 Mb have occurred within the Turkey Point site vicinity. (FPL 2016c, Section 2.5.3.1; USGS 2017b).

Limestone bedrock is at or near the ground surface at the site. The site area is far from any folded or deformed sediments, and surface faults are unknown. (FPL 2017b, Section 2.11.2)

Predicated on history, building codes (which do not require consideration of seismic loading), geologic conditions, and earthquake probability, the design earthquake has been conservatively established as 0.05 g horizontal ground acceleration. The nuclear units have also been checked for a 0.15 g ground acceleration to assure no loss of function of the vital systems and structures. Vertical acceleration is taken as 2/3 of the horizontal value and is considered to act concurrently. (FPL 2017b, Section 2.11.2)

Table 3.5-1
Onsite Soil Unit Descriptions (Sheet 1 of 6)

Map Unit Symbol (Figure 3.5-4)	Soil Unit Name	Description	Prime Farmland Designation
3	Lauder muck, frequently ponded 0 to 1 percent slopes	The Lauderhill component makes up 85 percent of the map unit. Slopes are 0 to 1 percent. This component is on depressions on marine terraces on coastal plains. The parent material consists of herbaceous organic material. Depth to a root restrictive layer, bedrock, lithic, is 16 to 36 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, July, August, September, October, November, December. Organic matter content in the surface horizon is about 60 percent. Nonirrigated land capability classification is 7w. This soil meets hydric criteria. There are no saline horizons within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 1 within 30 inches of the soil surface.	Not prime farmland
5	Pennsuco marl 0 to 1 percent slopes	The Pennsuco component makes up 95 percent of the map unit. Slopes are 0 to 1 percent. This component is on marshes on marine terraces on coastal plains. The parent material consists of loamy marine deposits over limestone. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 72 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is very high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 6 inches during June, July, August, September, October, November. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 7w. This soil meets hydric criteria. The calcium carbonate equivalent within 40 inches typically does not exceed 50 percent. There are no saline horizons within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 1 within 30 inches of the soil surface.	Not prime farmland

Table 3.5-1
Onsite Soil Unit Descriptions (Sheet 2 of 6)

Map Unit Symbol (Figure 3.5-4)	Soil Unit Name	Description	Prime Farmland Designation
6	Perrine marl, drained 0 to 2 percent slopes	The Perrine, drained component makes up 98 percent of the map unit. Slopes are 0 to 1 percent. This component is on flats on marine terraces on coastal plains. The parent material consists of loamy marine deposits over limestone. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during June, July, August. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 3w. This soil meets hydric criteria. The calcium carbonate equivalent within 40 inches typically does not exceed 60 percent. There are no saline horizons within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 1 within 30 inches of the soil surface.	Farmland of statewide importance
9	Udorthents-Water complex 15 to 60 percent slopes	The Udorthents component makes up 75 percent of the map unit. Slopes are 15 to 60 percent. This component is on fills on marine terraces on coastal plains. The parent material consists of altered marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. There are no saline horizons within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 1 within 30 inches of the soil surface.	Not prime farmland

Table 3.5-1
Onsite Soil Unit Descriptions (Sheet 3 of 6)

Map Unit Symbol (Figure 3.5-4)	Soil Unit Name	Description	Prime Farmland Designation
12	Perrine marl 0 to 1 percent slopes	The Perrine component makes up 92 percent of the map unit. Slopes are 0 to 1 percent. This component is on marshes on marine terraces on coastal plains. The parent material consists of loamy marine deposits over limestone. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during June, July, August, September, October, November. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 7w. This soil meets hydric criteria. The calcium carbonate equivalent within 40 inches typically does not exceed 60 percent. There are no saline horizons within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 1 within 30 inches of the soil surface.	Not prime farmland
14	Dania muck 0 to 1 percent slopes	The Dania component makes up 85 percent of the map unit. Slopes are 0 to 1 percent. This component is on marshes on marine terraces on coastal plains. The parent material consists of herbaceous organic material over limestone. Depth to a root restrictive layer, bedrock, lithic, is 10 to 29 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, July, August, September, October, November, December. Organic matter content in the surface horizon is about 75 percent. Nonirrigated land capability classification is 7w. This soil meets hydric criteria. There are no saline horizons within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 1 within 30 inches of the soil surface.	Prime farmland if drained

Table 3.5-1
Onsite Soil Unit Descriptions (Sheet 4 of 6)

Map Unit Symbol (Figure 3.5-4)	Soil Unit Name	Description	Prime Farmland Designation
15	Urban land	Built-up areas and nearly level to very steep, moderately well drained or well drained soils consisting of fill material that is 8 to more than 80 inches deep over limestone bedrock.	Not prime farmland
26	Perrine marl, tidal 0 to 1 percent slopes	The Perrine, tidal component makes up 90 percent of the map unit. Slopes are 0 to 1 percent. This component is on mangrove swamps on marine terraces on coastal plains. The parent material consists of loamy marine deposits over limestone. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is very frequently flooded. It is not ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, July, August, September, October, November, December. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 8. This soil meets hydric criteria. The calcium carbonate equivalent within 40 inches typically does not exceed 60 percent. The soil has a moderately saline horizon within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 7 within 30 inches of the soil surface.	Not prime farmland

Table 3.5-1
Onsite Soil Unit Descriptions (Sheet 5 of 6)

Map Unit Symbol (Figure 3.5-4)	Soil Unit Name	Description	Prime Farmland Designation
31	Pennsuco marl. Tidal 0 to 1 percent slopes	The Pennsuco, tidal component makes up 90 percent of the map unit. Slopes are 0 to 1 percent. This component is on mangrove swamps on marine terraces on coastal plains. The parent material consists of loamy marine deposits over limestone. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 80 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is very frequently flooded. It is not ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, July, August, September, October, November, December. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 8. This soil meets hydric criteria. The calcium carbonate equivalent within 40 inches typically does not exceed 35 percent. The soil has a slightly saline horizon within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 50 within 30 inches of the soil surface.	Not prime farmland

Table 3.5-1
Onsite Soil Unit Descriptions (Sheet 6 of 6)

Map Unit Symbol (Figure 3.5-4)	Soil Unit Name	Description	Prime Farmland Designation
32	Terrs Ceia muck 0 to 1 percent slopes	The Terra Ceia, tidal component makes up 92 percent of the map unit. Slopes are 0 to 1 percent. This component is on tidal marshes on marine terraces on coastal plains. The parent material consists of herbaceous organic material. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is very high. Shrink-swell potential is low. Soil is very frequently flooded. It is not ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, July, August, September, October, November, December. Organic matter content in the surface horizon is about 73 percent. Non-irrigated land capability classification is 8. This soil meets hydric criteria. The soil has a slightly saline horizon within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 1 within 30 inches of the soil surface.	Not prime farmland

(USDA 1996; USDA 2017c)

Table 3.5-2
Historic Earthquakes of Intensity IV/Magnitude 3 Mb or Greater within 400 Kilometers of PTN (Sheet 1 of 12)

Date	Time	Epicentral Intensity	Magnitude (Mb)	Approximate Location	Latitude	Longitude	Distance to Site (km)	Source
11/13/1762	-—	—	4.33	—	22.9800	-82.3700	339	(a)
7/7/1777	9:29 AM	—	4.77	—	22.8300	-82.0300	333	(a)
1810	—	—	4.33	—	23.1300	-82.4000	328	(a)
1812	—	—	4.33	—	23.0500	-81.5800	290	(a)
1824	—	—	4.33	—	22.8100	-80.0800	289	(a)
2/21/1843	—	—	4.77	—	23.1300	-82.4000	328	(a)
3/5/1843	—	—	3.89	—	23.0500	-81.5800	290	(a)
10/10/1846	—	—	4.11	—	23.0000	-82.0800	320	(a)
8/30/1849	—	—	4.33	—	22.1500	-80.4500	361	(a)
1852	—	—	4.77	—	23.0500	-81.5800	290	(a)
7/7/1852	2:59 PM	—	4.33	—	22.4200	-79.9700	333	(a)
9/9/1854	—	—	4.77	—	23.0500	-81.5800	290	(a)
7/7/1857	—	—	4.11	—	22.8100	-80.0800	289	(a)
3/7/1858	12:29 PM	—	4.62	—	22.4800	-79.5500	334	(a)
8/14/1858	6:29 AM	—	4.62	—	22.4800	-79.5500	334	(a)
8/15/1859	2:59 AM	—	4.33	—	22.4800	-79.5500	334	(a)
10/4/1859	-—	—	4.33	—	23.1300	-82.4000	328	(a)

Table 3.5-2
Historic Earthquakes of Intensity IV/Magnitude 3 Mb or Greater within 400 Kilometers of PTN (Sheet 2 of 12)

Date	Time	Epicentral Intensity	Magnitude (Mb)	Approximate Location	Latitude	Longitude	Distance to Site (km)	Source
5/27/1861	1:59 PM	—	4.11	—	22.8100	-80.0800	289	(a)
6/27/1861	—	—	4.84	—	22.8100	-80.0800	289	(a)
1862	—	—	3.89	—	23.1300	-82.4000	328	(a)
August 1862	—	—	3.89	—	23.1300	-82.4000	328	(a)
3/25/1868	—	—	4.77	—	23.1300	-82.4000	328	(a)
5/1/1868	—	—	4.33	—	22.3600	-79.5800	346	(a)
1872	—	—	3.89	—	22.9100	-81.8600	317	(a)
June 1872	—	—	5.13	—	22.5100	-79.4700	333	(a)
8/12/1873	3:29 AM	—	5.35	—	22.4800	-79.5500	334	(a)
6/12/1880	1:29 AM	—	4.33	—	22.4200	-79.6300	339	(a)
1886	—	—	4.33	—	22.8100	-80.0800	289	(a)
8/31/1886	10:20 PM	—	4.84	—	22.9400	-80.0100	276	(a)
9/3/1886	—	—	4.55	—	22.9400	-80.0100	276	(a)
4/12/1889	2:19 AM	—	4.33	—	22.8100	-80.0800	289	(a)
4/25/1896	—	—	4.92	—	22.5100	-79.4700	333	(a)
1903	—	—	5.06	—	22.6800	-81.1100	312	(a)
9/4/1905	—	III	3.06	—	27.5000	-82.6000	321	(a)

Table 3.5-2
Historic Earthquakes of Intensity IV/Magnitude 3 Mb or Greater within 400 Kilometers of PTN (Sheet 3 of 12)

Date	Time	Epicentral Intensity	Magnitude (Mb)	Approximate Location	Latitude	Longitude	Distance to Site (km)	Source
10/12/1905	—	—	4.33	—	23.0500	-82.0100	312	(a)
1/15/1906	—	—	4.40	—	22.6000	-80.3300	311	(a)
6/5/1906	5:59 AM	—	4.84	—	22.8800	-80.3800	280	(a)
2/19/1907	—	—	4.77	—	23.1300	-82.4000	328	(a)
4/15/1907	—	—	4.33	—	23.1300	-82.4000	328	(a)
January 1908	—	—	4.19	—	22.4800	-79.5500	334	(a)
5/6/1912	—	—	4.33	—	22.5100	-79.6900	328	(a)
1913	—	—	4.33	—	22.1500	-80.4500	361	(a)
1914	—	—	4.62	—	22.1500	-80.4500	361	(a)
5/27/1914	6:59 AM	—	4.33	—	22.7100	-82.2800	358	(a)
5/28/1914	3:29 AM	—	4.77	—	22.7100	-82.2800	358	(a)
1920	—	—	4.19	—	22.5100	-79.7100	327	(a)
9/23/1921	—	—	4.33	—	22.9100	-82.6100	360	(a)
1926	—	—	4.40	—	22.6000	-80.3300	311	(a)
January 1927	—	—	4.70	—	22.7700	-81.0200	301	(a)
6/5/1928	—	—	4.26	—	22.7700	-81.0200	301	(a)
7/19/1930	6:53 PM	V	4.06	—	25.8000	-81.4000	114	(a)

Table 3.5-2
Historic Earthquakes of Intensity IV/Magnitude 3 Mb or Greater within 400 Kilometers of PTN (Sheet 4 of 12)

Date	Time	Epicentral Intensity	Magnitude (Mb)	Approximate Location	Latitude	Longitude	Distance to Site (km)	Source
1931	—	—	4.33	—	22.2300	-79.3300	366	[(a)]
8/12/1931	6:00 PM	—	4.33	—	22.8100	-80.0800	289	[(a)]
1932	—	—	4.11	—	22.9800	-80.5900	270	[(a)]
1932	—	—	4.33	—	23.1300	-82.4000	328	[(a)]
1933	—	—	4.33	—	22.0500	-79.4600	382	[(a)]
1934	—	—	4.33	—	22.6600	-80.1900	305	[(a)]
1936	3:30 PM	—	4.62	—	22.3400	-79.3400	354	[(a)]
12/19/1936	3:30 PM	—	4.62	—	22.3400	-79.3400	354	[(a)]
1/1/1937	4:00 PM	—	4.33	—	22.2900	-79.2000	364	[(a)]
1/8/1937	—	—	4.33	—	22.3300	-79.2600	358	[(a)]
5/14/1937	—	—	4.70	—	22.7800	-80.0800	293	[(a)]
January 1938	—	—	4.19	—	22.3000	-79.7300	350	[(a)]
6/30/1938	—	—	4.11	—	22.5100	-79.4700	333	[(a)]
7/29/1938	—	—	4.11	—	22.4800	-79.5500	334	[(a)]
October 1938	—	—	4.19	—	22.3000	-79.7300	350	[(a)]
November 1938	—	—	4.33	—	22.3100	-79.2400	361	[(a)]
1/1/1939	2:00 PM	—	4.19	—	22.3100	-79.2400	361	[(a)]

Table 3.5-2
Historic Earthquakes of Intensity IV/Magnitude 3 Mb or Greater within 400 Kilometers of PTN (Sheet 5 of 12)

Date	Time	Epicentral Intensity	Magnitude (Mb)	Approximate Location	Latitude	Longitude	Distance to Site (km)	Source
1/13/1939	9:20 AM	—	4.84	—	22.5100	-79.4700	333	(a)
1/13/1939	9:30 AM	—	4.40	—	22.4200	-79.3500	346	(a)
1/13/1939	9:35 AM	—	4.11	—	22.3100	-79.2400	361	(a)
2/15/1939	—	—	4.33	—	22.3100	-79.2400	361	(a)
May 1939	—	—	4.33	—	22.5100	-79.4700	333	(a)
8/15/1939	3:52 AM	—	5.81	—	22.5000	-79.0000	349	(a)
1941	—	—	4.33	—	23.1300	-82.4000	328	(a)
4/24/1941	8:30 PM	—	4.33	—	22.8100	-80.0800	289	(a)
4/25/1941	2:15 AM	—	4.48	—	22.8500	-80.1000	285	(a)
1/19/1942	—	IV	3.47	—	26.5000	-81.0000	136	(a)
3/9/1942	6:10 PM	—	4.55	—	22.9400	-80.0100	276	(a)
4/11/1942	5:40 AM	—	4.33	—	22.4800	-79.5500	334	(a)
6/4/1942	6:00 AM	—	4.11	—	22.8100	-80.0800	289	(a)
7/31/1942	—	—	4.62	—	22.3400	-80.5600	341	(a)
8/18/1942	—	—	4.33	—	23.1300	-82.4000	328	(a)
12/18/1942	—	—	4.33	—	23.1300	-82.4000	328	(a)
1943	—	—	4.19	—	22.8100	-80.0800	289	(a)

Table 3.5-2
Historic Earthquakes of Intensity IV/Magnitude 3 Mb or Greater within 400 Kilometers of PTN (Sheet 6 of 12)

Date	Time	Epicentral Intensity	Magnitude (Mb)	Approximate Location	Latitude	Longitude	Distance to Site (km)	Source
1/1/1943	—	—	4.19	—	22.8100	-80.0800	289	(a)
July 1943	—	—	4.19	—	22.2100	-79.2400	371	(a)
7/31/1943	2:00 AM	—	4.33	—	22.1500	-79.9700	363	(a)
7/31/1943	3:15 AM	—	4.11	—	22.1100	-79.7200	370	(a)
December 1943	—	—	4.19	—	22.2100	-79.2400	371	(a)
1944	—	—	4.40	—	22.0600	-79.4000	383	(a)
January 1944	—	—	4.33	—	22.3500	-79.2300	357	(a)
1/1/1944	3:00 AM	—	4.84	—	22.3300	-79.2600	358	(a)
1/1/1944	7:00 PM	—	4.40	—	22.8000	-80.1000	290	(a)
1945	—	—	4.33	—	22.6800	-79.7100	309	(a)
12/22/1945	3:25 PM	III	3.06	—	25.8000	-80.0000	53	(a)
1946	—	—	4.40	—	22.0000	-79.3600	390	(a)
September 1948	—	—	4.33	—	22.8100	-80.0800	289	(a)
11/8/1948	5:44 PM	IV	3.47	—	26.5000	-82.2000	221	(a)
1950	—	—	4.33	—	22.8000	-80.2800	289	(a)
1/1/1950	—	—	4.33	—	22.8000	-80.2800	289	(a)
1/12/1951	11:00 AM	—	4.33	—	22.4800	-79.5500	334	(a)

Table 3.5-2
Historic Earthquakes of Intensity IV/Magnitude 3 Mb or Greater within 400 Kilometers of PTN (Sheet 7 of 12)

Date	Time	Epicentral Intensity	Magnitude (Mb)	Approximate Location	Latitude	Longitude	Distance to Site (km)	Source
2/3/1952	6:30 AM	—	4.62	—	22.7900	-80.1600	291	(a)
2/3/1952	4:30 PM	—	4.99	—	22.8800	-80.2800	280	(a)
1953	—	—	4.19	—	22.9800	-80.5900	270	(a)
1/1/1953	3:00 PM	—	4.19	—	22.9800	-80.5900	270	(a)
1/2/1953	3:00 PM	—	4.33	—	22.8000	-80.0200	291	(a)
3/26/1953	—	IV	3.47	—	28.6000	-81.4000	366	(a)
5/16/1953	—	—	4.84	—	23.0300	-82.1300	320	(a)
1954	—	—	4.40	—	22.5000	-79.6000	331	(a)
1/1/1954	—	—	4.40	—	22.5000	-79.6000	331	(a)
1956	—	—	4.11	—	22.8100	-80.0800	289	(a)
5/25/1960	3:30 PM	—	4.99	—	22.5800	-79.4800	325	(a)
6/30/1960	12:00 AM	—	4.33	—	22.4800	-79.5500	334	(a)
7/18/1960	1:35 PM	—	4.11	—	22.4800	-79.5500	334	(a)
December 1960	—	—	4.33	—	22.4800	-79.5500	334	(a)
1961	—	—	4.33	—	22.3300	-79.2600	358	(a)
January 1961	—	—	4.33	—	22.9800	-80.5900	270	(a)
January 1963	—	—	4.33	—	22.4800	-79.5500	334	(a)

Table 3.5-2
Historic Earthquakes of Intensity IV/Magnitude 3 Mb or Greater within 400 Kilometers of PTN (Sheet 8 of 12)

Date	Time	Epicentral Intensity	Magnitude (Mb)	Approximate Location	Latitude	Longitude	Distance to Site (km)	Source
8/26/1963	—	—	4.11	—	22.4800	-79.5500	334	(a)
3/27/1964	—	—	4.77	—	22.0700	-81.0400	377	(a)
1966	—	—	4.26	—	22.6400	-80.2800	307	(a)
1/1/1966	—	—	4.26	—	22.6400	-80.2800	307	(a)
7/29/1966	—	—	4.33	—	22.3100	-79.2400	361	(a)
7/29/1966	3:00 PM	—	4.11	—	22.3100	-79.2400	361	(a)
1/1/1968	—	—	4.33	—	22.9800	-80.5900	270	(a)
May 1969	—	—	4.33	—	22.1400	-78.9800	387	(a)
June 1969	—	—	4.33	—	22.1800	-78.9800	383	(a)
6/1/1969	3:00 AM	—	4.33	—	22.1400	-78.9800	387	(a)
December 1969	—	—	4.33	—	22.1800	-78.9800	383	(a)
4/27/1970	11:55 AM	—	4.33	—	23.0500	-81.5800	290	(a)
7/24/1970	—	—	4.26	—	22.9000	-83.1600	399	(a)
10/16/1970	1:07 PM	—	4.70	—	23.1000	-82.9000	364	(a)
10/27/1973	6:21 AM	V	3.49	—	28.4800	-80.6500	338	(a)
11/30/1973	—	—	4.55	—	22.7000	-81.2000	313	(a)
11/30/1974	—	—	4.33	—	22.7000	-79.6900	307	(a)

Table 3.5-2
Historic Earthquakes of Intensity IV/Magnitude 3 Mb or Greater within 400 Kilometers of PTN (Sheet 9 of 12)

Date	Time	Epicentral Intensity	Magnitude (Mb)	Approximate Location	Latitude	Longitude	Distance to Site (km)	Source
11/30/1975	—	—	4.11	—	22.5500	-79.7200	323	(a)
10/20/1976	8:15 AM	—	4.33	—	22.3000	-79.4500	356	(a)
November 1976	—	—	4.26	—	22.0000	-79.3700	390	(a)
11/1/1976	—	—	4.26	—	22.0000	-79.3700	390	(a)
1977	—	—	4.11	—	22.6800	-80.1500	303	(a)
1978	—	—	3.89	—	23.0500	-81.5800	290	(a)
1/1/1978	—	—	3.89	—	23.0500	-81.5800	290	(a)
1/12/1978	9:10 PM	IV	3.66	—	28.1000	-81.6000	321	(a)
5/31/1978	4:02 PM	—	3.96	—	23.5000	-82.1000	277	(a)
1979	—	—	4.33	—	22.6400	-79.7500	312	(a)
11/19/1979	6:00 AM	—	4.33	—	22.4800	-79.5500	334	(a)
1981	—	—	4.11	—	22.9000	-83.1600	399	(a)
1/1/1981	—	—	4.11	—	22.9000	-83.1600	399	(a)
November 1981	—	—	4.11	—	22.5900	-81.2400	326	(a)
11/16/1982	8:20 PM	—	5.72	Cuba region	22.6100	-81.2300	323	(a)
11/1/1983	5:09 PM	—	3.43	—	23.3000	-82.8000	342	(a)
1984	—	—	3.97	—	22.5100	-79.4700	333	(a)

Table 3.5-2
Historic Earthquakes of Intensity IV/Magnitude 3 Mb or Greater within 400 Kilometers of PTN (Sheet 10 of 12)

Date	Time	Epicentral Intensity	Magnitude (Mb)	Approximate Location	Latitude	Longitude	Distance to Site (km)	Source
4/9/1984	11:08 PM	—	4.51	—	22.6000	-80.3000	311	(a)
4/19/1984	7:54 PM	—	3.40	—	23.1000	-82.4000	330	(a)
5/16/1984	2:50 AM	—	4.55	—	22.9300	-80.5000	275	(a)
8/20/1984	6:37 PM	—	3.64	—	22.5000	-79.7400	328	(a)
11/7/1984	7:42 AM	—	3.97	—	22.5100	-79.4700	333	(a)
11/16/1984	1:34 PM	—	3.78	—	23.0100	-79.3200	285	(a)
11/22/1984	6:35 PM	—	4.07	—	22.9600	-79.6400	280	(a)
2/21/1985	8:22 PM	—	4.04	—	23.2500	-83.4000	391	(a)
9/13/1985	10:02 AM	—	3.69	—	24.0700	-76.9700	370	(a)
9/13/1985	5:49 PM	—	3.51	—	23.3600	-82.8300	339	(a)
10/8/1986	4:51 AM	—	4.26	—	22.2200	-78.7000	390	(a)
12/25/1986	6:13 AM	—	3.34	—	22.2300	-79.0300	376	(a)
12/30/1986	8:16 AM	—	3.49	—	22.3500	-79.3300	354	(a)
1/4/1988	10:33 AM	—	4.09	—	22.3200	-78.9400	370	(a)
6/2/1990	11:54 PM	—	4.19	—	23.4200	-79.4800	237	(a)
7/19/1990	12:36 PM	—	3.29	—	22.4700	-78.4700	376	(a)
2/22/1992	4:21 AM	—	3.21	Bahama Islands	26.3560	-78.8880	177	(a)

Table 3.5-2
Historic Earthquakes of Intensity IV/Magnitude 3 Mb or Greater within 400 Kilometers of PTN (Sheet 11 of 12)

Date	Time	Epicentral Intensity	Magnitude (Mb)	Approximate Location	Latitude	Longitude	Distance to Site (km)	Source
9/25/1992	12:51 AM	—	4.39	—	22.6500	-79.4000	320	(a)
9/25/1992	3:15 AM	—	3.64	—	22.6900	-79.3000	319	(a)
3/9/1995	6:29 PM	—	3.34	—	22.9000	-82.2100	337	(a)
8/8/1996	10:25 PM	—	3.81	Cuba region	22.1100	-80.1840	366	(a)
2/18/2006	3:59 PM	—	3.01	—	22.4260	-80.9660	336	(a)
9/15/2006	8:39 AM	—	3.21	—	22.1960	-79.8860	359	(a)
1/9/2014	3:57 PM	—	5.00	26km NNW of Corralillo, Cuba	23.1818	-80.7278	254	(b)
1/9/2014	9:25 PM	—	4.10	26km NNW of Corralillo, Cuba	23.1972	-80.6891	251	(b)
1/10/2014	6:23 AM	—	4.00	20km WNW of Corralillo, Cuba	23.0780	-80.7589	266	(b)
2/4/2014	10:19 PM	—	4.30	15km NNE of Marti, Cuba	23.0882	-80.8884	267	(b)
3/9/2014	6:26 AM	—	4.70	27km NW of Corralillo, Cuba	23.1573	-80.7795	257	(b)
3/30/2014	4:50 PM	—	4.20	18km NW of Corralillo, Cuba	23.1071	-80.7043	262	(b)

Table 3.5-2
Historic Earthquakes of Intensity IV/Magnitude 3 Mb or Greater within 400 Kilometers of PTN (Sheet 12 of 12)

Date	Time	Epicentral Intensity	Magnitude (Mb)	Approximate Location	Latitude	Longitude	Distance to Site (km)	Source
1/20/2015	11:07 PM	—	4.10	45km SW of Jaguey Grande, Cuba	22.2165	-81.4216	375	(b)
8/16/2015	6:47 AM	—	4.30	29km NNW of Corralillo, Cuba	23.2406	-80.6418	246	(b)

a. 1762–2006 (FPL 2016c)
b. 2014–2015 (USGS 2017b)

Notes:

— = not reported

Formula to calculate distance between site and earthquake location (USGS Earthquakes only) = ACOS(COS(RADIANS(90-LATPTN))× COS(RADIANS(90-LATearthquake)) +SIN(RADIANS(90-LATPTN)) ×SIN(RADIANS(90-LATearthquake)) ×COS(RADIANS(LONGPTN-LONGearthquake))) ×6371 (http://bluemm.blogspot.com/2007/01/excel-formula-to-calculate-distance.html).

PTN coordinates: 25.434512, -80.331154.

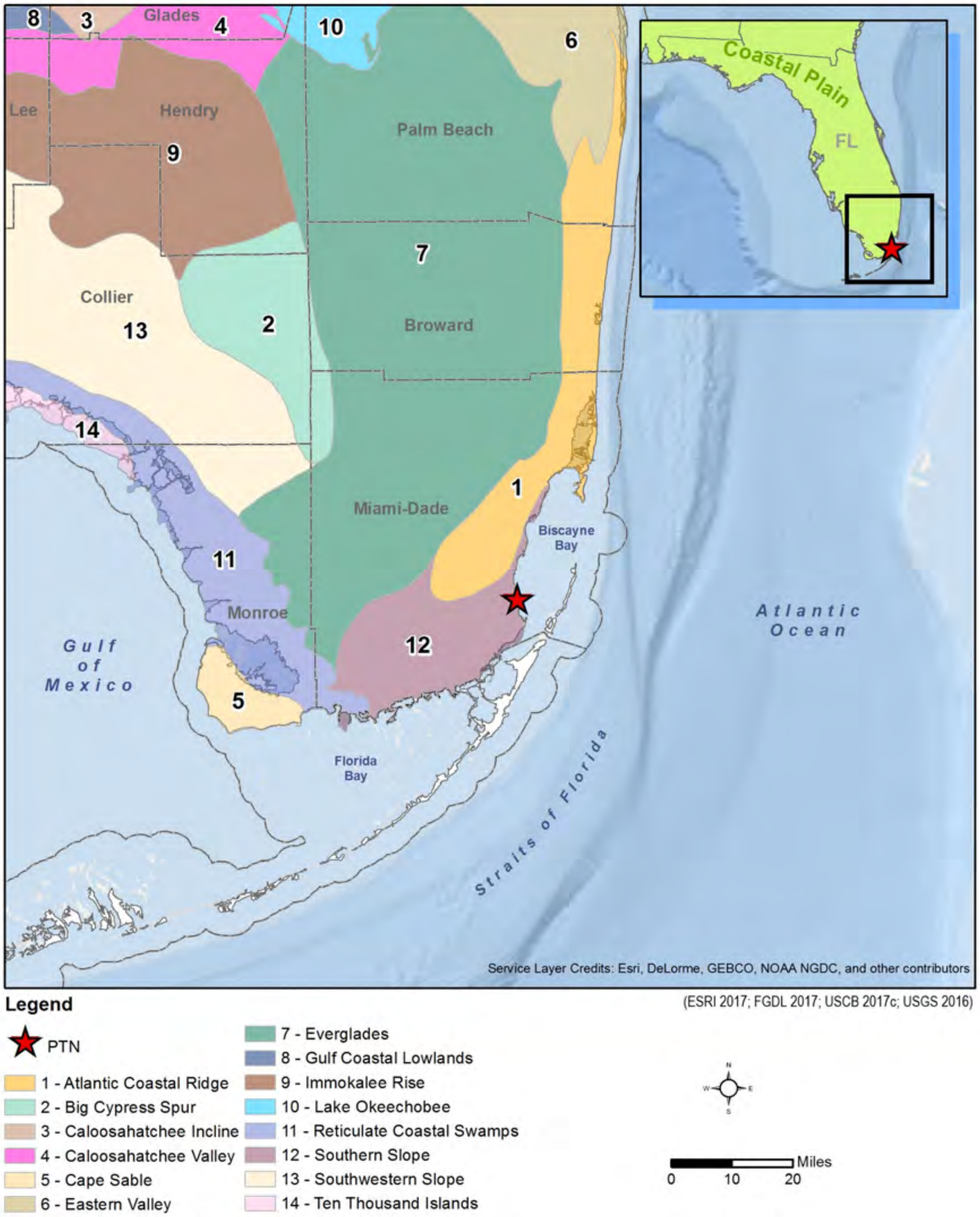

Figure 3.5-1
Physiographic Provinces Associated with the Turkey Point Site

Figure 3.5-2a
Columnar Geologic Section, Turkey Point Site Area

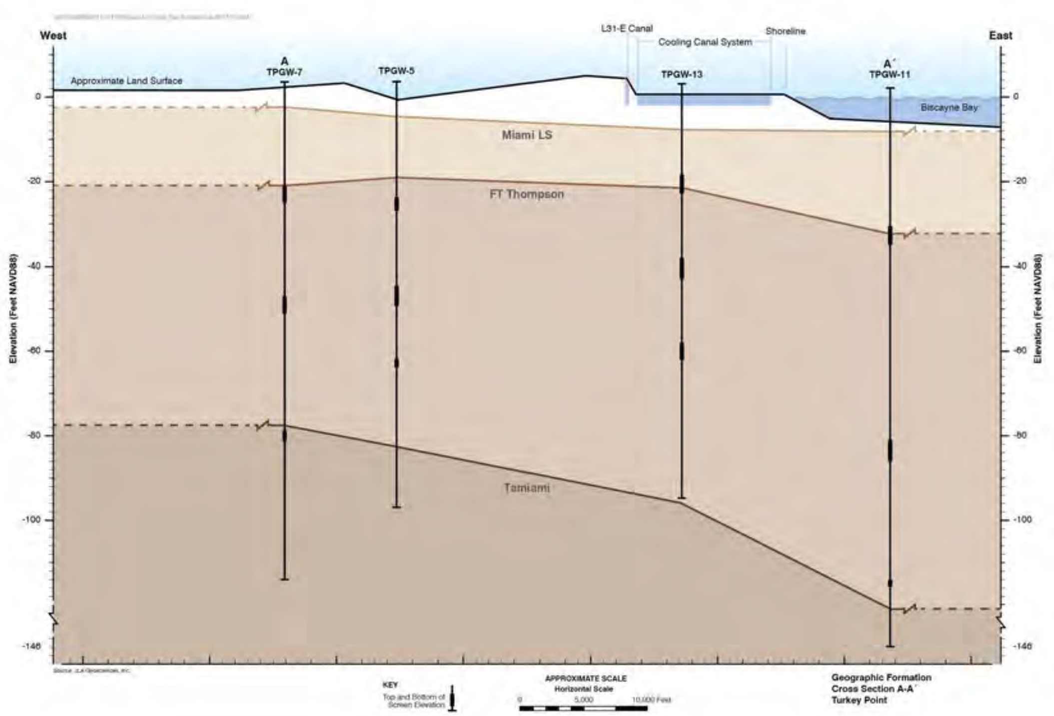

Figure 3.5-2b
Columnar Geologic Section, Turkey Point Site Area

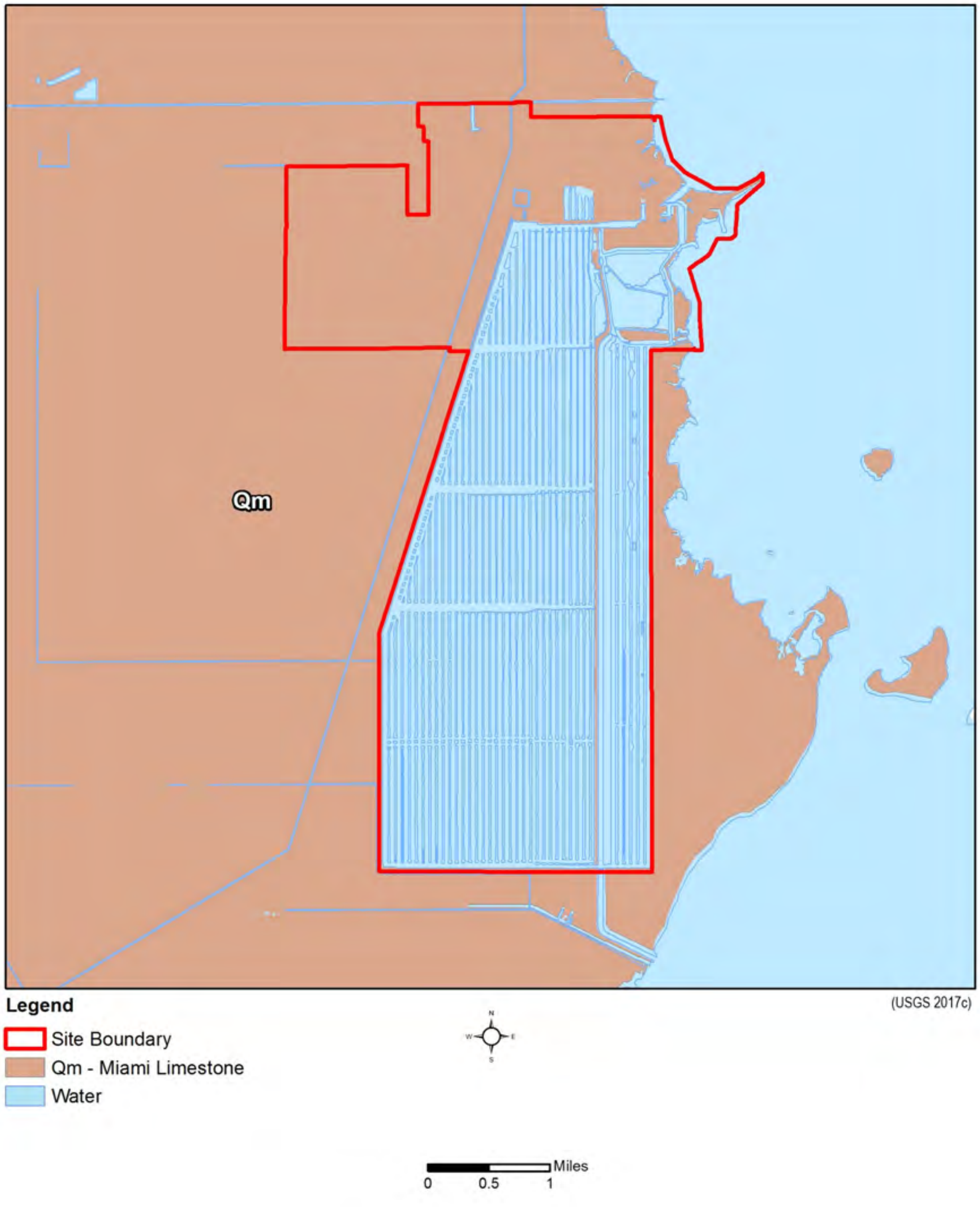

Figure 3.5-3
Surficial Geology Map, Turkey Point Property

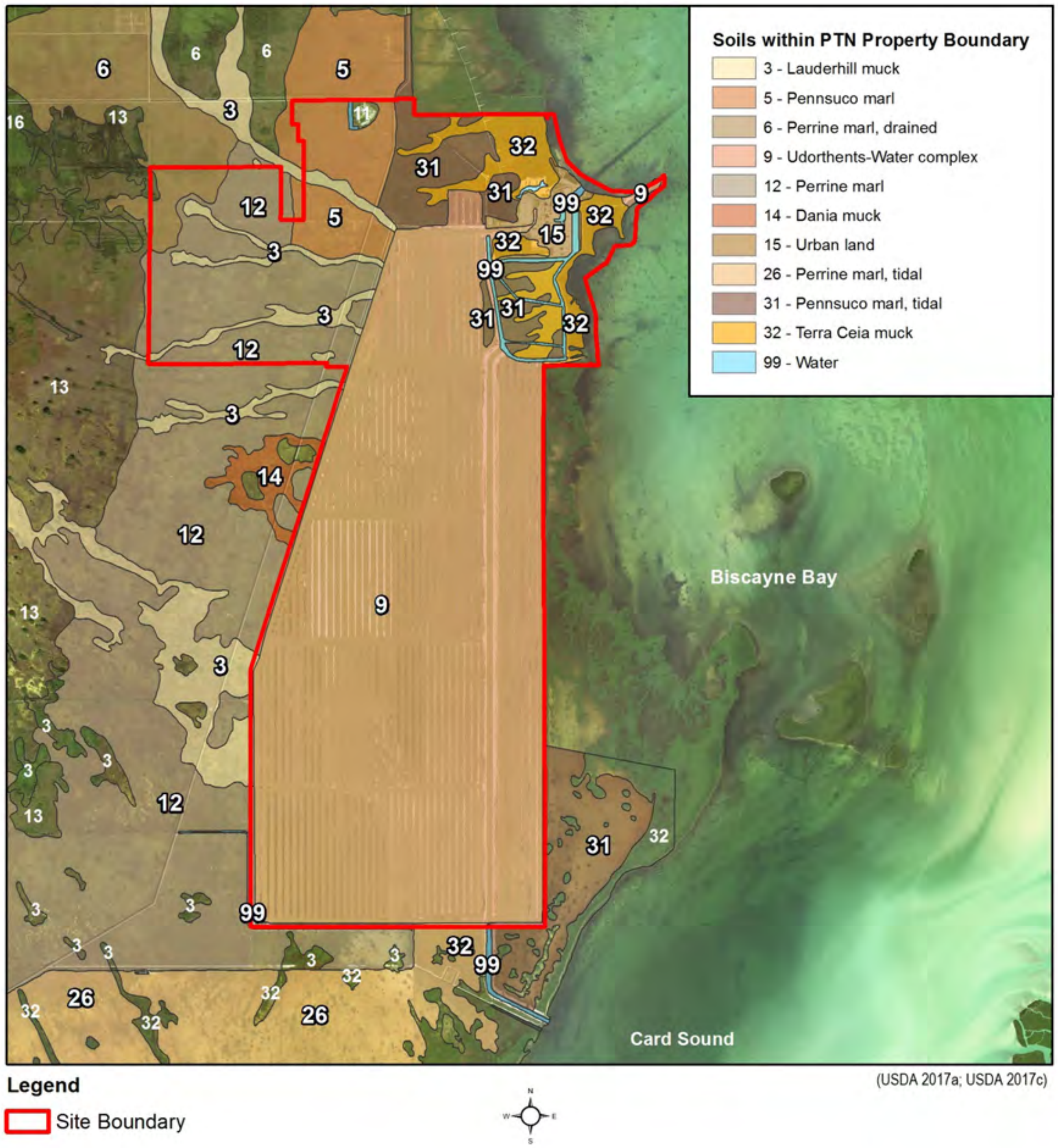

Figure 3.5-4
Distribution of Soil Units, Turkey Point Property

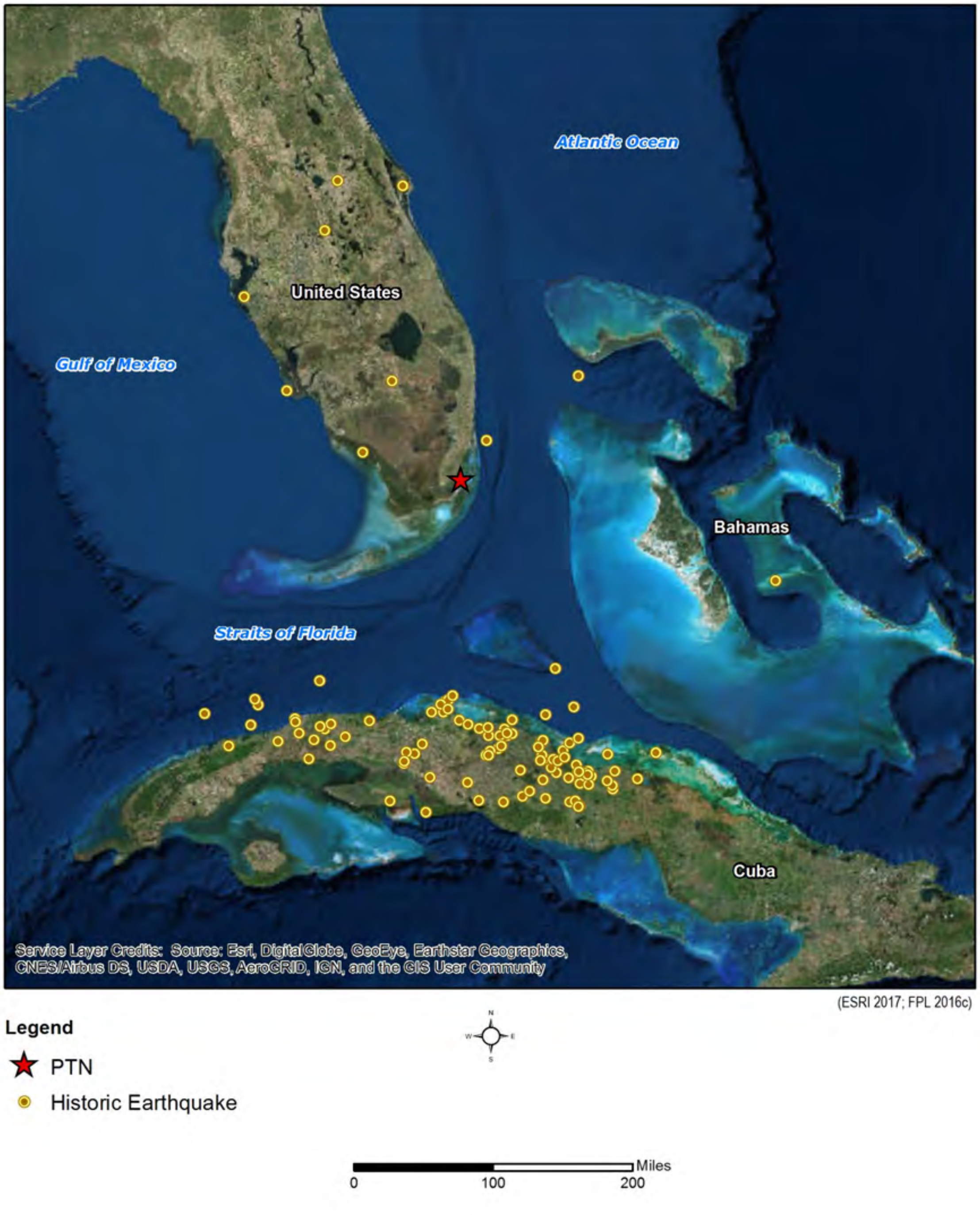

Figure 3.5-5
Historic Earthquakes

3.6 Water Resources

This section describes the hydrological characteristics of surface water and groundwater in the vicinity of PTN that may affect plant effluents and water supply, or that may be reasonably assumed to be affected by the continued operation of the facility.

3.6.1 Surface Water Resources

Turkey Point is located on the southern shore of Biscayne Bay in Miami-Dade County, Florida, approximately 25 miles south of Miami on FPL-owned property. The FPL property consists of approximately 9,460 acres with approximately 15,861 feet of frontage on Biscayne Bay within the Everglades drainage basin of the southern Florida watershed subregion, as shown on Figure 3.6-1. Higher topographic relief of the Immokalee Rise and Big Cypress Spur in the west and the Atlantic Coastal Ridge in the east of the Everglades historically guided the stormwater runoff and freshwater flows from Lake Okeechobee to drain south and southeast into the Everglades. However, flood control structures and an elaborate drainage canal system constructed in the past century have since modified the natural drainage basin, its freshwater discharge, and its interaction with the coastal bays of the Atlantic Ocean and Gulf of Mexico. The interaction of surface water and groundwater within the area further complicates the hydrology of the area. (FPL 2014a, Section 2.3.1.1)

There are no lakes, major rivers, or dams located near Turkey Point, as shown in Figure 3.6-1. However, a network of drainage canals, which includes canals from the Central and Southern Florida-South Dade Conveyance System (C&SF-SDCS) and local project (drainage) canals, provides freshwater supply and drainage to southeastern Florida and controlled drainage from southeastern Florida to the Biscayne Bay. Consequently, the hydrology near Turkey Point is mainly governed by climate, rainfall, regional groundwater flow, local and regional drainage features and practices, land use, and the dynamics of Biscayne Bay. (FPL 2014a, Section 2.3.1.1)

The CCS is a permitted IWW facility consisting of an approximately 5,900-acre closed-loop system that was designed to provide condenser and auxiliary equipment cooling for Turkey Point Units 1 through 4 and is currently serving that purpose for PTN. Additionally, the CCS (IWW facility) receives cooling tower blowdown from Unit 5 and other permitted discharges. Being a large open air system, water enters and leaves the system through a number of natural and engineered processes. Water enters the system through precipitation, groundwater in-seepage, and water sources that have been developed to assist achieving and maintaining low target salinity (Upper Floridan Aquifer well system). Water leaves the system through evaporation and groundwater out-seepage. (FPL 2017c) The CCS serves as the ultimate heat sink (UHS) for PTN. It is required to reject enough heat such that sufficiently cool water is provided to the plant intakes for cooling purposes.

The cooling canals are a closed system and are not considered waters of the U.S. or the State of Florida. The canals range from saline salinity to hypersaline, with high water temperatures [35ºC to 40°C (95ºF to 104°F)]. Canal temperatures vary with seasonal ambient air temperatures. Data taken in March 2015 show that canal temperatures can vary by as much as 4°F per day. Normal cooling is a combination of radiative and convective heat loss due to sea breeze and other environmental factors.

The total flow rate through the canal system is approximately 4,250 cubic feet per second (cfs), the average length of the circulation is 13.4 miles, and the estimated residence time is between 41–47 hours, depending upon the sea level conditions. The average depth of water in the canals is 2.3 feet at low sea level, and 3.3 feet at high sea level. In the deep canals, the average water depth is 20 feet. The average salinity in the CCS varies depending on recent rainfall activity. The typical water elevation at the plant intake is -1.4 feet, and the typical water elevation at the plant discharge is 1.7 feet. The western side water surface area is 3,495 acres, the eastern side water surface area is 835 acres, for a total of 4,330 acres. The berm land surface area is 1,520 acres.

The CCS (IWW facility) is further described in Section 3.6.4.1.1.

3.6.1.1 Everglades National Park-South Dade Conveyance System

The systematic and elaborate construction of drainage canals in southern Dade County was initiated in the 1960s. The federal Flood Control Act of 1962 authorized the Central and Southern Florida Flood Control District (C&SF) project for southern Dade County. The C&SF project implemented a system of canals and structures to provide drainage for urban development, prevent over-drainage of agricultural lands, and prevent contamination of groundwater by saltwater intrusion. The conveyance system relies on gravity drainage through a primary network of 12 canals with outlets to serve a system of secondary canals. (FPL 2014a, Section 2.3.1.1.2)

The canal system was modified in the 1970s to meet the hydrologic needs of the Everglades National Park, as authorized by the updated Flood Control Act of 1968, by implementing the Everglades National Park-South Dade Conveyance System (ENP-SDCS). The ENP-SDCS interconnected several drainage basins of the C&SF drainage project. Gated control structures were first installed at the eastern (coastal) end of the primary canals to release excess stormwater runoff to the coastal water bodies during the wet season and to manage saltwater intrusion during the dry seasons. Secondary controls on the inland reaches of canals were then installed to regulate flow eastward, control inland and agricultural flooding, and maintain higher water levels in the surficial aquifer system where appropriate. The surface water canal system was fully developed in the 1980s when the ENP-SDCS was completed. The conveyance system met its objectives by providing water supply, controlling inland flooding, and mitigating saltwater intrusion. (FPL 2014a, Section 2.3.1.1.2)

The ENP-SDCS was mandated to supply 55,000 acre-feet of water per year to Everglades National Park. It made use of the existing canals from the C&SF project. The existing north-south directed borrow canals, L-30 and L-31N/L-31W, were enlarged to convey water from the Miami Canal (C-6) to the Everglades. The west-east running canals provide drainage from the South Dade development corridor to Biscayne Bay by control structures at the mouth of the canals. The western borrow canal of Levee 31E (L-31E Canal) runs parallel to the Biscayne Bay coastline in southern Miami-Dade County, separating the coastal wetlands along the bay from the mainland and collects and conveys local drainage to coastal outfall structures to the bay (S-20, S20F, S-20G, and S21A). Starting north of Black Creek Canal (C-1) and extending to Card Sound Road in the south, the L-31E Canal has a levee crest elevation of approximately 7 feet North American Vertical Datum of 1988 (NAVD88). Near the Turkey Point plant property, the levee and canal are located immediately west of the Turkey Point interceptor ditch and the IWW facility. (FPL 2014a, Section 2.3.1.1.2)

Based on the hydrology of the area, the USACE delineated water management sub-basins in southern Dade County. At present, the water management area includes 17 sub-basins that contribute flow to Biscayne Bay, Card Sound, Florida Bay, and the Everglades. Surface water flows from the drainage sub-basins to the Everglades and the coast are controlled by numerous flow control structures. Flow control structures also control flow between the sub-basin areas. (FPL 2014a, Section 2.3.1.1.2)

3.6.1.2 Biscayne Bay

Biscayne Bay is a shallow coastal lagoon located on the lower southeastern coast of Florida. The bay is approximately 38 miles long, approximately 11 miles wide on average, and has an area of approximately 428 square miles. Biscayne Bay began forming between 5,000 and 3,000 years ago as sea level rose and filled a limestone depression. The eastern boundary of Biscayne Bay is composed of barrier islands that also form part of the Florida Keys and separates the bay from the Atlantic Ocean. Coral reefs east of the barrier islands make up the northern extent of the Florida reef tract. Several canals on the western shore discharge surface water into the bay. Biscayne Bay is connected to the Atlantic Ocean by a wide and shallow opening of coral shoal near the middle of the bay that is known as the "Safety Valve" and by several channels and cuts. (FPL 2014a, Section 2.3.1.1.3)

Part of Biscayne Bay is within the designated boundary of Biscayne National Park. With an area of 172,000 acres, this park is the largest marine park in the U.S. national park system. (Figures 3.1-5 and 3.1-6) The southern boundary of the park includes coastal wetlands east of the PTN cooling canals to Mangrove Point (adjacent to the CCS). The park contains a narrow fringe of mangrove forest along the mainland. Similar mangrove zones are present along the southern expanse of Biscayne Bay and in the northernmost islands of the Florida Keys, including Elliott Key. (FPL 2014a, Section 2.3.1.1.3)

Biscayne Bay is divided into three subregions: North Bay, Central Bay, and South Bay. The Turkey Point plant property is located on South Bay, which is generally undeveloped and fringed by mangrove wetlands. The South Bay (also identified as the Lower Biscayne Bay) is approximately 100 square miles in area. (FPL 2014a, Section 2.3.1.1.3)

The average depth of Biscayne Bay is approximately 6 feet with a maximum depth of approximately 13 feet. The volume of the bay at mean low water is approximately 1.5E10 ft^3. The mean low water datum is located at approximately elevation -1.9 feet NAVD88 at the NOAA Virginia Key, Florida, station. (FPL 2014a, Section 2.3.1.1.3)

Tides in Biscayne Bay are semidiurnal. NOAA maintains tidal stations in Biscayne Bay and surrounding areas. The stations with more than 10 years of record that remain in operation include Virginia Key, Florida (NOAA station 8723214), Vaca Key, Florida (8723970), and Key West, Florida (8724580). The Virginia Key, Florida, station is located approximately 25 miles north-northeast of Turkey Point. The Vaca Key, Florida, and Key West, Florida, stations are located approximately 70 miles and 110 miles southwest of Turkey Point, respectively. (FPL 2014a, Section 2.3.1.1.3)

In Biscayne Bay, the great diurnal tide range, which is the difference between the mean higher high and mean lower low tide levels, is higher near the entrance of the bay. At the Cutler, Biscayne Bay, Florida, station, the great diurnal range is 2.13 feet. At the barge-turning canal, the range is 1.78 feet, and in southern Biscayne Bay at Card Sound Bridge station, the range is reduced to 0.63 feet. The 100-year return period low water level in Biscayne Bay at the barge-turning canal is estimated to be approximately -3.8 feet NAVD88. (FPL 2014a, Section 2.3.1.1.3)

Monthly mean salinities vary widely over Biscayne Bay, ranging from a low of approximately 6 parts per thousand (ppt) to a high of 42 ppt, depending on the amount of rainfall and surface drainage reaching the coastal zone. Salinities in the bay are influenced by rainfall and freshwater inflows from the mainland. When conditions are calm and in deeper areas in the bay, salinity stratification occurs. In shallow areas and under windy conditions, bay waters are well mixed with only weak salinity-based density gradients. Salinity in the bay is affected by the pronounced wet-dry seasonal dynamics and is highest in June when rainfall is low and evaporation is high. Natural water temperatures range from 59°F to 92°F at the surface, with little or no thermal stratification. (FPL 2014a, Section 2.3.1.1.3)

Studies of Biscayne Bay show the principal circulation forces to be tidal. Hurricane storm events with persistent wind for long periods may also cause relatively large water movements. Measurements of tidal flow past discrete points such as Cutter Bank (east of the IWW facility) average approximately 50,000 acre-feet per day, or a continuous flow of 60,000 acre-feet per half tidal cycle. Tidal exchange between Biscayne Bay and the Atlantic Ocean is estimated to be less than 10,000 acre-feet per day. Apart from the wide and shallow opening of coral shoal near the middle of the bay, the major creeks and sloughs that control the tidal circulation within Biscayne Bay and interact with the Atlantic Ocean flows include Angelfish Creek, Broad Creek, and Caesar Creek in the South Bay and Virginia Key Channel in the North Bay. Measured data indicate a net southward tidal current magnitude of approximately 0.018 meter per second (0.06 foot per second). (FPL 2014a, Section 2.3.1.1.3)

The South Bay also includes Card Sound and Barnes Sound south of Biscayne Bay. Card Sound is part of the Biscayne Bay Aquatic Preserve of the Upper Florida Keys. Freshwater input to Card Sound is primarily surficial sheet flow with additional flow from groundwater seepage. Circulation within Card Sound and Barnes Sound is restricted because of the enclosed configuration of the sounds by barrier islands that increases residence times of its waters. (FPL 2014a, Section 2.3.1.1.3)

The waters of Biscayne Bay support a rich and diverse ecosystem of marine fauna and flora, and the bay serves the coral reef and marine ecosystems of Biscayne National Park. As Biscayne Bay evolved and formed, a natural cyclical change occurred as a result of the large-scale physical variation, such as sea level and climate change. Analysis of sediment core data from Biscayne Bay and Card Sound indicates that the Biscayne Bay ecosystem underwent many substantial changes between the last 100 and 500 years. Southern Biscayne Bay, including Card Sound and Barnes Sound, has been relatively isolated from direct marine influence for at least the last two centuries, and this area is less affected by the urbanization that has occurred to the north. Despite its relative isolation, however, the area has changed substantially during the last century. At Card Bank, salinity has varied substantially on multidecadal and centennial time scales relative to the variation observed at central Biscayne Bay sites. Marine influence at Card Bank has increased over the last century. The mud banks of central Biscayne Bay have become increasingly marine and increasingly stable (showing less fluctuation in salinity) during the last 100 years. (FPL 2014a, Section 2.3.1.1.3)

3.6.1.3 Potential for Flooding

Tidal flooding during hurricanes imports saline water into low-lying areas along the coast, Everglades watersheds. The highest tide that has been measured nearest the site was measured at an elevation of 8.45 NAVD88 (10.1 feet above msl) during Hurricane Betsy in September 1965. This station where measurement was made is located north of Palm Drive on the Florida City Canal, approximately 2.3 miles west of the shoreline. It has been reported that debris marks from the flood tide associated with Hurricane Betsy were seen approximately 10 feet above sea level at the site. (FPL 2017b, Section 2.7.4)

Because of the low, flat terrain, tidal floodwaters move inland several miles and cover large areas. Based on available information, dissipation of floodwaters by sheet flow and through natural and manmade drainage courses requires several days. The amount of infiltration of tidal floodwaters into inland groundwater supplies depends on the amount of water already in the shallow aquifer prior to inundation, with much greater infiltration occurring when pre-stormwater levels are below normal. During the hurricane period of June through October, the groundwater levels are generally at their highest, the storage capacity of the aquifer is filled, and additional groundwater recharge is at a minimum. (FPL 2017b, Section 2.7.4)

Construction of flood control projects in the area reduced the possibility of tidal floodwater reaching agricultural and populated areas. Of special interest is L-31, built by the USACE in cooperation with the C&SF. This project includes a levee with a crest elevation of about 7 feet above msl, running in a north-south direction, approximately 1 mile west of the plant and approximately 700 feet to a mile west of the CCS. (Figure 3.6-1) The levee and its appurtenant works are designed to provide surface salinity control and flood protection against most non-hurricane storm tides and are not designed to prevent flooding from very severe storms. For storms with extreme high tides of unusually long duration, there would be little reduction in the extent and depth of flooding. However, for a storm of the intensity and duration of Hurricane Betsy in 1965, inland movement of tidal floodwaters would be somewhat reduced, and it is estimated that flooding would be limited to less than 2 miles west of the levee (i.e., 4 miles west of the site). Based on published storm-tide frequency studies, it is estimated that a 7-foot tide may occur once every 20 to 25 years. (FPL 2017b, Section 2.7.5)

Based on Federal Emergency Management Agency (FEMA) data, most of the Turkey Point property is located inside the 0.2 percent annual chance floodplain (100-year flood level) with the exception of one small area near the northeastern corner. A small area near the shoreline along the northeastern property line have been designated as within the coastal flood zone with hazardous wave action with base flood elevations of 14 to 17 feet (NAVD88) (Figure 3.6-2). (FEMA 2017) Approximately 27 percent of the property has been designated by FEMA to be within the coastal flood zone with base flood elevations of 11 to 14 feet and 70 percent where the canal system is located has no base flood elevations determined.

Class 1 structures on the PTN site are flood protected up to a minimum elevation of 18.35 NAVD88 (20 feet mean level of water [MLW]). Components vital to safety, with the exception of the ICW pumps protected to 20.85 NAVD88 (22.5 feet MLW), are protected against flood tides, and wave runup, to 20.35 NAVD88 (22 feet MLW) on the east side of PTN. (FPL 2017b, Appendix 5G)

3.6.1.4 Surface Water Discharges

3.6.1.4.1 NPDES-Permitted Outfalls

Wastewater from the Turkey Point facility consists of a non-contact once-through condenser cooling water (OTCW), auxiliary equipment cooling water (AECW), Unit 5 cooling tower blowdown, non-contact once-through cooling water from Unit 5 back-up cooling water system, low-volume waste (LVW), and stormwater. LVW consists of chemical treatment system wastewater, boiler blowdown, reverse osmosis concentrate, condensate polishing system backwash water, and other process waste streams. Stormwater includes stormwater associated with industrial activity and stormwater not associated with industrial activity. (FDEP 2008; FPL 2017b, Section 2.10.4)

OTCW and AECW discharge to the facility's approximately 5,900 acre onsite closed-loop CCS (IWW facility). LVW, equipment area stormwater, and non-equipment area stormwater/drainage discharge either directly to the CCS or indirectly to the same system via solids settling basins and/or neutralization basin. The CCS is not lined and, therefore, not only receives an inflow of groundwater (Biscayne Aquifer) but also discharges to Class G-III (> 10,000 milligrams per liter [mg/L] total dissolved solids [TDS]) groundwater. Florida uses "Class G-III" to identify groundwater that has no reasonable potential as a future source of drinking water due to high TDS content. The CCS does not discharge to surface waters of the state. (FDEP 2005; FDEP 2008)

The PTN state IWW facility permit was issued by the FDEP on May 6, 2005, with an expiration date of May 2010. The IWW permit and the federal NPDES permit (delegated to State of Florida) are jointly issued under Permit No. FL0001562. An IWW permit renewal application was submitted on October 21, 2009, and the 2005 IWW permit has been administratively continued since that time. Currently FDEP is in the process of developing a draft IWW permit, which is expected to be issued in the first quarter of 2018 for public comment.

The NPDES permit does not authorize direct discharge to surface waters of the state. The permit does authorize discharges from existing internal Outfalls I-001 and I-002 to the CCS (FDEP 2005). Internal Outfall I-001 is located on the southern bank of the discharge canal that leads to the CCS and Internal Outfall I-002 is located in the Units 1 and 2 settling basins (Table 3.6-1 and Figure 3.6-3). The state IWW Permit No. FL0001562, issued by the FDEP, authorizes releases of IWW to the CCS and subsequently to groundwater. (FPL 2014a, Section 2.3.2.1.4.1)

A new replacement water treatment plant, which supplies pure water for steam-related use, was completed in 2017. The new plant has the ability to treat either potable water or Upper Floridan Aquifer well water (as does the Unit 5 treatment plant). Use of the Floridan Aquifer water will reduce water being taken from the Biscayne Aquifer, via a municipal well field, by more than 1 MGD, and will result in a significant cost savings for the plant. The treatment plant waste stream (using Floridan water as the source) is incorporated in the state IWW permit application for discharge into the CCS.

3.6.1.4.2 Stormwater Runoff

The natural drainage of the area is to the east and south towards Florida and Biscayne Bays. The shallow tidal creeks and swales in the area are submerged, and therefore any flow they may have is sluggish. This, together with the permeable limestone bedrock of the area, results in approximately two-thirds of the rainfall percolating directly to the water table aquifer. In the absence of well-defined stream channels, heavy precipitation runs off in a slow, sheet flow towards Florida and Biscayne Bays. (FPL 2014a, Section 2.3.2.1) The PTN site was traversed by two SFWMD water management canals that were re-routed around the southern end of the CCS at the time of PTN construction. Water management canals are part of the drainage system that the SFWMD maintains and that intercepts much of the sheet flow in the plant area. (FPL 2000b, Section 2.3) The interception of historic freshwater sheet flow by the L-31E Canal has contributed to high salinity levels within coastal wetlands south of the CCS. Culverts constructed and operated under FPL Mitigation Bank state and federal permits have begun to restore historic fresh sheet flow, which has reduced salinity and is contributing to the recruitment of freshwater wetland species in the area.

Non-equipment area stormwater runoff in the plant collects in drainage channels and floor drains, then typically through a series of stormwater catch basins before being discharged directly to the cooling canals. Equipment and containment area stormwater floor drains typically receive small amounts of particulate material, lubricating oils, and fuel oils. The equipment and containment area stormwater drains which can receive oil are routed to oil/water separators then to the solids settling basins prior to being discharged to the closed-cycle CCS. (PTN 2004)

The stormwater collected by the PTN stormwater conveyance system discharges from the plant's permitted Outfall I-002 to the closed-loop CCS. The stormwater management system for the plant is an IWW facility, permitted for discharges into Class G-III groundwater with no direct discharges to surface waters of the state. Review and approval of any changes to buildings and treatment facilities which could potentially affect the water quality characteristics of the discharges to the CCS is conducted prior to construction under the FDEP IWW and delegated NPDES permit review process.

3.6.1.4.3 Sanitary Wastewaters

Sanitary waste from showers, water closets, toilets, etc. is routed to county approved onsite septic systems for the fossil and land management facilities. The nuclear units' domestic wastewater is routed to an on-site, county and state permitted, contact stabilization sewage treatment plant. Effluent from this wastewater treatment plant (WWTP) is discharged to an on-site, permitted, single Class V, Group 3 gravity underground injection well used to dispose of up to 35,000 gallons per day (gpd) of domestic wastewater effluent. The well, designated IW1, is open from 42 to 62 feet below ground surface (bgs) and is 8 inches in diameter. (FPL 2014a, Section 2.3.2.2.2.1) Wastewater residuals generated by this plant are transported to an approved offsite facility. (PTN 2004) The clarified wastewater sludge is monitored per operational protocols 0-NCAP-103 to ensure the disposed material does not present an environmental or public health risk.

3.6.1.4.4 Sediment Removal Activities

Maintenance actions are implemented in the cooling canals and berms to manage temperature, salinity, and water quality in the CCS. Periodic sediment removal and flow adjustments in the cooling canals are a component of these maintenance actions. The sediment removal and associated work occurs in stages. Sections of canal in which sediment removal activities are undertaken are isolated from the rest of the canal system to avoid turbidity and nutrient releases into the remaining cooling canals. This stepwise maintenance process occurs in phases over several years due to the size of the CCS.

Sediment removal activities were conducted from April through September 2015 in Sections 1 and 3 of the CCS and removed 417,630 cubic yards of sediment from 16 canals. Sediment removal consisted of mechanically removing canal sediment from accessible portions of individual canals. Sediment in the canal was removed out to an average of 45 feet from the top edge of the berm. Because the canals average 230 feet in width, this resulted in approximately 40 percent of the material being removed from a canal and 60 percent of the material remaining through the center portion of the canal. Sediments removed from canals were placed on adjacent berms in a manner which prevented erosion back into the CCS. Individual canals were temporarily taken out of service during sediment removal activities, and returned to service after sediment removal was completed. These activities removed approximately 5 percent of the bottom sediment for the entire canal system. Future phases will be conducted as necessary to achieve and maintain the objective and requirements of the CO (see Section 3.6.1.4.5). Sections 4 and 5 play a lesser role in heat rejection, and have a more even sediment distribution. Therefore, the future phases are not directed at sediment removal in Sections 4 and 5. Sediment removal operations will have no effect on PTN operations as individual canals can be removed from service during sediment removal activities.

3.6.1.4.5 Compliance History

Since the inception of the CCS more than 40 years ago, its construction and operation have been closely monitored by federal, state, and local agencies to ensure ongoing protection of water quality and the environment. FPL has complied with all operational requirements of applicable permits, while working collaboratively with federal, state, and local agencies to make decisions and take action to meet applicable regulatory requirements related to the CCS. (FPL 2017c)

As a result of the expanded groundwater monitoring that was required prior to the implementation of the EPU project at Turkey Point, it was determined that a number of corrective actions were required to address impacts resulting from the hypersalinity of the CCS. FPL has not violated any of the operational requirements in the environmental permits associated with the CCS. Rather, the expanded monitoring enhanced the ability of FPL and the relevant regulatory authorities to ascertain the extent to which the hypersaline condition of the CCS was impacting the saline groundwater below and landward of the plant. Ultimately, that monitoring pointed to the need for corrective actions to curtail and retract the landward migration of hypersaline groundwater. In compliance with the directives of the various environmental agencies charged with oversight of the CCS, FPL is now in the mitigation and remediation phase. Already FPL’s actions are achieving improvements in CCS salinity. (FPL 2017c)

Prior to construction of the CCS, saltwater had already intruded into the Biscayne Aquifer for several miles inland. Near the coast, the aquifer was saline for the full depth of the aquifer. Therefore, when the cooling canals were constructed, the salinity of the water infiltrating into the CCS was consistent with that of the adjacent Biscayne Bay. (FPL 2017c)

Coastal saltwater intrusion that existed prior to construction of the CCS was due to many factors such as freshwater withdrawals by local communities, drought, drainage, and flood control operations and other human activities. Further, during the design and permitting of the CCS, authorized unlined cooling canals would exchange cooling canal waters with the saline groundwater below the CCS, and that salinity could increase in the canals and groundwater east of the L-31E Canal during operations. (FPL 2017c)

In recognition of these factors, as well as a common desire to limit the westward migration of saltwater, the approved CCS design incorporated an 18-foot-deep interceptor ditch along the western edge of the CCS to restrict movement of saline water from the CCS west of the L-31 Canal to amounts that otherwise would have occurred without the existence of the CCS.

Operational criteria for the interceptor ditch pumps were spelled out in the SFWMD agreement along with a monitoring plan consisting of 38 monitoring well sites and seven surface water sites monitored bi-weekly and monthly. Monitoring data were shared with the SFWMD in quarterly meetings. The SFWMD agreement provided that if, in the sole judgment of the SFWMD, the objectives of the agreement were not being achieved, FPL would be required to implement other feasible engineering measures to achieve those objectives. (FPL 2017c)

The CCS has experienced seasonal fluctuations in salinity corresponding to the annual variation in precipitation. Salinity in the CCS typically peaked in May, prior to the rainy season, and was at its lowest in November. During drought years, the overall salinity at end of year was higher than the prior year, resulting in a ratcheting effect. In this manner, annual average salinity gradually increased from approximately 34 practical salinity units (PSU) in the early 1970s to approximately 70 PSU in 2013. Throughout that time period, there were no external water sources provided to augment annual precipitation and groundwater inflow. (FPL 2017c)

As noted, the unlined canals allow for communication of the surface waters of the CCS with the groundwater in the aquifer below. As the CCS salinity levels increased, a hydraulic gradient developed whereby the higher salinity surface water is heavier than the lower salinity surface water below. Over the decades, the aquifer immediately below the CCS became saturated with the higher salinity water moving down into the aquifer. Current measurements indicate that the aquifer below the CCS has salinity on the order of 60 PSU. At the base of the aquifer (about 85 to 105 feet bgs), there is a much less transmissive limestone layer that defines the bottom of the aquifer and prevents further downward movement of the higher saline water. So once the aquifer below the CCS was saturated, the only direction of movement available to the higher salinity water was lateral. Some horizontal layers within the aquifer are more transmissive than others, resulting in greater lateral movement in those zones. In this manner, hypersaline water moved out from under the CCS to a current extent of approximately 1.5 miles from the CCS western boundary. (FPL 2017c)

The original SFWMD agreement has been amended several times with the first three amendments focused on changes related to the construction of the CCS. The SFWMD agreement was modified most recently in 2009. This version, referred to as the Fifth Supplemental Agreement, included a more extensive monitoring program for the CCS. (FPL 2017c)

As a result of the environmental review conducted under the Florida PPSA in 2008, Condition of Certification (COC) IX and X were included in the Site Certification Modification that required FPL to develop a monitoring plan for the CCS and the areas surrounding the CCS under the provisions of the agreement between FPL and the SFWMD. The resulting monitoring plan was finalized in October 2009 and included new requirements related to additional groundwater and surface water monitoring stations, increased data collection and reporting, and a requirement to determine the vertical and horizontal effects and extent of the CCS on existing and projected groundwater and ecological conditions surrounding Turkey Point. (FPL 2017c)

Environmental Compliance Activities for the CCS

Commencing in 2009, FPL began implementing the groundwater monitoring program required pursuant to COC IX and X. Construction of the monitoring network and initiation of monitoring began in 2010. The expanded monitoring network was comprised of 47 monitoring wells, 22 surface water monitoring stations, 12 meteorological sites, three CCS flow meter sites, 32 ecological transect sites located in freshwater/marine wetlands and Biscayne Bay, and 200 pore-water sample sites. Automated data from the surface water and groundwater sites initially were collected every 15 minutes. The comprehensive pre-uprate monitoring report containing data and analyses covering the pre-uprate monitoring period of June 2010 through June 2012 was completed and submitted to the appropriate agencies on October 31, 2012. (FPL 2017c)

In April 2013, the SFWMD sent a letter to FPL indicating that the district had completed its technical analysis of data associated with implementation of the comprehensive pre-uprate monitoring report. The letter also provided notice to FPL to begin consultation with the SFWMD to identify measures to mitigate, abate, or remediate the movement of CCS saline water. Following the issuance of this letter, FPL began active consultation with the FDEP, SFWMD, and MDC DERM. The result of that consultation was an AO issued by the FDEP in December 2014 directing FPL to develop a salinity management plan to lower salinity in the CCS, among other requirements. (FDEP 2014b)

The AO was challenged by several parties, including MDC DERM. On October 2, 2015, MDC DERM issued a notice of violation (NOV) to FPL for alleged violations of county water quality standards and criteria in groundwater. At the time the NOV was issued, FPL was working with MDC DERM to address its challenge to the AO. On October 7, 2015, MDC DERM entered into a consent agreement (2015 CA) with FPL, which acknowledged FPL's plans to reduce salinity in the CCS, and required FPL to implement actions to intercept, capture, contain, and retract hypersaline groundwater west and north of the Turkey Point CCS boundary. It also required FPL to conduct additional monitoring and reporting. As a result, MDC DERM dropped its challenge to the AO. (MDC 2015)

The 2015 CA addresses MDC DERM's October 2015 NOV and defines actions that FPL must take. The principal objectives of the 2015 CA are for FPL: (1) to demonstrate a statistically valid reduction in salt mass and volumetric extent of the hypersaline water in groundwater west and north of FPL's property without creating adverse environmental impacts; and (2) to reduce the rate of and arrest migration of hypersaline groundwater. Frequent meetings and correspondence between FPL and MDC DERM document the continued implementation of the CA. (MDC 2015)

The 2015 CA acknowledged the abatement activities that FPL was undertaking to lower the salinity of the CCS, thus reducing the movement of hypersaline water into the groundwater. The 2015 CA also recognized that factors beyond FPL's control may influence movement of groundwater in the surficial aquifer, and FPL must take into account such factors when developing and implementing remedial actions to minimize the timeframe for achieving compliance with the 2015 CA. The 2015 CA also required FPL to consider alternative water sources to reduce chloride concentration, including, e.g., reclaimed water from Miami-Dade County. FPL is moving forward with the implementation of the activities required by the 2015 CA. (MDC 2015)

The remaining challenges to the AO led to an administrative hearing in which the administrative law judge issued a recommended order to rescind or modify the AO. In response to that recommended order, the FDEP modified and issued the AO as a final AO on April 21, 2016. (FPL 2017c)

On April 25, 2016, the FDEP issued an NOV (the FDEP NOV) regarding the hypersaline groundwater west of the CCS and a warning letter identifying concerns related to water quality in deep artificial channels in four specific areas immediately adjacent to the east and south of the CCS. The FDEP NOV directed FPL to enter into consultations to develop a CO to develop corrective actions to reduce the CCS contribution to the hypersaline plume and to reduce the size of the hypersaline plume. On June 20, 2016, a CO (2016 CO) was executed between FPL and the FDEP. The 2016 CO and FPL's compliance with its requirements incorporate the issues and requirements identified in the final AO, as well as the FDEP NOV and the warning letter. As such, the 2016 CO supersedes all requirements of the final AO and rescinds the AO. (FDEP 2016b)

The primary objectives of the 2016 CO are to: (1) cease discharges from the CCS that impair the reasonable and beneficial use of the adjacent G-II groundwaters west of the CCS; (2) prevent releases of groundwater from the CCS to surface waters connected to Biscayne Bay that result in exceedances of surface water quality standards in Biscayne Bay by undertaking restoration projects at Turtle Point and Barge Basin; and (3) provide mitigation to address impacts due to historic operation of the CCS. To meet the first objective, the CO requires FPL to achieve an average annual salinity of 34 PSU by the end of the fourth year of freshening activities. If FPL is unable to meet this target, it must submit a plan to FDEP within 30 days with additional measures that it will implement to meet the target. FPL is moving forward with the implementation of the activities required by the 2016 CO activities including continued implementation of the nutrient management plan and thermal efficiency plan; complete construction of the RWS (Section 3.6.3.2.1) and commence full operation; initiate construction of Barge Basin and Turtle Point Canal restoration projects; and prepare and submit the annual monitoring reports. (FDEP 2016b)

Deep Canal Ammonia Consent Agreement Addendum

On August 15, 2016, MDC DERM and FPL executed an addendum to the October 2015 CA (2016 CAA). The 2016 CAA requires FPL to take action to address MDC DERM's alleged violations of water quality standards and cleanup target levels relating to the exceedance of ammonia in deep remnant canals adjacent to the Turkey Point CCS. The 2016 CAA required FPL to prepare and submit a site assessment plan (SAP) to MDC DERM to allow for the identification of source(s) of the ammonia exceedances and the delineation of the vertical and horizontal extent of the subject ammonia exceedances in surface water. Additionally, the SAP was required to adequately address the ammonia exceedances to the surface waters surrounding the facility, including but not limited to, waters tidally connected to Biscayne Bay. (MDC 2016a)

Following MDC DERM approval, and FPL's implementation of the SAP, the 2016 CAA required FPL to prepare and submit a site assessment report (SAR) addressing the requirements of the approved SAP, and further submit to MDC DERM a corrective action plan consisting of an environmental restoration plan to correct the exceedances of ammonia; details of proposed process modifications or changes in operational systems to manage and control the source(s) of ammonia to prevent future ammonia exceedances; and physical, structural, or hydraulic modifications to the area of the CCS to eliminate contributions of CCS water to surface water, including a timetable for implementation and completion of the corrective action plan. (MDC 2016a)

Compliance Status

Cooling Canal System

The actions FPL has taken over the last few years have resulted in improved conditions within the CCS. Most notably, FPL has observed improvements in thermal efficiency of the CCS as a direct result of sediment management activities. FPL has also been able to better control CCS water salinity concentrations and algae that can result from significant drought conditions. (FPL 2017c)

Since operations of the underground injection well testing phase of the RWS began on September 28, 2016, as of June 30, 2017, approximately 3.7 billion gallons (BG) of hypersaline groundwater from beneath the CCS have been extracted and disposed of in the naturally saline Boulder Zone Formation located 3,200 feet below the surface. This amounts to approximately 890,000 tons of salts removed from the Biscayne Aquifer beneath the CCS. Construction of the ten RWS extraction wells began in June 2017 and the wells are expected to begin operations in early 2018. Groundwater models of the RWS indicate the westward migration of the hypersaline plume will be stopped in three years of operation, with retraction of the hypersaline plume north and west of the CCS beginning in 5 years. Retraction of the plume back to the FPL site boundary is projected in 10 years. (FPL 2017c)

As noted above, the extracted groundwater is disposed of in a deep injection well in the Boulder Zone under FDEP Permit No. 293962-002-UC. The FDEP has permitted FPL and others to discharge treated sewage and other wastes through injection wells into the Boulder Zone. The Boulder Zone is located in the Lower Floridan Aquifer and is overlaid by a confining layer that prevents upward migration of the water (see Section 3.6.2 for detailed description of the aquifers underlying PTN). The competency of the middle confining layer at the Turkey Point site was recently evaluated and confirmed by the NRC staff as part of the PTN Units 6 and 7 licensing proceeding (ASLB 2017; NRC 2016a, Section 5.2.13; NRC 2016d, Section 11.2.4).

FPL has determined that Upper Floridan Aquifer water wells are the best choice of water supply for meeting its CCS freshening objective. Operation of the 14 MGD Upper Floridan Aquifer freshening well system began on November 28, 2016. The brackish water from the Floridan wells (2.5 PSU compared to bay salinity at 34 PSU) is being used to help reduce the CCS salinity to an average annual level of 34 PSU, essentially equivalent to the salinity of the bay. The addition of this water was instrumental in minimizing the increase in salinity that ordinarily occurs during the dry season. Continued operation of the freshening wells during the wet season will further reduce CCS salinities, achieving progress towards the overall goal of 34 PSU. (FPL 2017c)

Deep Canal Ammonia

The SAP was submitted to the MDC DERM on September 14, 2016, and approved for implementation on December 21, 2016. The SAR was submitted on March 17, 2017, and concluded that water samples collected from within the CCS contained ammonia less than the county ammonia standard of 0.5 mg/L. These findings indicate that the CCS is not the source of the measured elevated ammonia samples collected at some of the adjacent remnant canals (Figure 3.7-2) connected to Biscayne Bay. (FPL 2017d)

The data collected during the SAR investigation indicate the presence of elevated ammonia values in excess of MDC DERM surface water standards is not the result of point or non-point source contamination attributable to the Turkey Point site. Rather, the report concluded the occurrence of elevated ammonia is the result of the conversion of organic nitrogen sourced from organic wetland soils, decomposition of wetland and aquatic plant material, atmospheric nitrogen fixation, and natural microbial processes in anoxic, stagnant surface and groundwater environments similar to numerous other such occurrences documented along the coastal Biscayne Bay region. Therefore, FPL concludes that additional assessment work associated with the 2016 CAA is not warranted based on the SAP results. There is no evidence of any sources of ammonia being caused by FPL that warrant a corrective action plan by FPL. (FPL 2017d)

3.6.2 Groundwater Resources

3.6.2.1 Groundwater Aquifers

The regional hydrostratigraphic framework of Florida consists of a thick sequence of Cenozoic sediments which comprise three major aquifers: (1) the surficial aquifer system, (2) intermediate aquifer system/confining unit, and (3) the Floridan Aquifer system. The hydrologic parameters and lithologies of each aquifer system vary widely across the state. (FPL 2014a, Section 2.3.1.2.1.2)

3.6.2.1.1 Surficial Aquifer System

The surficial aquifer system is defined by the Southeastern Geological Society's ad hoc committee as "the permeable hydrologic unit contiguous with the land surface that is composed principally of unconsolidated to poorly indurated, siliciclastic deposits." Rocks making up the surficial aquifer system belong to all or part of the Upper Miocene to Holocene Series, consisting primarily of quartz sands, shell beds, and carbonates. In southern Florida, the surficial aquifer system consists of the Tamiami, Caloosahatchee, Fort Thompson, and Anastasia formations; the Key Largo and Miami limestones; and undifferentiated sediments. (FPL 2014a, Section 2.3.1.2.1.2)

The surficial aquifer system is under mainly unconfined conditions; however, beds of low permeability may cause semi-confined or locally confined conditions in its deeper parts. The base of the surficial aquifer system coincides with the top of laterally extensive and vertically persistent beds of low permeability belonging to the intermediate aquifer system/confining unit. The thickness of the surficial aquifer system in southeastern Florida ranges from approximately 80 to 115 feet. (FPL 2014a, Section 2.3.1.2.1.2)

The main aquifer in the surficial aquifer system in southeastern Florida is the Biscayne Aquifer, which is used for primary water supply. As discussed in Section 3.6.2.6, the Biscayne Aquifer has been declared a sole source aquifer (SSA) by the EPA. (FPL 2014a, Section 2.3.1.2.1.2) Although the Biscayne Aquifer underlies the PTN plant, it lies in a coastal portion which contains TDS concentrations greater than 10,000 mg/L (saline to saltwater), designated as Class G-III groundwater (non-potable water use).

3.6.2.1.2 Intermediate Aquifer System/Confining Unit

Regionally, a sequence of relatively low-permeability, largely clayey deposits approximately 900 feet thick, forms a confining unit that separates the Biscayne Aquifer from the underlying fresh-to-saline Floridan Aquifer system. The confining unit also contains transmissive units that can locally act as an aquifer system. (FPL 2014a, Section 2.3.1.2.1.2)

The Southeastern Geological Society defines the intermediate aquifer system/confining unit as "all rocks that lie between and collectively retard the exchange of water between the overlying surficial aquifer system and the underlying Floridan Aquifer system." In general, the rocks of this system consist of fine-grained siliciclastic deposits interlayered with carbonate strata of Miocene or younger age. (FPL 2014a, Section 2.3.1.2.1.2)

In areas where poorly yielding to non-water yielding units occur, the term "intermediate confining unit" is used. In areas where low- to moderate-yielding units are interlayered with relatively impermeable confining beds, the term "intermediate aquifer system" applies. The aquifer's units within this system contain water under confined conditions. The top of the intermediate aquifer system/confining unit coincides with the base of the surficial aquifer system. The base of the intermediate aquifer, or confining unit, is at the top of the vertically persistent, permeable, carbonate section that composes the Floridan Aquifer system. The sediments that compose the intermediate aquifer system/confining unit are widely variable across the state. In the southern part of the state, the Hawthorn Group, consisting of the Peace River Formation and the Arcadia Formation, forms both an intermediate confining unit and an intermediate aquifer system. The

Hawthorn Group sediments are up to approximately 900 feet thick in southern Florida. In many areas of the state, permeable carbonates occurring at the base of the Hawthorn Group may be hydraulically connected to the Floridan Aquifer system and locally form the top of the Upper Floridan Aquifer. The intermediate confining unit provides an effective aquiclude for the Floridan Aquifer system throughout the state. (FPL 2014a, Section 2.3.1.2.1.2)

3.6.2.1.3 Floridan Aquifer System

The Floridan Aquifer system underlies approximately 100,000 square miles in southern Alabama, southeastern Georgia, southern South Carolina, and all of Florida. Potable water is present in some parts of the aquifer system in central and northern Florida, while the water is saline in southern Florida. The Floridan Aquifer system is a vertically continuous sequence of interbedded carbonate rocks of Tertiary age that are hydraulically interconnected by varying degrees and with permeabilities several orders of magnitude greater than the hydrogeologic systems above and below. The system may occur as a continuous series of vertically connected carbonate sediments or may be separated by subregional to regional confining beds. The Floridan Aquifer formally consists of three main hydrogeologic units: the Upper Floridan Aquifer, the middle confining unit, and the Lower Floridan Aquifer. Porosity and permeability in the aquifer units vary widely depending on location and formation. (FPL 2014a, Section 2.3.1.2.1.2)

In southern Florida, the Floridan Aquifer system is composed of all or parts of the Cedar Keys Formation, Oldsmar Formation, Avon Park Formation, Ocala Limestone, Suwannee Limestone, and, possibly, the basal carbonates of the Hawthorn Group in limited areas. The top of the Floridan Aquifer system ranges in elevation from approximately -1,000 feet National Geodetic Vertical Datum of 1929 (NGVD29) to more than -1,100 feet NGVD 29, with thicknesses ranging from approximately 2,300 feet to more than 3,400 feet. Throughout most of southern Florida, the Floridan Aquifer system occurs under confined conditions. (FPL 2014a, Section 2.3.1.2.1.2)

3.6.2.2 Local Hydrogeology

Two major aquifer systems underlie the local area including all of Miami-Dade County and Turkey Point:

- The surficial aquifer system, composed of the Biscayne Aquifer.
- The Floridan Aquifer system consisting of the Upper Floridan Aquifer, the middle confining unit, and the Lower Floridan Aquifer.

The surficial Biscayne Aquifer extends from near surface to a depth of approximately 240 feet near Fort Lauderdale and approximately 80 to 115 feet locally (FPL 2014a, Section 2.3.1.2.1.3). Shallow water table conditions prevail in the area, and the aquifer is unconfined except for a thin (4 to 6 feet) layer of organic soils in the coastal swamp areas. Groundwater levels and the direction and rate of groundwater flow in the surficial aquifer are products of the topography, rainfall and recharge, hydraulic gradients, canals and drainage channels, groundwater use, and the hydrologic properties of the aquifer. (FPL 2017b, Section 2.10.2)

Because the natural ground elevations at the site are generally slightly above sea level, and considering the normal tide range in Biscayne Bay, the site is subject to tidal inundation. Because of tidal inundation, the groundwater and surface water at and in the vicinity of the site are highly saline. The water table responds very rapidly to rainfall and tidal fluctuations. (FPL 2017b, Section 2.10.3)

The Upper Floridan Aquifer extends from approximately 1,000 to 1,200 feet bgs. The middle confining unit extends from approximately 1,200 to 2,400 feet bgs. The Lower Floridan Aquifer extends from approximately 2,400 feet bgs to an undetermined depth thought to be greater than 4,000 feet bgs in the Miami-Dade County area. The Boulder Zone in the Lower Floridan Aquifer extends from approximately 2,800 at the Turkey Point plant property to approximately 3,200 feet bgs at the MDWASD South District Wastewater Treatment Plant (SDWTP), which is located approximately 9 miles north of the Turkey Point property. (FPL 2014a, Section 2.3.1.2.1.3)

3.6.2.2.1 Surficial (Biscayne) Aquifer

The surficial aquifer system comprises all the rocks and sediments from the land surface downward to the top of the intermediate confining unit. These lithologic materials consist primarily of limestones and sandstones with sands, shells, and clayey sand with minor clays and silts. The base of the system is defined by a significant change in lithology and hydraulic conductivity. Sedimentary bedrock and unconsolidated sediments in the surficial aquifer system have a wide range of hydraulic properties and locally may be divided into one or more aquifers separated by less-permeable or semi-confining units. Within the surficial aquifer system, the major water-producing unit is the unconfined Biscayne Aquifer, which underlies the Turkey Point area and all of Miami-Dade County and parts of Broward, Monroe, and Palm Beach counties. The aquifer contains carbonate rocks, sandstones, and sand extending from land surface to an elevation of approximately -10 feet NGVD29 in southern Miami-Dade County and deepening northward to more than elevation -240 feet NGVD29 in southeastern Palm Beach County and eastern Broward County. These formations include, from oldest to youngest (bottom to top) the upper portion of the Tamiami Formation, Caloosahatchee Formation, Fort Thompson Formation, Anastasia Formation, Key Largo Limestone, Miami Limestone, and Pamlico Sand. However, the entire sequence of units is not present in any one place. In the vicinity of the plant area, the formations within the Biscayne Aquifer include the Miami Limestone, Key Largo Limestone, and the Fort Thompson Formation. The Fort Thompson Formation and Key Largo Limestone are the major water-producing formations within the aquifer. Site-specific boring data indicate that the maximum thickness of the Biscayne Aquifer is approximately 115 feet at Turkey Point. (FPL 2014a, Section 2.3.1.2.1.3)

The water table occurs primarily within the organic soils (muck) or the Miami Limestone and fluctuates in response to variations in tide levels, recharge, natural discharge, water levels in adjacent canals, and well withdrawal/injection. The aquifer extends beneath Biscayne Bay and the Atlantic Ocean. Because of the aquifer's high permeability, the difference in fluid density between sea water and fresh water, and in response to the lowering of inland groundwater levels due to drainage and pumpage, saltwater has migrated inland along the base of the aquifer and affects the entire coastal zone. (FPL 2014a, Section 2.3.1.2.1.3) Saltwater moves inland in response to differences in hydraulic gradients that result from differences in fluid densities and water levels. (FPL 2014a, Section 2.3.1.2.1.3)

Biscayne Aquifer groundwater use in the immediate vicinity of the plant area is limited by regulatory constraints including potential impacts to wetlands, water reservations for Biscayne Bay, regional water availability rules, potential interference with other existing legal uses, and saline water intrusion. The saltwater interface at the base of the aquifer is approximately 6 to 8 miles inland of the Units 3 and 4 plant area. (FPL 2014a, Section 2.3.1.2.1.3)

3.6.2.2.2 Intermediate Confining Unit

The intermediate confining unit (upper confining unit for the Upper Floridan Aquifer) extends from the base of the surficial aquifer system to the top of the Floridan Aquifer system and is characterized by complex interbedded lithologies of the Hawthorn Group. These lithologies consist primarily of silty clay, calcareous sands, silts, calcareous wackestones, limestones, sandstones and sands, and obtain a thickness of approximately 600 to 1,050 feet at Turkey Point. Site information suggests a thickness of approximately 700 feet just to the north of the Turkey Point site (Unit 5 Upper Floridan Aquifer production well PW-3) to approximately 1,000 feet southwest of the site. (FPL 2014a, Section 2.3.1.2.1.3)

The top of the Hawthorn Group occurs at approximately -100 feet msl southwest of the site to approximately -215 feet msl at well PW-3 in the vicinity of the site. The unit is not exposed at the land surface. Sand beds and limestone lenses compose the permeable parts of the system; however, the overall hydraulic conductivity of the group is very low and provides good confinement for the underlying Floridan Aquifer system. (FPL 2014a, Section 2.3.1.2.1.3)

3.6.2.2.3 Floridan Aquifer System

The Floridan Aquifer system underlies the Turkey Point area and all of Florida. The system formally consists of three main hydrogeologic units: the Upper Floridan Aquifer, the middle confining unit, and the Lower Floridan Aquifer. In the Miami-Dade County area, the top of the Floridan Aquifer system is found at a depth of approximately 1,000 feet bgs, is approximately 3,000 feet thick, and is directly overlain by the intermediate confining unit. The Floridan Aquifer system forms the deepest part of the active groundwater flow system in southeastern Florida. (FPL 2014a, Section 2.3.1.2.1.3)

<u>Upper Floridan Aquifer</u>

The top-most hydrogeologic unit of the Floridan Aquifer system is the Upper Floridan Aquifer. This unit is overlain by the intermediate confining layer that acts as a confining unit to the Upper

Floridan Aquifer. The Upper Floridan Aquifer consists of several thin water-bearing zones of high permeability interlayered with thick zones of low permeability. The hydrogeology of the Upper Floridan Aquifer varies throughout Florida. In southeastern Florida, the aquifer has been interpreted to include a thinner Suwannee Limestone and extends down into the Avon Park Formation. Confinement is typically better between flow zones in southwestern Florida than in southeastern Florida. In southeastern Florida, the Upper Floridan Aquifer ranges from 100 feet to greater than 400 feet in thickness. In the vicinity of the Turkey Point plant property, the Upper Floridan Aquifer is approximately 200 feet thick. (FPL 2014a, Section 2.3.1.2.1.3)

Although the Upper Floridan Aquifer is a major source of potable groundwater in much of Florida, water withdrawn from the unit in southeastern Florida, including Miami-Dade County, is brackish and variable in quality (FPL 2014a, Section 2.3.1.2.1.3).

Middle Confining Unit

The middle confining unit of the Floridan Aquifer system underlies the Upper Floridan Aquifer, separating it from the Lower Floridan Aquifer. In many places, the middle confining unit is divided into upper and lower units separated by the Avon Park permeable zone. The middle confining unit contains beds of micritic limestone (wackestone to mudstone), dolomitic limestone, and dolomite (dolostone) that are distinctly less permeable that the strata of the Upper Floridan Aquifer and Lower Floridan Aquifer. The elevation of the top of the middle confining unit is approximately -1,200 feet NGVD29 and the thickness is approximately 1,000 feet in the vicinity of Turkey Point. (FPL 2014a, Section 2.3.1.2.1.3)

Lower Floridan Aquifer

The Lower Floridan Aquifer in southern Florida consists of a thick sequence of low permeability rocks separated by relatively thin permeable zones. The aquifer underlies the middle confining unit and extends from a depth of approximately 2,400 feet bgs to a depth that is undetermined, but thought to be greater than 4,000 feet bgs in the Miami-Dade County area. The Lower Floridan Aquifer includes the lower part of the Avon Park Formation, the Oldsmar Limestone, and the upper part of the Cedar Keys Formation. The base of the Lower Floridan Aquifer (or the base of the Floridan Aquifer system) is marked by impermeable, massive anhydrite beds of the Cedar Keys Formation. (FPL 2014a, Section 2.3.1.2.1.3)

A highly permeable zone in the Lower Floridan Aquifer known as the Boulder Zone occurs in southern Florida (FPL 2014a, Section 2.3.1.2.1.3). The on-site WWTP Class V injection well, as well as the Biscayne Aquifer hypersaline recovery system Class I injection well and the proposed Turkey Point Units 6 and 7 Class I injection well, will discharge to the Boulder Zone beneath the PTN facility. The Boulder Zone contains saltwater and has been permitted by the FDEP as a zone to discharge treated sewage and other wastes disposed of through injection wells operated in southern Florida. (FPL 2014a, Section 2.3.1.2.1.3)

In southern Florida, the Lower Floridan Aquifer contains thick confining units above the Boulder Zone. These confining units are similar in lithology to the middle confining unit of the Floridan Aquifer system. The base of the Lower Floridan Aquifer is below the base of the Boulder Zone, with the lower section consisting of permeable dolomites or dolomitic limestones of the Cedar Keys Formation. (FPL 2014a, Section 2.3.1.2.1.3)

3.6.2.3 Hydraulic Properties

3.6.2.3.1 Surficial/Biscayne Aquifer

Hydrogeologic properties of the Biscayne Aquifer vary based on lithology. Along the coast, where the Biscayne Aquifer is the thickest, transmissivities are lower due to the amounts of sandy material. In central and southern Miami-Dade County, the aquifer is thinner with higher hydraulic conductivity due to the occurrence of cavernous limestone. The permeable limestone content in the aquifer decreases northward and the overall transmissivity of the aquifer decreases with increased sand content. Transmissivities for the highly permeable limestones and less permeable sandstones and sands of the aquifer in the vicinity of Turkey Point have been estimated to range from less than 1.0×10^6 gpd per foot (gpd/ft) to 8.9×10^6 gpd/ft. (FPL 2014a, Section 2.3.1.2.2.3)

The Biscayne Aquifer is the most productive of the shallow non-artesian aquifers in the area. The Biscayne Aquifer is one of the most permeable in the world with transmissivity values (hydraulic conductivity x saturated thickness) for the highly permeable limestones ranging from 4.0×10^6 to 15.0×10^6 gpd/ft (5.4×10^5 to 2.0×10^6 square feet per day [ft^2/day]) with a median value of 5.0×10^6 gpd/ft (6.7×10^5 ft^2/day) and storage coefficients ranging from 0.047 to 0.247. In Broward County, transmissivities are reported to range from about 4.0×10^5 gpd/ft (5.4×10^4 ft^2/day) to 4.0×10^6 gpd/ft (5.4×10^5 ft^2/day) with storage coefficients as high as 0.34. (FPL 2014a, Section 2.3.1.2.2.3)

Large-capacity municipal wells are commonly completed as open holes and yield from approximately 500 to more than 7,000 gpm with only small drawdowns. Specific capacities obtained from pumping tests are on the order of 1,000 gpm per foot of drawdown in Miami-Dade County. (FPL 2014a, Section 2.3.1.2.2.3)

Two studies performed to the northwest of the plant property by the USGS examined the vertical variations in aquifer properties of the Biscayne Aquifer. Core samples were tested for horizontal air permeability, vertical air permeability, porosity, and grain density. The horizontal air permeability test included a maximum permeability at 90 degrees to the maximum permeability direction to assess horizontal anisotropy. The studies included a detailed examination of the core samples to determine lithology and fossil assemblages. As a result of this examination, the Biscayne Aquifer was subdivided into a series of high-frequency depositional cycles that ranged from a freshwater to a marine depositional environment. These depositional cycles control the permeability and porosity of the aquifer. The freshwater and transitional portions of the depositional cycles are characterized by lower permeability (< 1,000 milliDarcies) and porosity

(< 20 percent), while the marine portions of depositional cycles exhibit higher permeability (> 1,000 milliDarcies) and porosity (20–40 percent). (FPL 2014a, Section 2.3.1.2.2.3)

Four aquifer pumping tests were conducted in the proposed Units 6 and 7 power block area, approximately 3,500 feet south of PTN, to determine hydrogeologic properties of the Biscayne Aquifer. These tests were performed to measure the hydrogeologic properties of the aquifer units and the overlying or underlying aquitards for use in the design and implementation of the construction dewatering system, development of the site groundwater flow model, and simulation of the radial collector wells in the groundwater model. Based on these analyses, the average transmissivity for the upper Biscayne Aquifer is approximately 2.3 x 10^6 gpd/ft and for the lower Biscayne Aquifer it is approximately 1.3 x 10^5 gpd/ft. (FPL 2014a, Section 2.3.1.2.2.3)

Based on the requirements of the CA, FPL performed an aquifer performance test (APT) in February and March 2016 to support the design of a hypersaline groundwater RWS. The pumping well location was located at the northwestern corner of the CCS between the interceptor ditch and L-31 Canal. The average transmissivity for the aquifer in the area of the APT site was reported as 2.03 x 10^5 ft^2/day.

An additional aquifer pumping test was performed on the Turkey Point peninsula to evaluate the hydrogeologic suitability of that area for the installation and operation of radial collector wells. A single test zone from 22 feet bgs to 46 feet bgs in the upper portion of the Biscayne Aquifer was targeted as the production interval. Results from the Turkey Point peninsula pumping test indicate a leaky aquifer system with a mean transmissivity value ranging from 700,000 to 1,200,000 ft^2/day (5.2 x 10^6 to 8.9 x 10^6 gpd/ft). (FPL 2014a, Section 2.3.1.2.2.3)

3.6.2.3.2 Intermediate Aquifer System/Confining Unit

The overall hydraulic conductivity of the intermediate aquifer system/confining unit is very low and provides good confinement for the underlying Floridan Aquifer system. The leakage coefficient of this confining unit is highly variable, especially in the semi-confined areas where the confining beds may be either sandy or clayey. Leakage coefficient values of the upper confining unit derived by simulation are reported from less than 0.01 inches per year per foot in tightly confined areas to more than 1.00 inch per year per foot in semi-confined areas; however, reported leakage coefficients derived from aquifer test data, in general, are much larger than those obtained from simulation, ranging from 0.44 to 88 inches per year per foot. The analyses indicate that in the majority of locations, leakage coefficients from aquifer test data are too large to realistically represent the exchange of water between the surficial aquifer and the . The values obtained from aquifer test data can reflect not only downward leakage from the surficial aquifer, but upward leakage from permeable rocks beneath the pumped interval, as well as leakage from beds of relatively low permeability that might exist within the pumped interval. Upper confining unit leakage coefficients derived from Floridan Aquifer test data are composite or lumped properties that include leakage from all available sources. (FPL 2014a, Section 2.3.1.2.2.3)

3.6.2.3.3 Floridan Aquifer System

Hydraulic parameters of the Upper Floridan Aquifer vary considerably as a result of the wide variation in hydrogeologic conditions encountered at different locations. Conditions that most affect transmissivity are the degree of solution development in the aquifer and, to a lesser extent, aquifer thickness. High transmissivities are usually found in the areas having less confinement because circulation of flow helps to develop solution openings in the aquifer. Transmissivities are lowest (less than 50,000 ft^2/day) in the Florida panhandle and southernmost Florida (where the aquifer is confined by thick clay sections and contains thick sections of low-permeability limestone) and are highest (greater than 1,000,000 ft^2/day) in the karst areas of central and northern Florida where the aquifer is generally unconfined or semi-confined. (FPL 2014a, Section 2.3.1.2.2.3)

Regionally, storage coefficients calculated from aquifer tests conducted in the Upper Floridan Aquifer range from a low of 1.0×10^{-5} to a high of 2.0×10^{-2} with most values in the 1.0×10^{-3} to 1.0×10^{-4} range. A pump test conducted at Turkey Point in 1975 calculated average values for transmissivity, storage coefficient, and leakance obtained from graphical solutions of the test data were 400,000 gpd/ft (53,600 ft^2/day), 6.0×10^{-4}, and 0.002 gpd/ft^3, respectively. Additionally, the transmissivity of the Upper Floridan Aquifer was reported as approximately 232,000 gpd/ft (31,000 ft^2/day). (FPL 2014a, Section 2.3.1.2.2.3)

The most transmissive zone is generally found at the top of the unit and is estimated to range between 10,000 to 60,000 ft^2/day. Transmissivity of the Upper Floridan Aquifer is highest in west central Florida (greater than 100,000 ft^2/day) with lower transmissivities (less than 10,000 ft^2/day) in central Florida. (FPL 2014a, Section 2.3.1.2.2.3)

The middle confining unit of the Floridan Aquifer system includes most of the Avon Park Formation. The base of the middle confining unit at the top of the first permeable zone, which in general is in the Oldsmar Formation. However, this permeable zone has been identified in places to be within the lower Avon Park Formation, above the top of the Oldsmar Formation. The base of the middle confining unit is encountered at a depth of about 2,460 feet in a well (MDS-I12) drilled in southeastern Miami-Dade County, 230 feet below the top of the Oldsmar Formation. Based on core sample analysis, packer tests, and aquifer tests conducted at the MDWASD's SDWTP site, the hydraulic conductivity of the middle to lower part of the confining unit ranges from 3.0×10^{-3} to 3.0 feet per day. Vertical hydraulic conductivity measured in eight core samples from a well drilled in eastern Broward County, ranged from 1.3×10^{-4} to 0.24 feet per day. Core analyses of the low porosity (< 15 percent) dolostones from the Floridan Aquifer middle confining unit in Palm Beach County gave vertical hydraulic conductivities of less than or equal to 4.82×10^{-5} feet per day (1.7×10^{-8} centimeters per second). The lowest recorded value was 7.65×10^{-6} feet per day (2.7×10^{-9} centimeters per second). (FPL 2014a, Section 2.3.1.2.2.3)

The Lower Floridan Aquifer underlies the middle confining unit and consists of thick sequences of carbonate rocks containing several permeable zones separated by thick confining units. These confining units are similar in lithology to the middle confining unit of the Floridan Aquifer system.

Underlying the confining beds in the lower part of the Lower Floridan Aquifer is the highly transmissive Boulder Zone, which is of varying thickness. The base of the Lower Floridan Aquifer extends below the base of the Boulder Zone with the lower section consisting of impermeable dolomites or dolomitic limestones of the Cedar Keys Formation. Because the Lower Floridan Aquifer is deeply buried in southern Florida and contains saltwater, the unit has not been intensively drilled or tested; therefore, the hydraulic characteristics are not well known. (FPL 2014a, Section 2.3.1.2.2.3)

The Boulder Zone is a highly transmissive zone of cavernous limestones and dolomites found in the lower Oldsmar Limestone in the Lower Floridan Aquifer in southeastern Florida. However, locally the Boulder Zone may range upward to the middle of the Oldsmar Limestone or downward to the top of the Cedar Keys Formation. It consists mostly of massively bedded dolostones within which secondary permeability has been extensively developed. The term "Boulder Zone" is a misnomer because no boulders are present other than large chunks occasionally broken off during drilling. The difficult slow drilling and rough bit behavior, similar to that observed drilling in boulders, encountered while drilling dolostone, gave rise to the term Boulder Zone. The Boulder Zone can be up to 700 feet in thickness. Based on previous studies in the region, the Boulder Zone underlies a 13-county area in southern Florida with the elevation of the top of the zone ranging from about -2,000 feet NGVD29 to about -3,400 feet NGVD29. The Boulder Zone is found at a depth of approximately 2,800 feet at the Turkey Point plant property. (FPL 2014a, Section 2.3.1.2.2.3)

Transmissivities for the Boulder Zone range from 3.2×10^6 to 24.6×10^6 ft^2/day. A measured hydraulic conductivity value of approximately 4,250 feet per day was obtained from an injection well at the SDWTP operated by the MDWASD in Miami-Dade County. This value is approximately two orders of magnitude larger than measured values in the overlying portion of the Lower Floridan Aquifer and the middle confining unit. (FPL 2014a, Section 2.3.1.2.2.3)

3.6.2.4 Potentiometric Surfaces

Regional temporal trends in the Biscayne Aquifer groundwater levels are monitored by the USGS and the SFWMD. Several wells and surface water control structures in the vicinity of Turkey Point are used for long-term monitoring of groundwater and surface water levels. Hydrographs for these locations show varying degrees of short-term tidal influence and fluctuations associated with precipitation events. The long-term trends in the wells and surface water indicate a generally steady water level over the period examined. Generally, the wells show a range of fluctuation of less than 3.5 feet. (FPL 2014a, Section 2.3.1.2.2.2)

Regional groundwater flow in the Biscayne Aquifer is generally toward the east-southeast. Based on the regional data, the hydraulic gradient in the vicinity of the Turkey Point plant property is approximately 0.00002 foot per foot. Regional groundwater flow in the Upper Floridan Aquifer is generally toward the east. The apparent hydraulic gradient in the vicinity of the Turkey Point property is approximately 0.00006 foot per foot. Determination of groundwater flow directions and hydraulic heads in the Boulder Zone have been unreliable due to the lack of head data and the transitory effects of ocean tides, earth tides, and atmospheric tides. Regional groundwater movement in the Lower Floridan Aquifer in southern Florida is estimated to follow the circulation pattern described as follows: (1) cold sea water moves inland through the Lower Floridan Aquifer, (2) heating of the sea water in the Lower Floridan Aquifer during inland movement results in lower fluid density, (3) upwelling of this sea water from the Lower Floridan Aquifer occurs through the middle confining unit, and (4) dilution of the sea water (further reducing fluid density) results in its transport back to the ocean by seaward flowing groundwater in the Upper Floridan Aquifer. This circulation is generally very slow due to the low permeability of the middle confining unit. (FPL 2014a, Section 2.3.1.2.2.1)

The interceptor ditch system was designed to restrict westward movement of CCS water by maintaining a seaward groundwater gradient during times when a natural seaward gradient does not exist. During most of the year, a natural seaward gradient does exist. During those times when a westward gradient is measured from the interceptor ditch/CCS and the L-31E Canal, pumps located within the interceptor ditch are activated to lower the stage in the interceptor ditch to at least 0.25 feet below the concurrent stage measured in the L-31E, thereby restoring a seaward gradient. (PTN 2004)

Groundwater flow at the plant is strongly influenced by gradients produced by the circulation pumps which lower surface and groundwater levels near the cooling intake and elevate stages along the discharge area. Surface water differences from the intake to the discharge sides of the plant are approximately 1.5 feet.

Groundwater contour maps indicate groundwater flows from the discharge canals in the northeastern part of the facility toward the intake canal. The elevated water level in the discharge canal also induces components of groundwater flow towards the north and towards the portion of the intake canal to the south. The hydraulic gradient beneath Turkey Point is significantly altered by the intake and discharge canals as well as the numerous subsurface structures present at Turkey Point. The hydraulic gradient in the immediate vicinity of the discharge canal is significantly greater than the average hydraulic gradient at Turkey Point because of the elevated surface water elevation in the discharge canal. The discharge canal is predominantly unlined (except near the discharge structure), which allows for an immediate hydraulic connection between the surface water in the canal and the groundwater. As a result of this connection, the hydraulic head within the shallow zone diminishes quickly with distance from the discharge canal.

Similarly, the hydraulic gradient increases near the unlined intake canal where the groundwater discharges. The gradient is especially steep immediately adjacent to the intake canal and near the ash pond/wastewater treatment basin. Historically, an elevated groundwater level in the monitoring wells near the pond/basins has been observed (TP-1). The influence of this local groundwater mounding enhances the flow direction and gradients around these structures into the intake canal.

Contour maps of the shallow, intermediate, and deep groundwater systems at both low tide and high tide based on water level data collected on June 8, 2009, as part of the Nuclear Energy

Institute (NEI) groundwater protection initiative (GPI) program are provided in Figures 3.6-4, 3.6-5, 3.6-6, 3.6-7, 3.6-8, and 3.6-9. These maps were produced using data obtained prior to the power uprate authorization and shutdown of CCS water withdrawals for Units 1 and 2; however, the hydrogeological assumptions (depression at PTN intake and mounding at PTN discharge) remain valid as no significant changes (e.g., increase in water supply well pumping in the PTN location, site construction) to the hydrogeology are known to have occurred.

3.6.2.5 Groundwater Protection Program

In May 2006, the NEI approved the GPI, an industry-wide voluntary effort to enhance nuclear power plant operators' management of their groundwater protection program (NEI 2007).

Industry implementation of the GPI identifies actions to improve utilities' management and response to instances where the inadvertent release of radioactive substances may result in detectable levels of plant-related materials in subsurface soils and water, and also describes communication of those instances to external stakeholders. Aspects addressed by the initiative include site hydrology and geology, site risk assessment, onsite groundwater monitoring, and remediation. In August 2007, NEI published updated guidance on implementing the GPI as NEI 07-07, *Industry Ground Water Protection Initiative—Final Guidance Document* (NEI 2007). The goal of the GPI is to identify leaks of licensed material as soon as possible.

In 2010, FPL established and maintains a sampling and analysis program to meet the recommendations of NEI 07-07 and any future revisions to the document. Specific actions and requirements of the program are controlled by site and corporate procedures. Periodic reviews of the program are performed to meet the recommendations of NEI 07-07. Locations of the monitoring wells and the depths and construction were chosen following a study of geology and hydrology of the site. (PTN 2016a)

In conjunction with the GPI, FPL performs groundwater monitoring from 28 onsite locations to monitor for potential radioactive releases via groundwater pathways at the site in accordance with site procedures. Figures 3.6-10 and 3.6-11 show locations of these groundwater monitoring wells, including 42 (14 cluster) piezometer wells (TPGW-1S, 1M, 1D through TPGW-14S, 14M, 14D) that are used for water level data, with construction details presented in Table 3.6-2. (PTN 2017a)

3.6.2.6 Sole Source Aquifers

An SSA, as defined by the EPA, is an aquifer that supplies at least 50 percent of the drinking water consumed by the area overlying the aquifer and there is no reasonably available alternative drinking water source should the aquifer become contaminated. The SSA program was created by the U.S. Congress in the Safe Drinking Water Act and allows for the protection of these resources. (EPA 2016)

PTN is located in EPA Region 4, which has federal oversight responsibilities for the public water supply in Florida and eight other southeastern states. The EPA has designated three aquifers in EPA Region 4 as SSAs. Two of these SSAs (Biscayne and Volusia-Floridan) are located in the state of Florida. (EPA 2017c) The Volusia-Floridan Aquifer is located in east-central Florida, well beyond the boundaries of the local hydrogeologic system underlying the plant area; however, the Biscayne Aquifer underlies the site and Miami-Dade County. These areas have no alternative drinking water source(s) that could physically, legally, and economically supply all those who depend upon the aquifer for drinking water. As discussed in Section 3.6.1.4.5, saltwater intrusion affects the entire coastal zone of the Biscayne Aquifer, including the Turkey Point plant property. As a result, groundwater beneath the Turkey Point plant property is not used as a drinking water source because of its salinity, which is further discussed in Section 3.6.4.2. (FPL 2014a, Section 2.3.2.2.3)

3.6.3 Water Use

3.6.3.1 Surface Water Use

In southern Florida, most (approximately 90 percent) of the water used in homes and businesses comes from groundwater sources, with the remainder coming from surface water sources. (FPL 2014a)

The consumptive use of water in the state of Florida is regulated exclusively by the water management districts and FDEP, as prescribed in Part II of Chapter 373 of the Florida statute (FPL 2014a, Section 2.3.2.1.1.1). In Miami-Dade County, the surface water drainage canals are the dominant surface water supply. In 2010, surface water withdrawals were reported as 26.15 MGD, of which 14.88 MGD were used for irrigation and 11.26 MGD for mining, with no surface water withdrawals for power generation. (USGS 2017d) A summary of surface water use in Miami-Dade and surrounding counties is presented in Table 3.6-3.

The SFWMD prepares water supply plans for each of its four planning areas to support planning initiatives and address local issues. The regional water supply plans encompass a minimum 20-year future planning horizon and are updated every 5 years. Each regional water supply plan update provides revised water demand estimates and projections. (FPL 2014a, Section 2.3.2.1.1.2)

According to the SFWMD's *Water Supply Plan Update 2005–2006*, the total water demand of the lower east coast region, which includes Miami-Dade, Monroe, Broward, and Palm Beach counties, will increase by 27 percent between 2005 and 2025. (FPL 2014a, Section 2.3.2.1.1.2)

In Miami-Dade County, surface water is rarely used as a source for public or domestic water supply. Moreover, no surface water use and withdrawal permit for the Turkey Point property is anticipated in the future. Although the withdrawal demand for recreational water use could be increased in the future, the total consumptive surface water use is not expected to significantly increase in Miami-Dade County. (FPL 2014a, Section 2.3.2.1.1.2)

As discussed in Section 3.6.1, PTN utilizes the closed-loop CCS (IWW facility) for condenser and auxiliary system cooling. Process wastewater is released into the cooling canals of the IWW facility (CCS), and the sanitary wastewater is sent to an onsite treatment plant and disposed of through an underground injection well. (FPL 2014a, Section 2.3.2.1.4.1) The cooling canals are a closed system and are not considered waters of the U.S. or the State of Florida. PTN does not withdraw from, nor discharge to, any surface water source. PTN has no plans to use surface water sources for maintenance or operation during the license period.

3.6.3.2 Groundwater Use

Freshwater withdrawal of groundwater in Miami-Dade County is authorized by the SFWMD and the FDEP and is restricted to the Biscayne Aquifer. However, the FPL property is in an area of the Biscayne Aquifer with Class G-III groundwater (non-potable water use). Groundwater use has shown a steady increase between the 1960s and the present. (FPL 2014a, Section 2.3.2.2.1.1)

Miami-Dade County and the Florida Keys Aqueduct Authority treat water from the Upper Floridan Aquifer (characterized as Class G-II waters and discussed in Section 3.6.4.2) through reverse osmosis. Groundwater usage in Miami-Dade County is greater than surface water usage. In 2010, groundwater withdrawals were reported as 432.13 MGD with only 6.5 MGD used for power generation. Public water supply use was the largest consumer of groundwater in Miami-Dade County, reported at 339.11 MGD in 2010. The remaining water use was for irrigation, mining, industrial, and livestock supply purposes. (USGS 2017d) A summary of groundwater use in Miami-Dade and the surrounding counties is presented in Table 3.6-4.

No registered groundwater supply wells within a 2-mile band around the Turkey Point property boundary were identified. A list of registered groundwater supply wells within a 5-mile band around the Turkey Point property boundary is depicted on Figure 3.6-12 and presented in Table 3.6-5. The closest water well to the Turkey Point property is 6.3 miles from the PTN center point and is identified as the Homestead ARB–Well #5 (3484), listed as a domestic self-supplied well. (FDEP 2017b)

In addition to the traditional uses of the groundwater aquifer, other uses of the groundwater aquifer are present in southern Florida. These include disposal of municipal and IWW in Class I injection wells and the use of aquifer storage and recovery wells. The aquifer storage and recovery wells are used to inject raw or partially treated water into the aquifer for later extraction and use. Aquifer storage and recovery wells are typically completed as open-hole wells in the Upper Floridan Aquifer. Class I injection wells are typically completed as open-hole wells in the Boulder Zone portion of the Lower Floridan Aquifer, which is below the lowermost underground source of drinking water (USDW). (FPL 2014a, Section 2.3.2.2.1.2) More than 90 Class I injection wells are used to dispose of more than 200 MGD of secondary treated wastewater in southeastern Florida (FPL 2014a, Section 2.3.2.2.2.2).

PTN uses the CCS for condenser and auxiliary system cooling. Cooling water and process water for Unit 5 are obtained from Upper Floridan Aquifer saline production wells (PW-1, PW-3, and PW-4). The locations of these production wells, which were commissioned in February 2007, are shown in Figure 3.6-11. The average combined production from the three wells is approximately 170 million gallons per month. (FPL 2014a, Section 2.3.2.2.2.1)

Marine wells (PW-1 (Test), SW-1, SW-2) were installed in 2015. The Biscayne Aquifer wells have been employed during peak CCS salinity to moderate further salinity rise. Operation of the wells does not require a consumptive use permit because saltwater is not regulated, as confirmed by the SFWMD. Use of marine wells is appropriate only in response to “extraordinary circumstances” or “upset recovery.” However, in keeping with these special circumstances, operation of the marine wells to manage salinity and stage level in the CCS is to be considered an abnormal condition, and they are seldom used. (PTN 2017a)

Additional production wells were installed in 2016 under a site certification modification. Upper Floridan Aquifer production wells F-1, F-3, F-4, F-5, and F-6 provide up to 14 MGD of Upper Floridan Aquifer water into the CCS. The wells are artesian flow between 1,000 and 1,250 feet deep and located along the northernmost canal and western side of the CCS east of the inceptor ditch as shown in Figures 3.6-10 and 3.6-11. (PTN 2014a, pg. 7)

Water supply for other water uses at PTN comes from the MDWASD potable water system (FPL 2014a, Section 2.3.2.2.2.1).

3.6.3.2.1 Local Projected Groundwater Use

In accordance with the 2016 CO (Section 3.6.1.4.5), a hypersaline extraction project was initiated on September 29, 2016, with the commencement of a 15 MGD extended deep well injection test using hypersaline (chloride content in excess of 19,000 mg/L) Biscayne Aquifer water from beneath the CCS.

The extended testing will continue until early 2018, when construction of the Turkey Point RWS will be completed and extended operations begin. The ten RWS wells, with a combined extraction rate of 15 MGD, will be located along the western edge of the inceptor ditch and north of the CCS when they are fully operational in March 2018, and be in operation for approximately 10 years. The recovery system will be operated under a consumptive use permit (13-06251-W) from SFWMD. (SFWMD 2017a)

Extracted groundwater from the RWS wells will be disposed of by the existing Class I injection well. The RWS will be operated to meet the objectives of the Miami-Dade County CA and 2016 CO, which is anticipated to take ten years. (SFWMD 2017a; FDEP 2016b)

As discussed in Section 3.6.3.2, three marine wells are employed under extraordinary circumstances to moderate further salinity rise in the CCS. Operation of the wells does not require a consumptive use permit because saline groundwater is not regulated, as confirmed by the SFWMD. Use of marine wells is appropriate in response to "extraordinary circumstances" or "upset recovery." However, in keeping with these special circumstances, operation of the marine wells to manage salinity and stage level in the CCS is to be considered an out of normal condition.

3.6.3.2.2 Planned Groundwater Use for Turkey Point Units 6 and 7

Under normal operations, the proposed Turkey Point Units 6 and 7, approximately 3,500 feet south of PTN, will use reclaimed water from the MDWASD. If reclaimed water is insufficient, saltwater from radial collector wells would be utilized as an emergency source. Water supply for potable water, service water system makeup, fire protection, and miscellaneous raw water use would be from the MDWASD (FPL 2014a, Section 2.3.2.2.2.2) and the onsite water treatment plant, as discussed in Section 3.6.1.4.1.

Four radial collector wells, each capable of producing approximately 45 MGD, would be installed. At any time, one collector well will operate in standby mode as a reserve well in the event of an unplanned well outage or scheduled maintenance event. Each radial collector well would consist of a central reinforced concrete caisson extending below the ground surface with laterals projecting horizontally from the caisson beneath the bottom of Biscayne Bay. The wells would be designed and located to induce infiltration from Biscayne Bay. (FPL 2014a, Section 2.3.2.2.2.2)

3.6.4 Water Quality

3.6.4.1 Surface Water Quality

Turkey Point is located adjacent to Lower Biscayne Bay. Card Sound is south of Biscayne Bay. Card Sound Canal starts at the southern end of the CCS and terminates at Card Sound. (FPL 2014a, Section 2.3.3.1.1) The locations of Biscayne Bay, Card Sound, and the Card Sound Canal are shown in Figure 3.6-1.

To meet the requirements of Section 303(d) of the federal Clean Water Act (CWA), the 1999 Florida Watershed Restoration Act was created directing the FDEP to implement a comprehensive, integrated watershed approach to evaluating and managing impacts to Florida's waters. Turkey Point is located in the Everglades (Hydrologic Unit Code [HUC] 090202)/Florida Bay (HUC 090203) watershed. This watershed is currently managed by the SFWMD, a regional Florida state-run agency responsible for water quality, flood control, water supply, and environmental restoration in 16 counties from Orlando to the Florida Keys. (FPL 2014a, Section 2.3.3.1.1)

Biscayne Bay water quality (BBWQ) is monitored by the SFWMD through a project with the four-letter code name BISC (renamed BBWQ). Project BISC (Project BBWQ) is monitored by two entities: MDC DERM and Florida International University. The entities monitor different parts of Biscayne Bay with the same goals, which are to determine water quality and provide data to SFWMD staff and outside agencies. (FPL 2014a, Section 2.3.3.1.1)

MDC DERM's monitoring program consists of monthly surface water monitoring in Biscayne Bay and its tributaries. Routine monitoring was initiated to detect spatial and seasonal water quality trends, determine impacts on the health of the bay ecosystem, and identify areas of degradation. The program with Florida International University is part of an integrated monitoring network known as the South Florida Coastal Water Quality Monitoring Network. The network monitors water quality on the coastal regions of southern Florida. The data generated from the South Florida Coastal Water Quality Monitoring Network are used to examine water quality trends along the Florida coast as well as address issues concerning freshwater inflow, water clarity, salinity, and nutrient availability patterns. (FPL 2014a, Section 2.3.3.1.1)

Project BISC (Project BBWQ) monitors the following parameters: temperature, dissolved oxygen, pH, turbidity, nitrogen oxides (NO_x), nitrate, ammonia, total Kjeldahl nitrogen, orthophosphate, total phosphate, silica, chlorophyll A, nitrite, total nitrogen, salinity, total organic carbon, and alkaline phosphate. Analysis of the data from Project BISC (Project BBWQ) for horizontal spatial variation reveals that alkaline phosphate, silica, and NO_x are slightly elevated in samples closest to the shore. Total Kjeldahl nitrogen and nitrate are slightly elevated at sampling location BISC 101, located approximately 3 miles north-northeast of PTN (SFWMD 2006). Water quality data from samples taken in Card Sound show no meaningful water quality differences when compared to data from Biscayne Bay. In summary, Biscayne Bay, including Card Sound, is relatively consistent in regard to horizontal spatial variations. (FPL 2014a, Section 2.3.3.1.1) Temperature, dissolved oxygen, and salinity were sampled at two depths and there was no meaningful variation in the data. The water quality data are consistent with the data analyzed for other sample locations in Biscayne Bay at varying depths and, as a result, it can be concluded that Biscayne Bay is relatively consistent in regard to vertical spatial variations in water quality. (FPL 2014a, Section 2.3.3.1.1)

Seasonal analysis of the data collected through Project BISC (Project BBWQ) shows higher concentrations of total nitrogen during the summer months for all sampling locations. In addition, the temperature of Biscayne Bay varies from an average monthly maximum of 31.1°C in July at BISC 101 to an average monthly minimum of 17.5°C in January at BB44, located approximately 5 miles east-southeast of PTN (SFWMD 2006) (average of samples taken at greater than 1 foot deep). Otherwise, most likely because of the limited atmospheric temperature variation seasonally (Florida's proximity to the equator), there is minimal seasonal variation in Biscayne Bay. (FPL 2014a, Section 2.3.3.1.1)

3.6.4.1.1 Cooling Canal System (CCS)

As previously discussed in Section 3.6.3.1, the CCS is a permitted IWW facility and not considered waters of the U.S. or the State of Florida. The CCS (IWW facility) canals are unlined, which allows the CCS to interact with the groundwater in the aquifer below. As the CCS salinity levels increased, a hydraulic gradient developed whereby the higher salinity surface water was heavier than the lower salinity surface water below. Over the decades, the aquifer immediately below the CCS became saturated with the higher salinity water moving down into the aquifer. Current measurements indicate that the aquifer below the CCS has salinity on the order of

60 PSU. (FPL 2017c) Improvement initiatives for groundwater and thermal efficiency are described in Section 3.6.1.4.5. Monitoring programs for water quality are further discussed in Section 3.7.

As discussed in Section 3.6.1, the CCS serves as the UHS for PTN. In early July 2014, the water temperature in the cooling canals began to approach the permissible limit of 100°F. Consequently, on July 10, 2014, FPL sought license amendments to raise the limit to 104°F. On July 20, 2014, the NRC approved a notice of enforcement discretion, which allows the UHS temperature to exceed 100°F up to 103°F for a period of no more than 10 days. In August 2014, the NRC issued license amendments to FPL that increased the UHS water temperature limit for the cooling canals at Turkey Point to 104°F. (79 FR 44464; 80 FR 76324)

Additional initiatives have commenced to improve the thermal efficiency and elevated salinity levels within the CCS. These initiatives are discussed in Section 3.6.1.4.5.

Low level liquid radioactive waste effluent from Units 3 and 4 is also discharged by procedurally controlled processes to the IWW facility (CCS) with quarterly sampling. The tritium level in the cooling canals averaged 5,250 picocuries per liter (pCi/L) during the period 2000–2007. (FPL 2014a, Section 2.3.3.1.2) The canal system average tritium level was 7,089 pCi/L between 2013 and 2016 (PTN 2014c; PTN 2015b; PTN 2016b; PTN 2017b). The maximum concentrations were reported as 18,376 pCi/L in 2015 and 17,456 pCi/L in 2016. (PTN 2016b; PTN 2017b)

3.6.4.1.2 Section 303(d) List of Impaired Waters

Section 303(d) of the CWA requires states to develop a list of waters not meeting water quality standards or waters not supporting their designated uses. Chapter 99-223, *Laws of Florida*, sets forth the process by which the list is refined through more detailed water quality assessments. Total maximum daily loads are required by Florida for the waters determined to be impaired based on these detailed assessments because technology-based effluent limitations, current effluent limitations required by state or local authority, or other pollution-control requirements are not stringent enough to meet current water quality standards. (FPL 2014a, Section 2.3.3.1.3)

Water quality criteria have been established for each designated use classification. While some criteria are intended to protect aquatic life, others are designed to protect human health. The southeastern coast/Biscayne Bay is given surface water Class III—recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife classification. (FPL 2014a, Section 2.3.3.1.3)

Section 305(b) requires each state to report every two years to the EPA on the condition of its surface waters, and Section 303(d) requires each state to report on its impaired water bodies (those not meeting water quality standards). Three listed segments within the southeastern coast/Biscayne Bay group (Mowry Canal, Military Canal, and Biscayne Bay) are the only water bodies located within a 6-mile radius of PTN to appear on the 2016 Florida 305(b) list of waters (Statewide Comprehensive List of Impaired Waters) assessed for impaired water quality. Mowry

Canal and Military Canal are listed as impaired for specific conductance and Biscayne Bay is listed for nutrients (chlorophyll-a). (FDEP 2017e)

3.6.4.2 Groundwater Quality

The state of Florida has conducted an extensive characterization of the background water quality in the major aquifer systems. In 1983, the state of Florida designated the surficial groundwater (Biscayne Aquifer) within the Turkey Point plant property as Class G-III waters to identify groundwater that has no reasonable potential as a future source of drinking water due to high TDS (> 10,000 mg/L) content. (FPL 2014a, Section 2.3.1.2.2.4) Surficial groundwater adjacent to PTN has been classified as G-II with TDS levels between 1,000 mg/L and 10,000 mg/L.

Although the Upper Floridan Aquifer is a major source of potable groundwater in much of Florida, water withdrawn from the unit in southeastern Florida, including Miami-Dade County, is brackish and characterized as Class G-II waters with dissolved solid concentrations greater than 1,000 mg/L and is used for potable water supply by several neighboring users after desalinization. Groundwater samples from the Upper Floridan Aquifer production wells at Unit 5 show an average chloride concentration of 2,900 mg/L. (FPL 2014a, Section 2.3.1.2.2.4)

Chemically, the water in the middle confining unit is similar to sea water, but salinity varies greatly at the top of the unit as the upward moving saline water from the Lower Floridan is blended with the seaward flowing fresh water in the Upper Floridan Aquifer. Although the Upper Floridan Aquifer is a major source of potable groundwater in much of Florida, water withdrawn from the unit in southeastern Florida, including Miami-Dade County, is brackish and variable with chloride and dissolved solid concentrations greater than 1,000 mg/L. Groundwater samples from the Upper Floridan Aquifer production wells at Unit 5 show an average chloride concentration of 2,900 mg/L. (FPL 2014a, Section 2.3.3.2)

Average dissolved solids concentration of Boulder Zone groundwater is approximately 37,000 mg/L TDS. There is also a pronounced temperature anomaly present in the Boulder Zone with the lowest observed temperatures (approximately 50°F) occurring along the southeastern coast. The temperature increases from the Straits of Florida toward the center of the Florida Plateau, suggesting recharge from cold sea water through the lower part of the Floridan Aquifer system. (FPL 2014a, Section 2.3.1.2.2.4)

As part of the Turkey Point radiological groundwater monitoring program, groundwater samples are collected from selected monitoring wells on site and analyzed for radionuclides to detect potential impacts to groundwater from inadvertent leaks or spills. Samples are collected on at least a quarterly basis, or more frequently if deemed necessary. As discussed in Section 3.6.4.2.1, no plant-related gamma isotopes or hard-to-detect radionuclides have been detected since the groundwater monitoring program was initiated in 2010. (PTN 2017b)

3.6.4.2.1 History of Radioactive Releases

Low level radioactive gases, liquids, and solids are routine byproducts of nuclear power plant operation. Radioactive waste management systems, commonly called radwaste systems, collect, process, and either recycle or dispose of these radioactive materials. The design and operation of the radwaste systems are regulated by the NRC. As part of normal operation of the plant, radioactive material must sometimes be discharged to the environment. Such discharges are also regulated by the NRC and submittal of annual reports to the NRC detailing the amounts and compositions of radwaste discharged intentionally or accidentally from their facilities are required. The EPA has a separate regulation that limits the radioactivity of drinking water. This regulation sets a maximum allowed concentration for each radionuclide in drinking water including a maximum radioactivity concentration of 20,000 pCi/L for tritium, a radioactive form of hydrogen produced by power plants. Tritium levels that are discharged during normal, procedurally controlled, operations (outages, maintenance activities, normal discharges) into the IWW facility (CCS) and the deep injection well at PTN are far below this 20,000 pCi/L tritium concentration. Since no drinking water pathway exists, a value of 30,000 pCi/L is used. (PTN 2015c, Table 5.2-1)

The cooling canals by design are in direct hydraulic connection to the underlying surficial aquifer and are authorized to discharge to groundwater by the state of Florida IWW permit and the associated federal NPDES permit which is issued under delegation to the state of Florida (Permit No. FL0001562). Groundwater beneath and surrounding the cooling canals has historically been very saline and is classified as non-potable G-III groundwater by the state of Florida (Chapter 62-520.410 FAC). As previously noted, tritium is routinely released to the cooling canals and migrates into the groundwater in concentrations that do not present an environment or health risk either onsite or offsite. Tritium concentrations in groundwater beneath and adjacent to the plant are monitored as required under the NRC license and for state of Florida regulatory agencies. Accordingly, releases of tritium to groundwater at the plant site, either intentionally or accidentally, are extensively monitored and do not present an environmental or health risk either onsite or offsite. However, the potential for tritium in the groundwater at the site due to this exchange does not present an environmental or health risk either onsite or offsite. Facility personnel are provided a municipal source of drinking. As such, health risks due to human consumption are not credible. (FPL 2017b, Section 2.10.4)

As discussed in Section 3.6.2.5, FPL implemented a groundwater monitoring program in accordance with NEI's Groundwater Protection Program. The configuration of the wells is designed to provide early warning of any unplanned releases of radioactive material and to provide indications of migration of radioactive material in groundwater. As of 2016, tritium has been measured in the groundwater at a range from non-detect to 5,500 pCi/L. The highest reported level of tritium at 5,500 pCi/L is well below the required reporting level of 30,000 pCi/L. (PTN 2017b) The Turkey Point radiological groundwater monitoring program has detected tritium but no plant-related gamma isotopes or hard-to-detect radionuclides since the groundwater monitoring program was initiated in 2010.

Since 2012, there have been nine unplanned releases of radioactive materials from PTN.

In 2012, a valve on the auxiliary building roof developed a leak which released about 10 gallons of radioactive water. The leak was promptly cleaned up by site personnel. A small portion went down the roof drains but was not detected in a downstream catch basin. A sample of the water from the system was analyzed isotopically. There were no radioactive gases. Approximately 1.99×10^{-03} Ci of soluble nuclides were released to the auxiliary building roof. (PTN 2013b)

On September 30, 2013, approximately 80 gallons of PTN Unit 4 RWST water were lost. The spill happened due to an improperly installed drain/seal water line on the PTN Unit 4 refueling water purification pump (4P209) from maintenance activity. The spill was stopped by closing the suction valve to the Unit 4 refueling water purification pump. An undetermined amount of the 80 gallons was spilled on the gravel area surrounding the PTN Unit 4 RWST, while the rest of the water went via the drain to the #1 WHT. The area was remediated within 24 hours, bringing the soil samples to within acceptable levels based on historical analysis. All nearby well samples have been within the limits of the *Offsite Dose Calculation Manual* (ODCM), Table 5.1-2, Reporting Levels for Radioactivity Concentrations in Environmental Samples. Monitoring continues on a monthly basis.

On March 19, 2014, an unplanned liquid release occurred when a PTN Unit 3 demineralizer fill valve leaked a small amount of RCS water (estimated to be approximately less than 1 gallon) on the roof of the auxiliary building. The leak was promptly cleaned up. (PTN 2015a)

On August 24, 2014, an unplanned liquid release occurred when the PTN Unit 4 RWST purification pump (4P209) drain line leaked 5 gallons of RCS water to the ground. Corrective actions included increasing sampling of the groundwater monitoring wells PTN-MW-8s, PTN-MW-9s, and P-94-4 for gamma and tritium activity. (PTN 2015a) The monitoring results for the wells before and after the unplanned release through 2015 are presented in Table 3.6-6. The results do not show a sustained trend.

On September 23, 2014, an unplanned liquid release occurred when the Unit 4 demineralizer resin fill valve and flange located on the roof of PTN Unit 4 auxiliary building leaked about 50 gallons of RCS water. At the time, falling rain migrated the leak onto the storm drain system, which became contaminated. The majority of the gamma activity detected was due to Co-58. There was approximately 0.132 Ci of Co-58 and 0.019 Ci of tritium released due to this event. This unplanned release occurrence and related corrective actions to monitor the SE storm drain for activity and to increase monitoring of groundwater monitoring wells in the path of the storm drain have been captured in the site's corrective action program (CAP). (PTN 2015a) The groundwater wells in closest proximity to the SE storm drain are PTN-MW-8s and PTN-MW-9s (PTN 2015b and PTN 2016b). The monitoring results for the wells before and after the unplanned release through 2015 are presented in Table 3.6-6. The results do not show a sustained trend.

On October 14, 2014, an unplanned liquid release occurred when the PTN Unit 4 RWST valve 4-804 B leaked during the transfer of water from refueling cavity. Approximately 1 liter of

RCS water was released to the ground before the leak was stopped. The related activity to this leak is estimated to be 1.67×10^{-5} Ci. Corrective actions include increasing sampling of groundwater wells PTN-MW-8s, PTN-MW-9s, and P-94-4 on a monthly basis for gamma activity and tritium. This unplanned release and related corrective actions have been captured in the site's CAP. (PTN 2015a) The monitoring results for the wells before and after the unplanned release through 2015 are presented in Table 3.6-6. The results do not show a sustained trend.

On November 11, 2014, an unplanned liquid release occurred when it was discovered that there was a pump casing leak from the 4P209 U4 RWST purification pump. The pump leak was estimated to be approximately 60 drops per minute. There is no estimate of how long the leak lasted, but the pump was shut down immediately to address the leak. Corrective actions include increasing sampling of groundwater wells PTN-MW-8s, PTN- MW-9s, and P-94-4 monthly for monitoring gamma activity and tritium. This unplanned release and related corrective actions have been captured in the site's CAP. (PTN 2015a) The monitoring results for the wells before and after the unplanned release through 2015 are presented in Table 3.6-6. The results do not show a sustained trend.

From July 26 to September 15, 2015, an unplanned release of ICW that had become contaminated with Na-24 from the PTN Unit 3 CCW system had occurred. The CCW system has a large quantity of chemical inhibitors which contain sodium. The sodium becomes activated when the CCW system travels into a neutron field. The PTN Unit 3 CCW heat exchanger, cooled by ICW, developed a leak, and CCW, which had a concentration of activated sodium, leaked into the tube side of the heat exchanger. The release took place over a period of 45 days prior to the heat exchanger being plugged. The ICW discharges into the mixing basin on the western side of the plant, which is the same area used as discharge for the regular liquid radwaste tanks. Based on CCW makeup volumes, the total volume of CCW leakage into the ICW system was approximately 4,828 gallons. The highest amount released in one day was approximately 154 gallons. The highest concentration of Na-24 in the PTN Unit 3 CCW system during the release timeframe was 3.38×10^{-07} μCi/mL. The total microcuries of Na-24 released during the timeframe was approximately 6.19 μCi. The maximum amount of activity released from the CCW system on any day was 0.197 μCi. The heat exchanger was plugged and related corrective actions have been captured in the site's CAP. (PTN 2016a)

On April 23, 2016, an unplanned release from the resin system caused a contaminated area on the auxiliary building roof inside and outside the vent. The highest activity concentration during the release timeframe was 1.577×10^{-06} μCi/ml. The total microcuries released was 0.0298 μCi. Related corrective actions have been captured in the site's CAP. (PTN 2017a)

3.6.4.2.2 History of Nonradioactive Releases

Based on the review of site records for the most recent 5 years (2012–2016), there has been no inadvertent release that would not be classified as an incidental spill associated with PTN.

Table 3.6-1
NPDES-Permitted Outfalls

Internal Outfall	Description	Parameter	Permit Requirement
001	Non-process wastewater	Temperature (°F), Water (°F)	Monthly, instantaneous
		Solids, total suspended (mg/L)	Quarterly, grab
		pH (SU)	Quarterly, grab
		Salinity (ppt)	Quarterly, grab
		Specific conductance (UMHO/CM)	Quarterly, grab
		Copper, total recoverable (ug/L)	Semiannually, grab
		Iron, total recoverable (mg/L)	Semiannually, grab
		Zinc, total recoverable (ug/L)	Semiannually, grab
002	Process wastewater and stormwater	Solids, total suspended (mg/L)	Semiannually, grab
		pH (SU)	Monthly, grab
		Specific conductance (UMHO/CM)	Quarterly, grab
		Lead, total recoverable (ug/L)	Semiannually, grab
		Oil and grease (mg/L)	Semiannually, grab
		Copper, total recoverable (ug/L)	Semiannually, grab
		Zinc, total recoverable (ug/L)	Semiannually, grab

(FDEP 2005)

Table 3.6-2
Groundwater Monitoring Well Construction Details (Sheet 1 of 7)

Well	Well Diameter[(a)]	Elevations (feet NGVD29)					Well Construction Material
		Top of Casing	Top of Filter[(b)]	Top of Screen[(b)]	Bottom of Screen[(b)]	Bottom of Filter[(b)]	
TPGW-1S	2	3.82	-24.27	-26.65	-28.65	-28.27	Sch 40 PVC screen and riser
TPGW-1M	2	3.92	-45.55	-46.55	-48.55	-49.55	Sch 40 PVC screen and riser
TPGW-1D	2	4.20	-78.55	-79.55	-83.55	-84.55	Sch 40 PVC screen and riser
TPGW-2S	2	1.36	-20.85	-22.12	-26.12	-26.85	Sch 40 PVC screen and riser
TPGW-2M	2	1.18	-45.85	-48.11	-50.11	-50.85	Sch 40 PVC screen and riser
TPGW-2D	2	1.14	-80.85	-82.85	-84.85	-86.85	Sch 40 PVC screen and riser
TPGW-3S	2	1.44	-22.85	-23.85	-27.85	-28.85	Sch 40 PVC screen and riser
TPGW-3M	2	1.42	-50.85	-51.85	-55.85	-56.85	Sch 40 PVC screen and riser
TPGW-3D	2	1.10	-82.35	-83.85	-85.85	-86.35	Sch 40 PVC screen and riser
TPGW-4S	2	2.24	-17.63	-19.43	-21.43	-21.63	Sch 40 PVC screen and riser
TPGW-4M	2	1.82	-32.93	-34.75	-39.75	-44.13	Sch 40 PVC screen and riser
TPGW-4D	2	1.92	-57.13	-58.13	-57.13	-63.13	Sch 40 PVC screen and riser
TPGW-5S	2	5.35	-20.70	-21.73	-25.73	-26.70	Sch 40 PVC screen and riser
TPGW-5M	2	5.07	-40.53	-42.73	-47.73	-48.73	Sch 40 PVC screen and riser
TPGW-5D	2	5.22	-58.70	-60.23	-65.23	-66.20	Sch 40 PVC screen and riser

Table 3.6-2
Groundwater Monitoring Well Construction Details (Sheet 2 of 7)

Well	Well Diameter[(a)]	Elevations (feet NGVD29)					Well Construction Material
		Top of Casing	Top of Filter[(b)]	Top of Screen[(b)]	Bottom of Screen[(b)]	Bottom of Filter[(b)]	
TPGW-6S	2	1.56	-17.75	-18.75	-20.75	-21.75	Sch 40 PVC screen and riser
TPGW-6M	2	1.52	-43.75	-44.75	-48.75	-49.75	Sch 40 PVC screen and riser
TPGW-6D	2	1.59	-76.75	-78.75	-82.75	-84.75	Sch 40 PVC screen and riser
TPGW-7S	2	1.36	-17.95	-18.95	-22.95	-23.95	Sch 40 PVC screen and riser
TPGW-7M	2	1.25	-43.95	-44.95	-48.95	-49.95	Sch 40 PVC screen and riser
TPGW-7D	2	1.19	-74.95	-76.95	-80.95	-81.95	Sch 40 PVC screen and riser
TPGW-8S	2	1.98	-13.71	-14.85	-18.85	-19.71	Sch 40 PVC screen and riser
TPGW-8M	2	2.12	-31.71	-32.81	-34.81	36.71	Sch 40 PVC screen and riser
TPGW-8D	2	2.01	-44.70	-47.21	-51.21	-52.70	Sch 40 PVC screen and riser
TPGW-9S	2	3.63	-8.60	-9.70	-13.70	-14.70	Sch 40 PVC screen and riser
TPGW-9M	2	3.53	-27.70	-28.70	-30.70	-31.70	Sch 40 PVC screen and riser
TPGW-9D	2	3.52	-41.70	-42.70	-44.70	-45.70	Sch 40 PVC screen and riser
TPGW-10S	2	8.3	-25.20	-26.40	-28.40	-29.20	Sch 40 PVC screen and riser
TPGW-10M	2	8.3	-48.70	-50.40	-54.40	-55.40	Sch 40 PVC screen and riser
TPGW-10D	2	8.3	-115.30	-116.50	-120.50	121.50	Sch 40 PVC screen and riser

Table 3.6-2
Groundwater Monitoring Well Construction Details (Sheet 3 of 7)

Well	Well Diameter[(a)]	Elevations (feet NGVD29)					Well Construction Material
		Top of Casing	Top of Filter[(b)]	Top of Screen[(b)]	Bottom of Screen[(b)]	Bottom of Filter[(b)]	
TPGW-11S	2	8.7	-28.15	-29.35	-33.35	-34.35	Sch 40 PVC screen and riser
TPGW-11M	2	8.7	-79.25	-80.35	-84.35	-85.35	Sch 40 PVC screen and riser
TPGW-11D	2	8.7	-110.60	-112.35	-116.35	-117.50	Sch 40 PVC screen and riser
TPGW-12S	2	0.52	-18.50	-19.50	-21.50	-22.50	Sch 40 PVC screen and riser
TPGW-12M	2	0.73	-52.50	-53.50	-57.50	-58.50	Sch 40 PVC screen and riser
TPGW-12D	2	0.76	-85.50	-87.50	-91.50	-92.50	Sch 40 PVC screen and riser
TPGW-13S	2	2.19	-24.06	-26.06-	-30.06	-30.06	Sch 40 PVC screen and riser
TPGW-13M	2	2.13	-51.06	-53.06	-57.06	-57.06	Sch 40 PVC screen and riser
TPGW-13D	2	2.18	-80.06	-81.06	-85.06	-85.66	Sch 40 PVC screen and riser
TPGW-14S	2	8.8	-19.76	-22.06	-26.06	-26.76	Sch 40 PVC screen and riser
TPGW-14M	2	8.8	-42.76	-46.06	-50.06	-50.76	Sch 40 PVC screen and riser
TPGW-14D	2	8.6	-90.76	-91.76	-95.76	-96.76	Sch 40 PVC screen and riser
TPGW-15S	3	3.88	-23.00	-23.70	-28.70	-30.50	Sch 40 PVC screen and riser
TPGW-15M	3	3.7	-44.80	-46.20	-49.20	-51.00	Sch 40 PVC screen and riser
TPGW-15D	3	3.63	-78.00	-79.10	-83.10	-84.00	Sch 40 PVC screen and riser

Table 3.6-2
Groundwater Monitoring Well Construction Details (Sheet 4 of 7)

Well	Well Diameter[(a)]	Elevations (feet NGVD29)					Well Construction Material
		Top of Casing	Top of Filter[(b)]	Top of Screen[(b)]	Bottom of Screen[(b)]	Bottom of Filter[(b)]	
TPGW-16S	3	5.21	-26.50	-27.50	-30.50	-32.60	Sch 40 PVC screen and riser
TPGW-16M	3	5.15	-47.20	-48.70	-51.70	-53.90	Sch 40 PVC screen and riser
TPGW-16D	3	4.88	-62.40	-62.70	-65.70	-66.10	Sch 40 PVC screen and riser
L-3	4	8.289	NA	NA	NA	NA	Sch 40 PVC screen and riser
L-4	NA	NA	NA	NA	NA	NA	NA
G-21	NA	6.88	NA	NA	NA	NA	NA
G-28	NA	5.81	NA	NA	NA	NA	NA
G-35	NA	NA	NA	NA	NA	NA	NA
IW-1	NA	NA	NA	NA	NA	NA	NA
PTN-MW-1S	2	9.19	-7.38	-7.88	-17.88	-17.88	Sch 40 PVC screen and riser
PTN-MW-1I	2	9.21	-38.68	-40.68	-45.68	-45.68	Sch 40 PVC screen and riser
PTN-MW-1D	2	9.20	-58.69	-60.69	-65.69	-65.69	Sch 40 PVC screen and riser
PTN-MW-2S	2	8.83	-6.21	-7.71	-17.71	-17.71	Sch 40 PVC screen and riser
PTN-MW-3S	2	16.24	-22.49	-26.49	-36.49	-36.49	Sch 40 PVC screen and riser
PTN-MW-4S	2	5.88	-6.62	-8.12	-18.12	-18.12	Sch 40 PVC screen and riser

Table 3.6-2
Groundwater Monitoring Well Construction Details (Sheet 5 of 7)

Well	Well Diameter[(a)]	Elevations (feet NGVD29)					Well Construction Material
		Top of Casing	Top of Filter[(b)]	Top of Screen[(b)]	Bottom of Screen[(b)]	Bottom of Filter[(b)]	
PTN-MW-4I	2	5.86	-39.08	-41.08	-46.08	-46.08	Sch 40 PVC screen and riser
PTN-MW-4D	2	5.41	-56.95	-60.95	-65.95	-65.95	Sch 40 PVC screen and riser
PTN-MW-5S	2	10.75	-7.6	-10.10	-20.10	-20.10	Sch 40 PVC screen and riser
PTN-MW-5I	2	10.70	-38.45	-42.45	-47.45	-47.45	Sch 40 PVC screen and riser
PTN-MW-5D	2	10.76	-58.58	-62.58	-67.58	-67.58	Sch 40 PVC screen and riser
PTN-MW-6S	2	5.97	-2.7	-4.2	-14.2	-14.2	Sch 40 PVC screen and riser
PTN-MW-6D	2	6.09	-53.27	-57.27	-62.27	-62.27	Sch 40 PVC screen and riser
PTN-MW-7S	2	14.53	-20.78	-24.78	-34.78	-34.78	Sch 40 PVC screen and riser
PTN-MW-7I	2	15.48	-46.65	-50.65	-55.65	-55.65	Sch 40 PVC screen and riser
PTN-MW-7D	2	16.64	-69.13	-73.13	-78.13	-78.13	Sch 40 PVC screen and riser
PTN-MW-8S	2	16.15	-22.46	-26.46	-36.46	-36.46	Sch 40 PVC screen and riser
PTN-MW-9S	2	15.83	-27.12	-31.12	-36.12	-36.12	Sch 40 PVC screen and riser
PTN-MW-10S	2	14.92	-21.33	-25.83	-35.83	-35.83	Sch 40 PVC screen and riser
PTN-MW-10I	2	15.23	-46.52	-51.02	-56.02	-56.02	Sch 40 PVC screen and riser
PTN-MW-10D	2	15.30	-66.68	-70.68	-75.68	-75.68	Sch 40 PVC screen and riser

Table 3.6-2
Groundwater Monitoring Well Construction Details (Sheet 6 of 7)

Well	Well Diameter[(a)]	Elevations (feet NGVD29)					Well Construction Material
		Top of Casing	Top of Filter[(b)]	Top of Screen[(b)]	Bottom of Screen[(b)]	Bottom of Filter[(b)]	
PTN-MW-11S	2	15.84	-22.90	-26.90	-36.90	-36.90	Sch 40 PVC screen and riser
PTN-MW-12S	2	16.21	-23.51	-27.51	-37.51	-37.51	Sch 40 PVC screen and riser
MW-2	NA	5.88	NA	0.30	-9.70	NA	Sch 40 PVC screen and riser
MW-3	NA	6.13	NA	0.40	-9.70	NA	Sch 40 PVC screen and riser
MW-4A	NA	7.58	NA	1.90	-8.10	NA	Sch 40 PVC screen and riser
MW-6	NA	5.46	NA	-0.20	-10.20	NA	Sch 40 PVC screen and riser
PW-3	NA	NA	NA	NA	NA	NA	Sch 40 PVC screen and riser
PW-4	NA	NA	NA	NA	NA	NA	Sch 40 PVC screen and riser
STP-1	NA	4.93	NA	NA	NA	NA	Sch 40 PVC screen and riser
STP-2	NA	15.36	NA	7.60	-2.40	NA	Sch 40 PVC screen and riser
CD-1	Unknown	13.24	NA	3.30	-6.70	NA	Sch 40 PVC screen and riser
CD-2	Unknown	13.56	NA	4.00	-6.00	NA	Sch 40 PVC screen and riser
PTPED-1	2	15.72	NA	3.80	-6.20	NA	Sch 40 PVC screen and riser
PTPED-2	2	10.22	NA	2.14	-7.86	NA	Sch 40 PVC screen and riser
PTPED-3	2	12.53	NA	2.70	-7.30	NA	Sch 40 PVC screen and riser

Table 3.6-2
Groundwater Monitoring Well Construction Details (Sheet 7 of 7)

Well	Well Diameter[(a)]	Elevations (feet NGVD29)					Well Construction Material
		Top of Casing	Top of Filter[(b)]	Top of Screen[(b)]	Bottom of Screen[(b)]	Bottom of Filter[(b)]	
CU-1	Unknown	14.88	NA	5.70	-4.30	NA	Sch 40 PVC screen and riser
P-94-2	2	8.41	NA	0.20	-9.80	NA	Sch 40 PVC screen and riser
P-94-3	2	13.11	NA	NA	NA	NA	Sch 40 PVC screen and riser
P-94-4	2	15.65	NA	0.70	-9.30	NA	Sch 40 PVC screen and riser

a. In inches
b. Approximate measurements
NA = not available

Table 3.6-3
Surface Water Usage Summary, 2010

Category	Miami-Dade County (MGD)	Monroe County (MGD)	Broward County (MGD)
Public supply	0.00	0.00	0.00
Industrial	0.00	0.00	0.00
Irrigation	14.88	0.45	23.81
Livestock	0.01	0.00	0.03
Aquaculture	0.00	0.00	0.00
Mining	11.26	0.00	0.00
Power generation	0.00	0.00	1005.82
Total	**26.15**	**0.45**	**1029.66**

(USGS 2017d)

Table 3.6-4
Groundwater Usage Summary, 2010

Category	Miami-Dade County (MGD)	Monroe County (MGD)	Broward County (MGD)
Public supply	339.11	0.00	231.40
Industrial	1.28	0.00	0.00
Irrigation	64.40	0.55	17.33
Livestock	0.06	0.00	0.30
Aquaculture	0.00	0.00	0.00
Mining	20.78	0.00	0.00
Power generation	6.50	0.00	0.00
Total	**432.13**	**0.55**	**249.03**

(USGS 2017d)

Table 3.6-5
Registered Water Wells

Water Well Number	Distance[a]	Well Depth (feet)	Use Description	Aquifer Name
AAK6426	6.2	NA	Public water system, municipal/city well	Biscayne Aquifer
252704080261401	6.7	26	Private drinking water well (domestic)	Biscayne Aquifer
AAE2325	7.0	50	Public water system, municipal/city well	Biscayne Aquifer
AAE2324	7.0	45	Public water system, municipal/city well	Biscayne Aquifer
AAH8903	7.0	NA	Public water system, municipal/city well	Biscayne Aquifer
AAE2326	7.4	40	Public water system, municipal/city well	Biscayne Aquifer
AAH8902	7.4	NA	Public water system, municipal/city well	Biscayne Aquifer
AAE2327	7.4	40	Public water system, municipal/city well	Biscayne Aquifer
AAH8901	7.4	45	Public water system, municipal/city well	Biscayne Aquifer
AAJ7768	7.8	NA	Public water system, municipal/city well	Biscayne Aquifer
AAJ7769	8.2	NA	Public water system, municipal/city well	Biscayne Aquifer
AAJ7734	8.2	NA	Public water system, municipal/city well	Biscayne Aquifer
6118	8.5	1,074	Commercial water well, golf course irrigation	Biscayne Aquifer
12740	8.5	1,200	Commercial water well	Biscayne Aquifer

(FDEP 2017b)

a. Distance is in miles from the PTN center point. Wells listed are limited to those within a 5-mile band around the property boundary.

NA = not available.

Table 3.6-6
Groundwater Protection Initiative Monitoring - Select Wells in Proximity to Unplanned Releases

Well	July 2014	Oct 2014	Nov 2014	Dec 2014	1Q 2015	2Q 2015	3Q 2015	4Q 2015
PTN-MW-8s	2390	2000	5570	1900	2740	568	561	1430
PTN-MW-9s	600	637	592	667	747	676	470	773
P-94-4	953	279	2950	2950	2010	3060	1690	2460

Readings are tritium in pCi/L
Sources: PTN 2015b for 2014 readings and PTN 2016b for 2015 readings

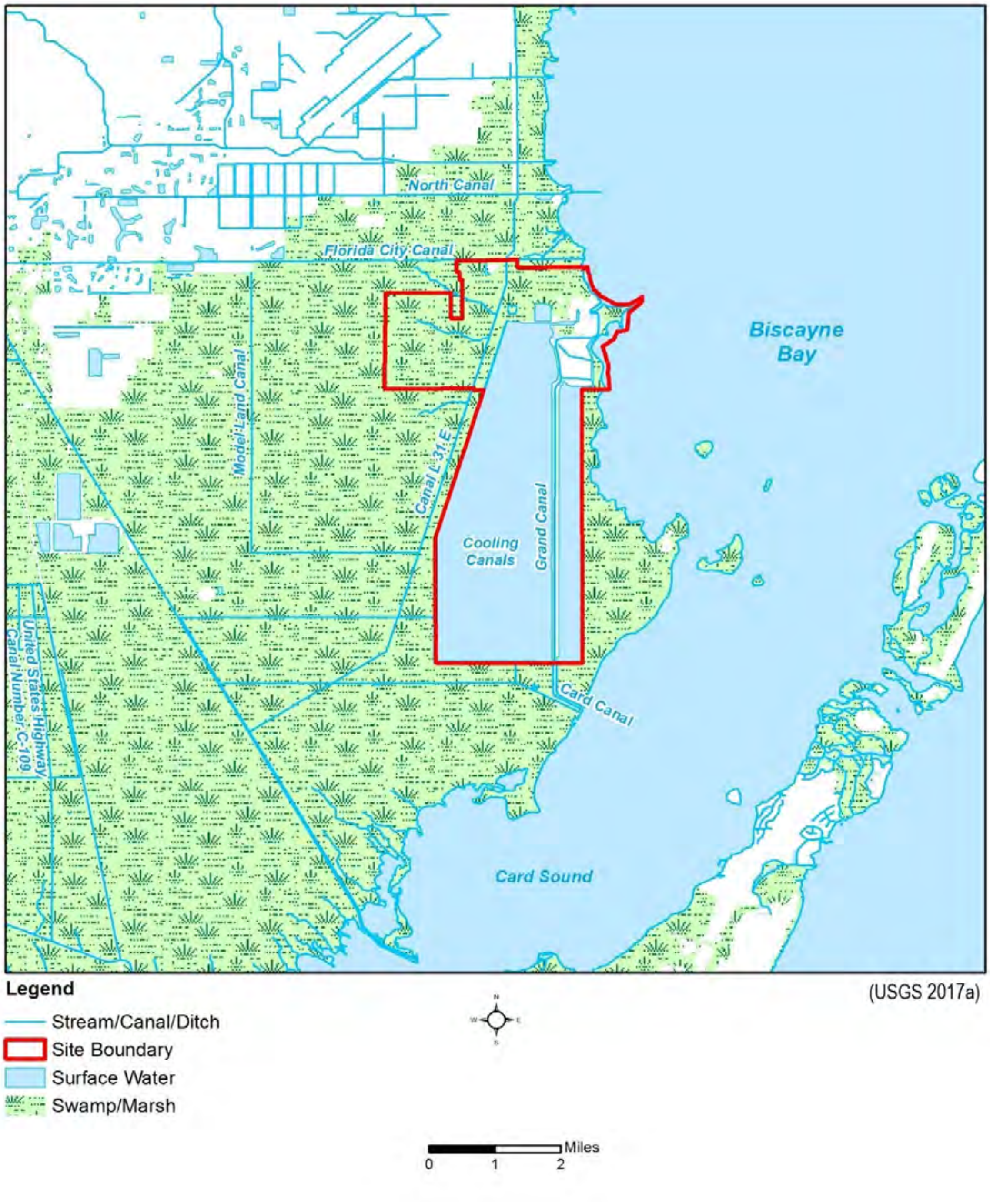

Figure 3.6-1
Regional Hydrologic Features

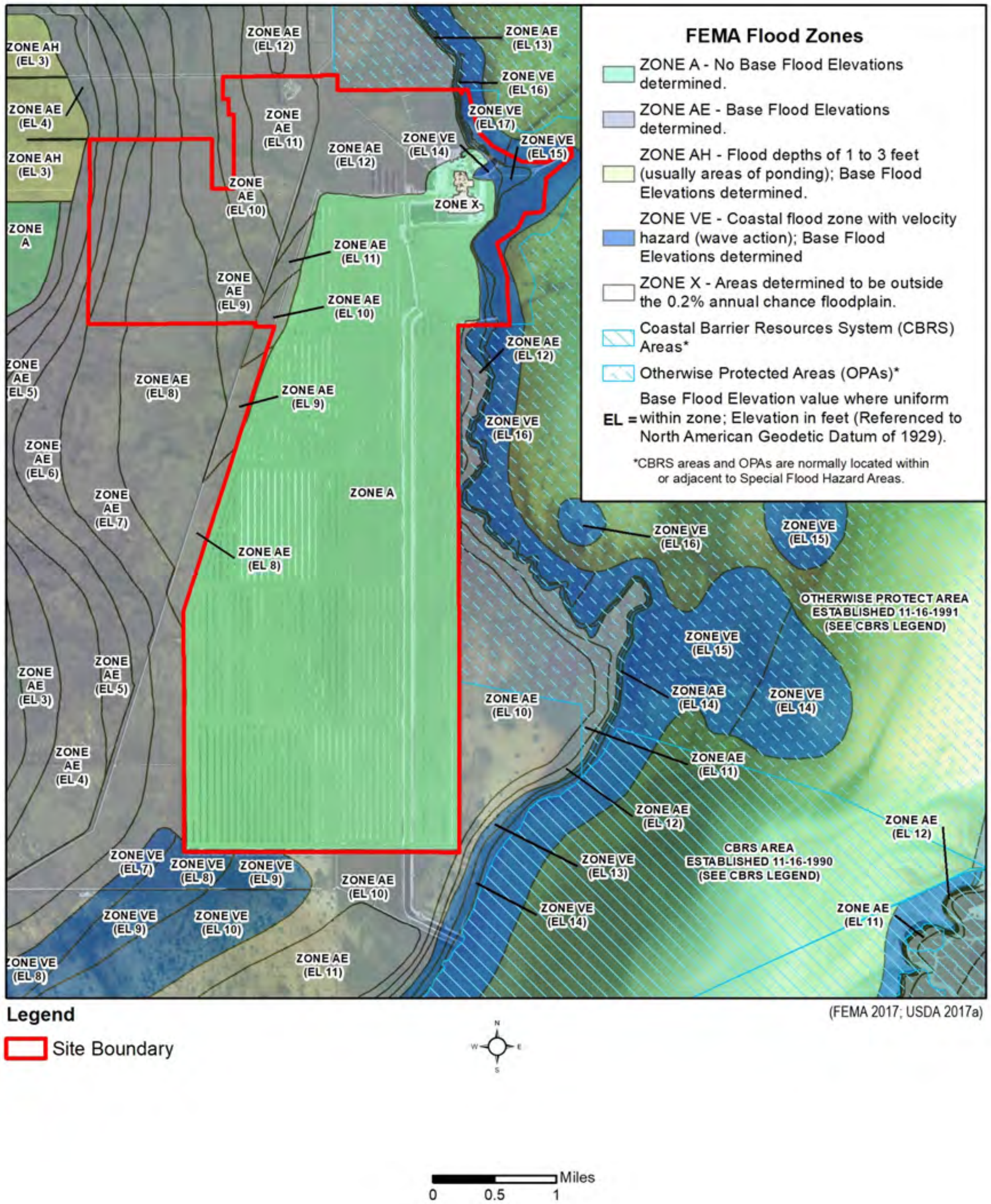

Figure 3.6-2
FEMA Flood Zones, Turkey Point Property

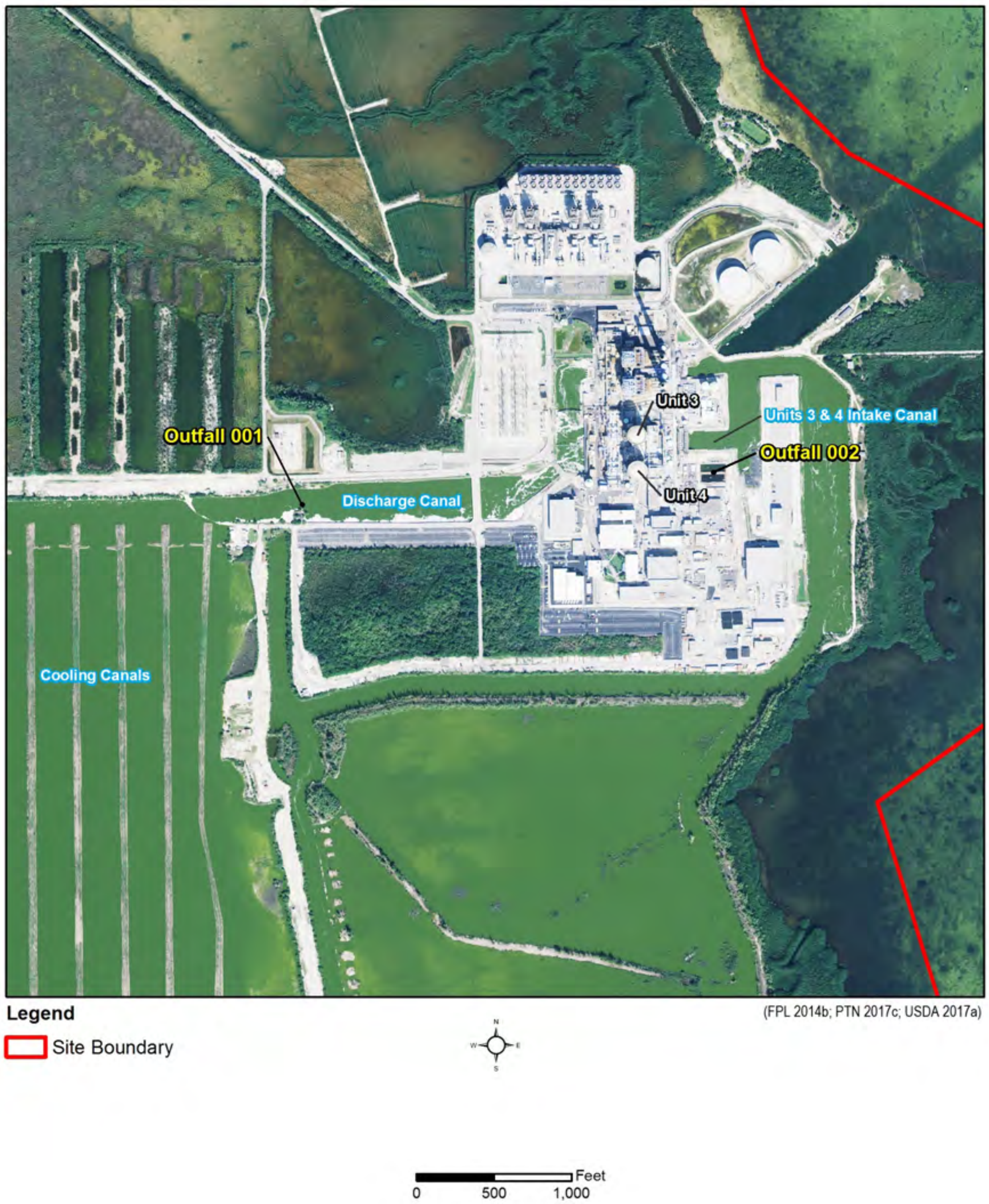

Figure 3.6-3
FDEP IWWW NPDES Permitted Outfalls

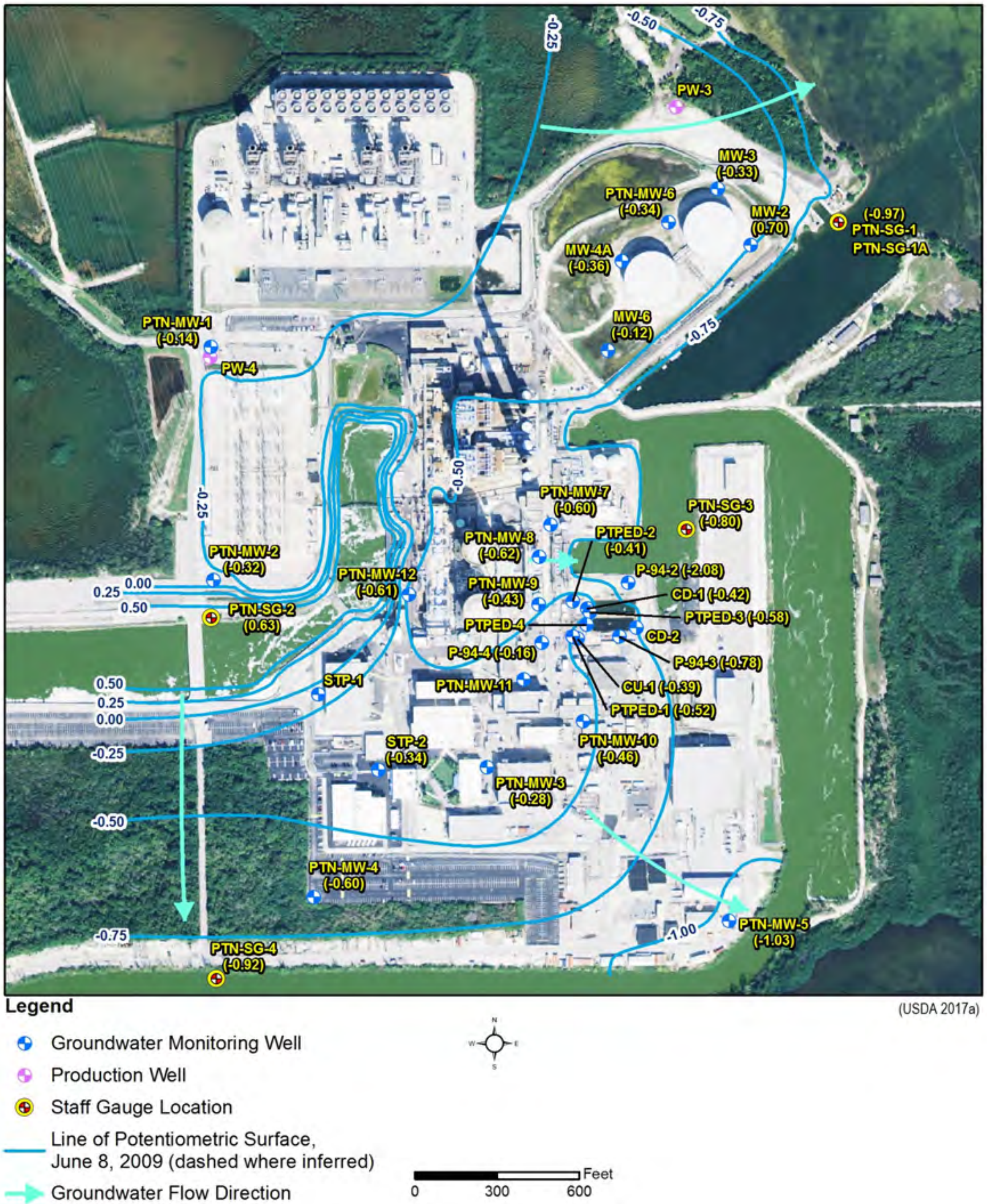

Figure 3.6-4
Turkey Point Potentiometric Surface Map
Low Tide Shallow Groundwater Elevation

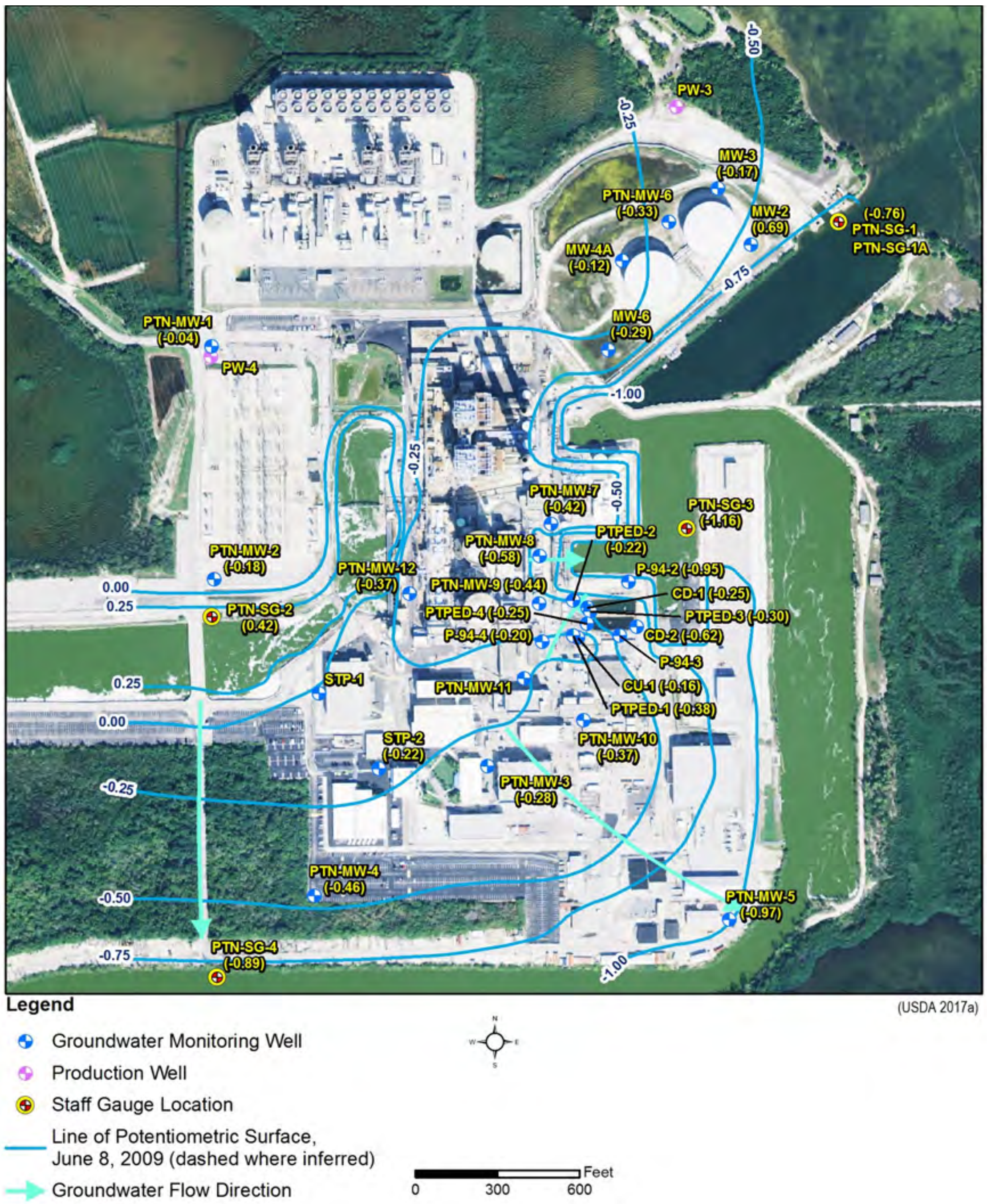

Figure 3.6-5
Turkey Point Potentiometric Surface Map
High Tide Shallow Groundwater Elevation

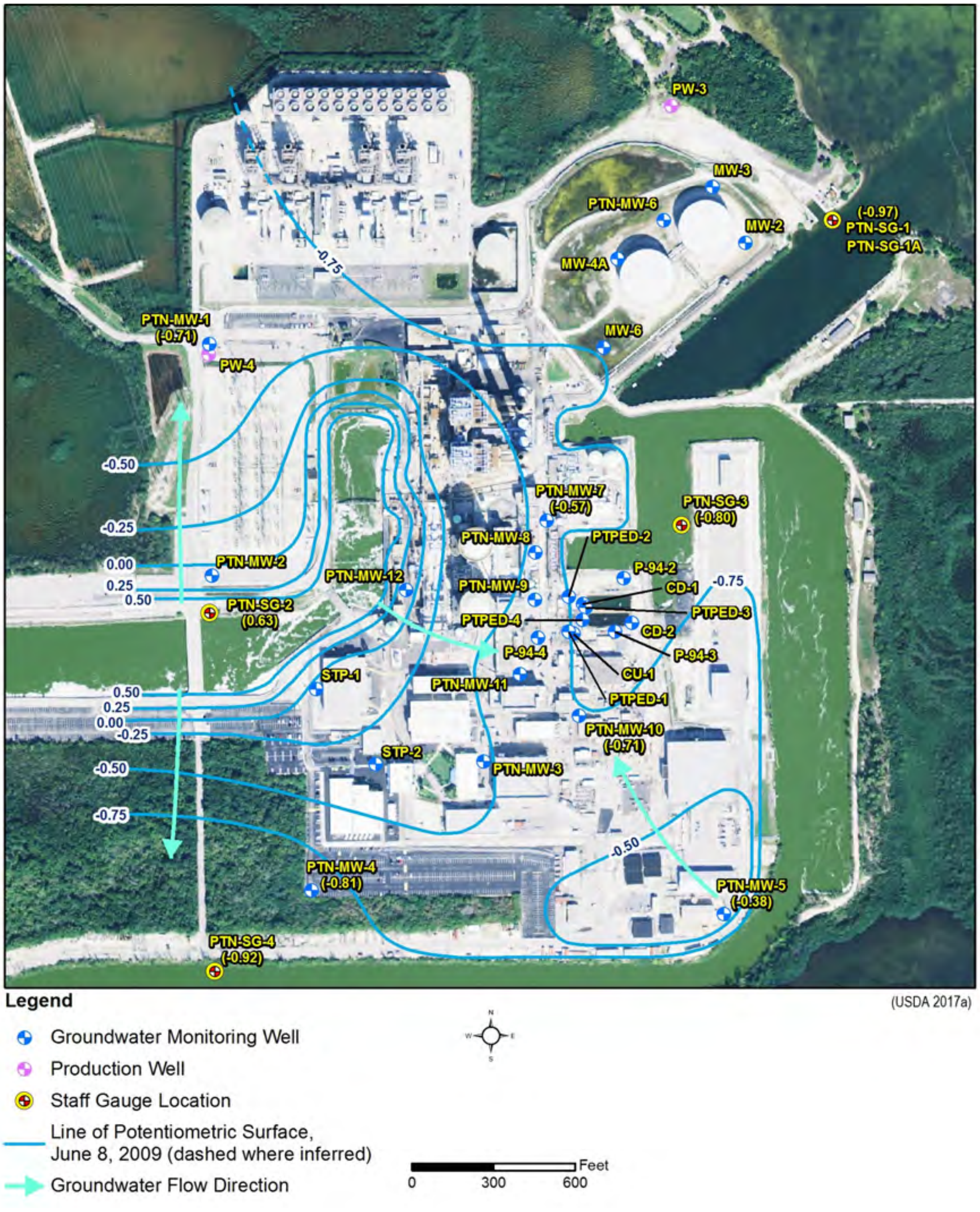

Figure 3.6-6
Turkey Point Potentiometric Surface Map
Low Tide Intermediate Groundwater Elevation

Figure 3.6-7
Turkey Point Potentiometric Surface Map
High Tide Intermediate Groundwater Elevation

Legend (USDA 2017a)

- Groundwater Monitoring Well
- Production Well
- Staff Gauge Location
- Line of Potentiometric Surface, June 8, 2009 (dashed where inferred)
- Groundwater Flow Direction

Feet: 0 300 600

Figure 3.6-8
Turkey Point Potentiometric Surface Map
Low Tide Deep Groundwater Elevation

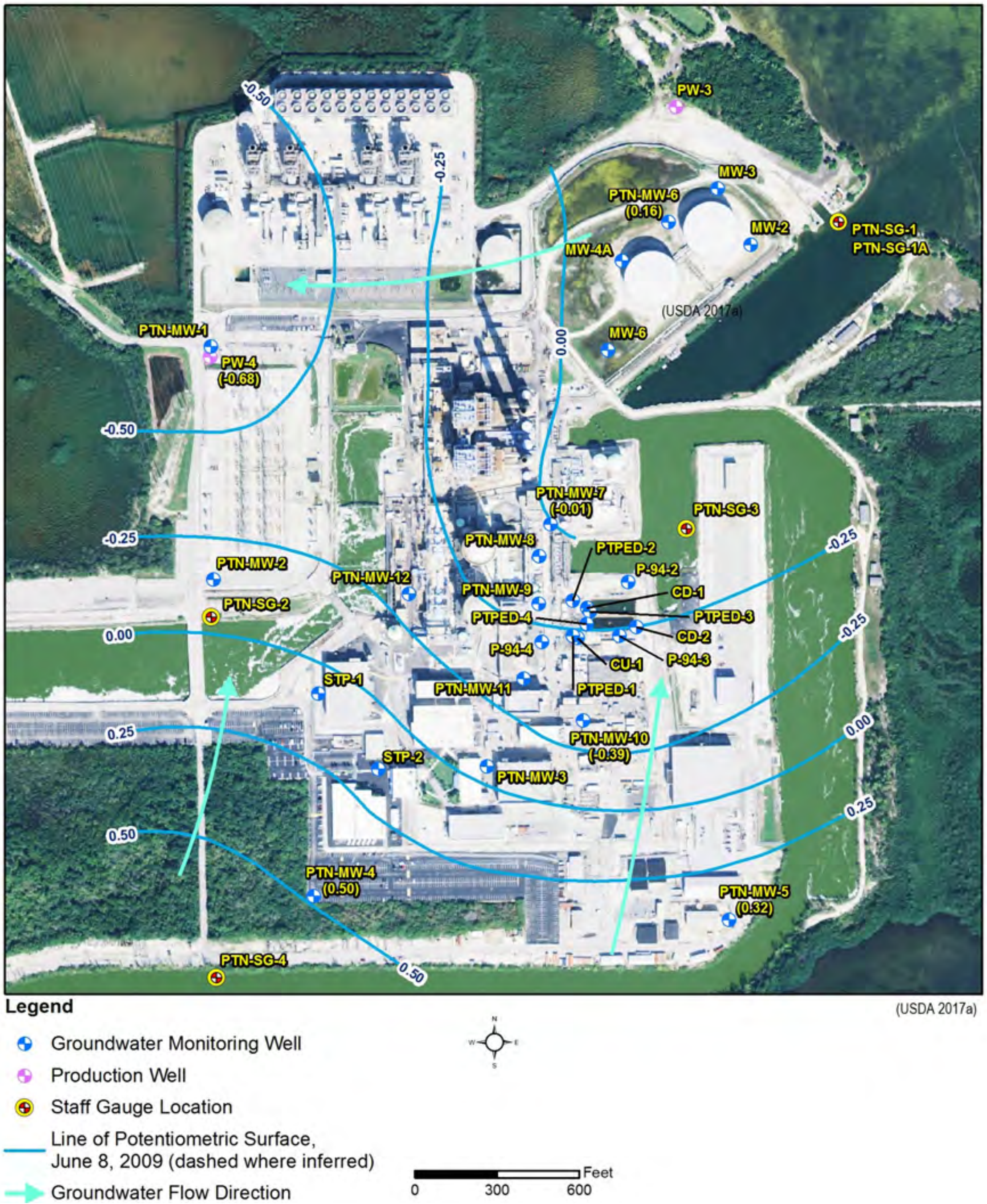

Figure 3.6-9
Turkey Point Potentiometric Surface Map
High Tide Deep Groundwater Elevation

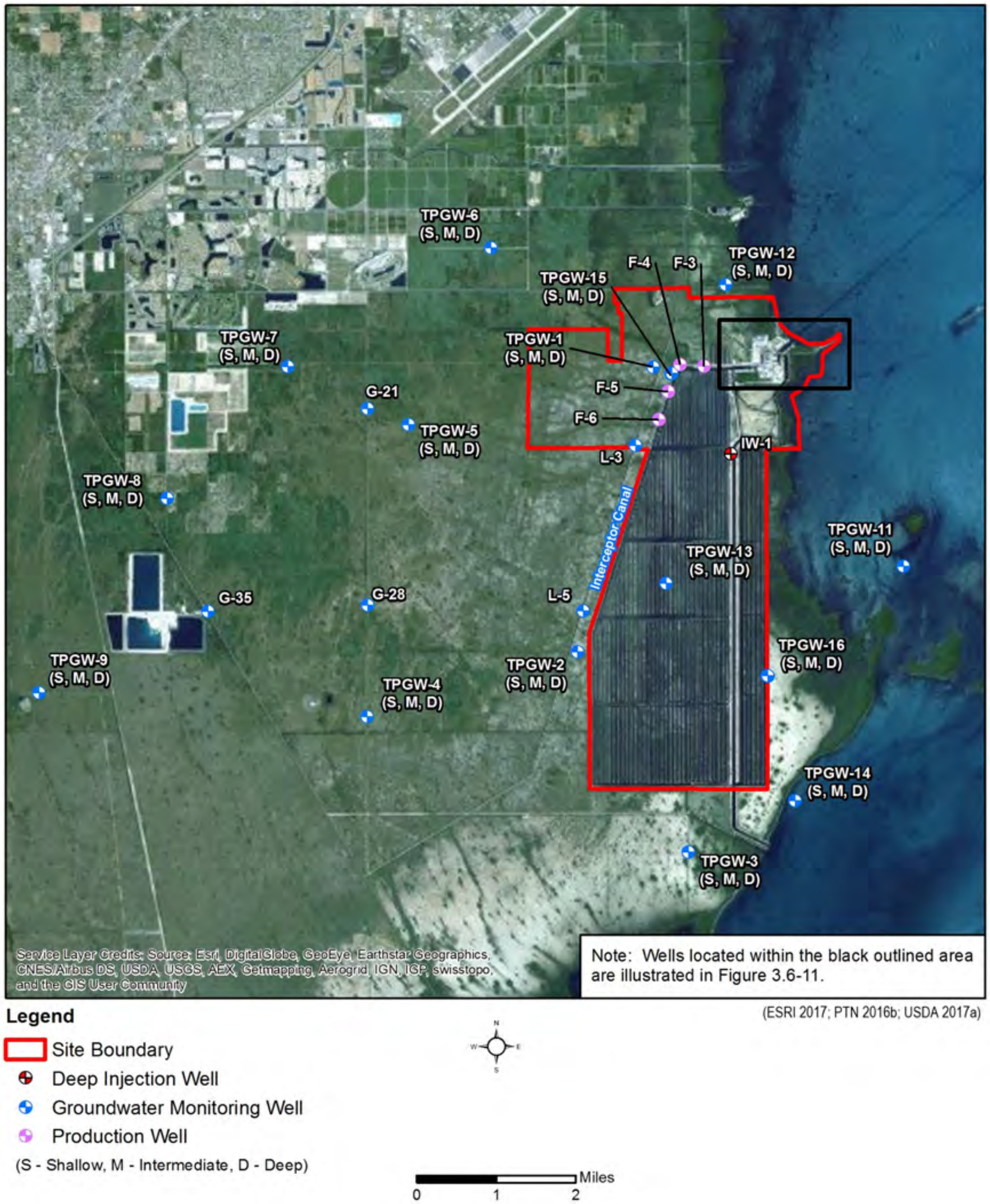

Figure 3.6-10
PTN Groundwater Monitoring, Injection, and Production Wells

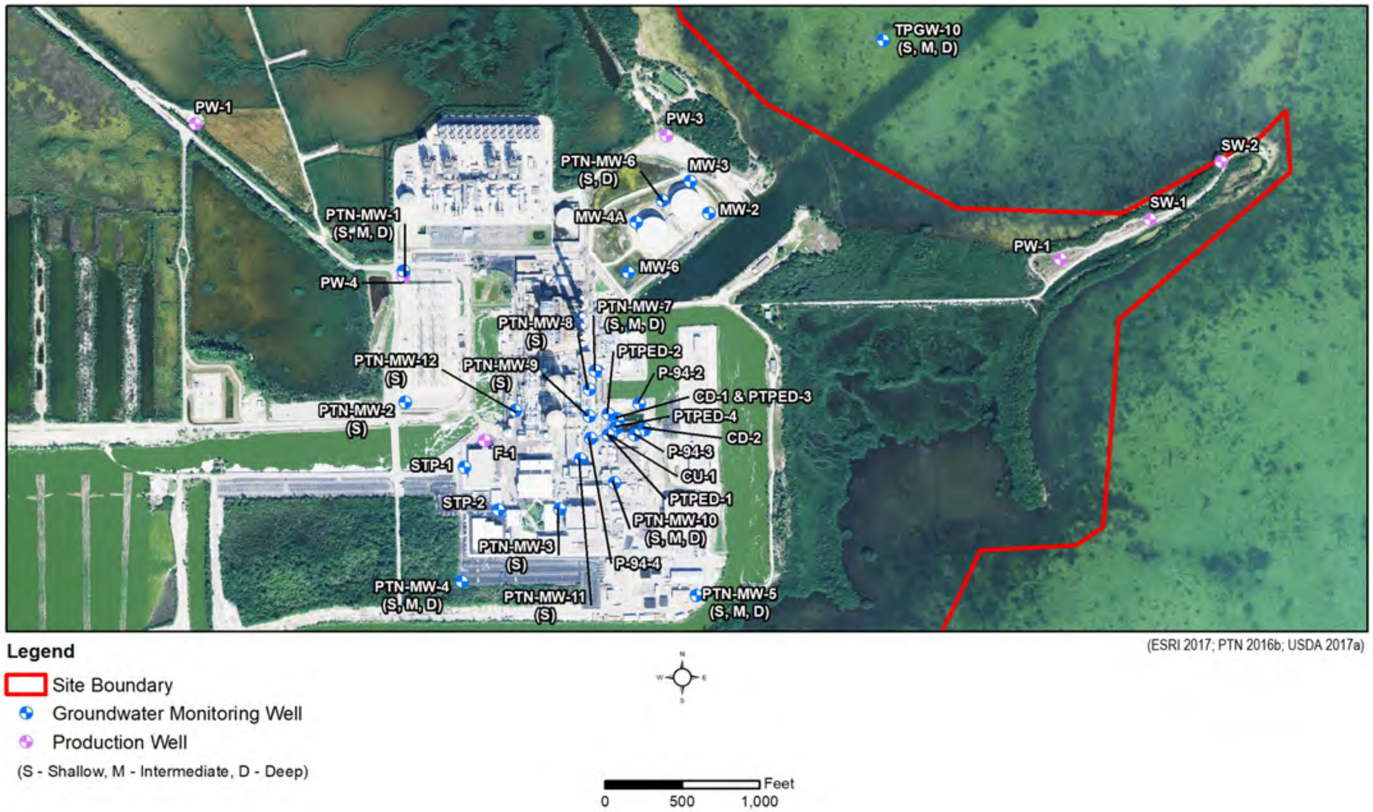

Figure 3.6-11
PTN Groundwater and Production Wells

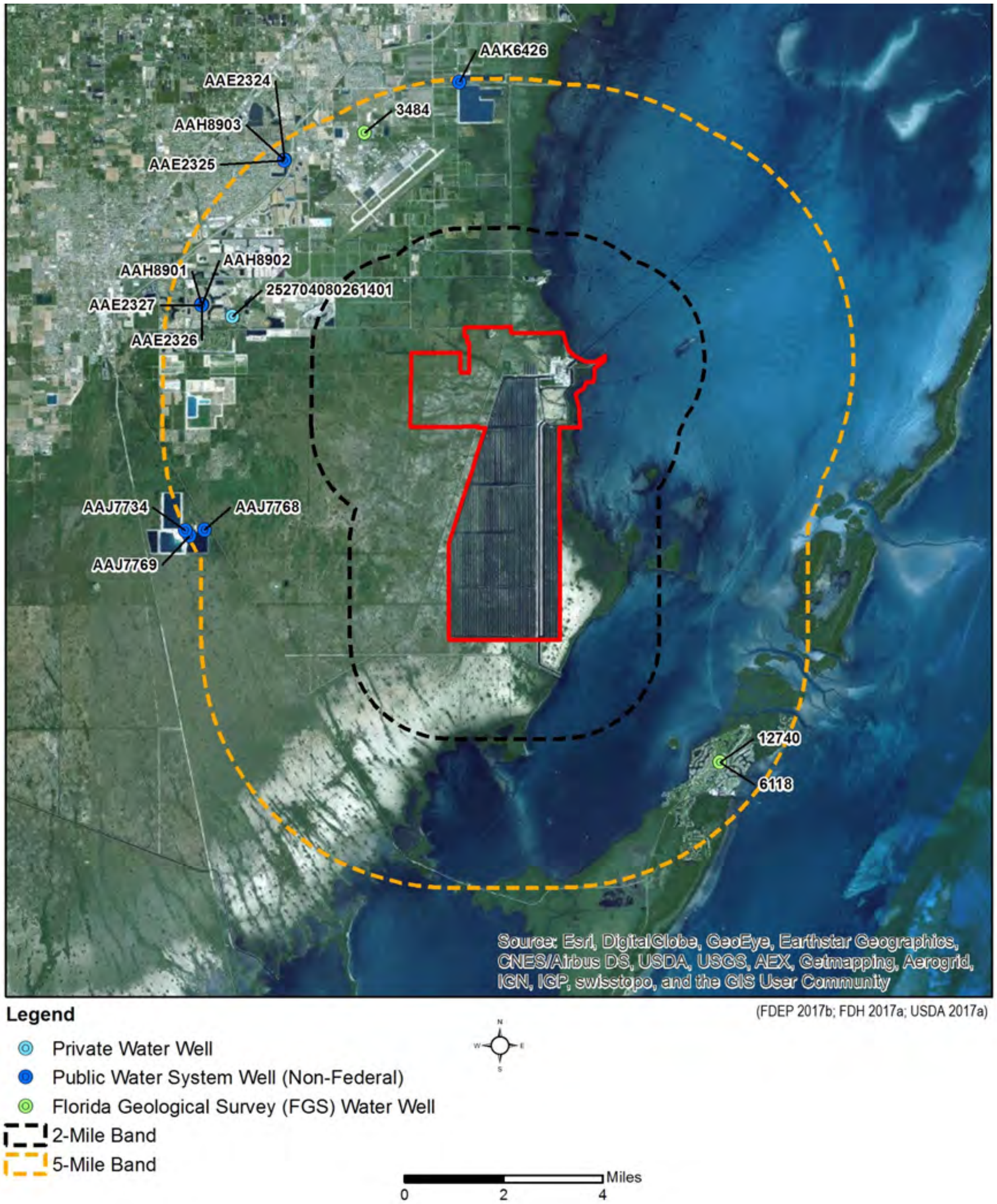

Figure 3.6-12
Registered Water Wells

3.7 Ecological Resources

This section describes the terrestrial and aquatic ecology of the site and vicinity that might be affected by the continued operation and maintenance of PTN. Detailed descriptions are provided where needed to support the analysis of potential environmental impacts resulting from continued operation of PTN. These descriptions support the evaluation of mitigation activities identified during the analyses to avoid, reduce, minimize, rectify, or compensate for potential impacts. Monitoring programs for terrestrial and aquatic environments are also described. Impacts to ecological resources are discussed in Section 4.6.

3.7.1 Aquatic Communities

This section describes the aquatic environment and biota near the Turkey Point site and other areas potentially affected by the continued operation of PTN. This section includes a description of the aquatic ecosystems at or near the site, a description of representative important species that are present or are expected to occur, and the location of sanctuaries, reserves, national parks, critical habitats, or other areas carrying special designation.

As described in Section 3.1, the Turkey Point site is located on the southeastern coast of Florida in unincorporated Dade County. Figure 3.1-3 shows the location of Turkey Point with respect to Biscayne Bay and Card Sound with the locations of the principal canal network near the area. Onsite aquatic resources include the CCS (IWW facility), surface water habitats and canal systems, and Biscayne Bay nearshore areas adjacent to the Turkey Point peninsula. Nearby offsite aquatic resources include Biscayne Bay, Biscayne National Park, Biscayne Bay Aquatic Preserve, Florida Keys National Marine Sanctuary, and Card Sound. Everglades National Park is located south and west of the site. (NRC 2016a, Section 2.4.2)

Prior to drainage and development activities, the wetland and aquatic ecosystems of southern Florida encompassed approximately 8.9 million acres, which included ridge and slough landscapes, sawgrass plains, cypress and mangrove swamps, and coastal lagoons and bays. This pre-drainage condition is characterized as a "hydrologically interconnected, slow-flowing system that extended from the Kissimmee River and Lake Okeechobee southward over low-gradient lands to the estuaries of Biscayne Bay, Ten Thousand Islands, and Florida Bay, and eastward and westward to the northern estuaries" (Ogden et al. 2005). Prior to development, Biscayne Bay possessed both marine and estuarine habitat and fauna. Construction of major canals and subsequent water drainage affected the salinity gradients and ecotones from the Everglades through coastal wetlands and tidal creeks into Biscayne Bay. Historical accounts suggest that prior to inlet and navigational dredging and related development, the northern and central portions of Biscayne Bay had much lower salinity conditions, low nutrient concentrations, and low turbidity/high light transmittance that promoted the presence of extensive seagrass meadows on the bay bottom. (NRC 2016a, Section 2.4.2)

Anthropogenic impacts over the last century have substantially altered the ecosystem and profoundly affected the three essential characteristics—salinity, nutrient concentrations, and turbidity—that defined historical conditions. (NRC 2016a, Section 2.4.2)

During the late 1800s and early 1900s, the lack of flood control was recognized as the principal impediment to development in southern Florida. Land was drained to support urban and agricultural development, and a series of canals was constructed to support flood control, water supply and retention, irrigation, and transport. In 1948, Congress authorized the creation of the Central and Southern Florida Flood Control Project—one of the largest water-management systems in the world. As a result of this and other projects, a substantial portion of the original wetland system in southern Florida has been lost or converted to support agriculture, urban development, and related infrastructure. These changes have dramatically reduced sheet flow and created pulsed point-source discharges of fresh water into estuarine and coastal wetland areas that are dissimilar in timing and duration to pre-development patterns. The effects of these changes include the creation of deeper water habitats within canal systems that have contributed to the spread of exotic and nuisance species, the creation of unnatural habitats for predatory fish and alligators, and unnatural reversals in wet and dry patterns. This substantially changed the dynamics of the system and resulting aquatic species compositions. (NRC 2016a, Section 2.4.2)

3.7.1.1 Aquatic Resources—Site and Vicinity

This section provides a general description of aquatic resources that are or could be present at or near the Turkey Point site. The surface water habitats associated with the PTN plant area include remnant and active canals and channels associated with operation of Units 1–4 (the CCS IWW facility), the L-31E Canal, the interceptor ditch, freshwater ponds on the berms, freshwater wetlands, hypersaline mudflats, and dwarf mangrove wetlands. (NRC 2016a, Section 2.4.2.1)

This section discusses aquatic species and habitats present on or near the Turkey Point site, including a discussion of the following:

- PAs such as sanctuaries, refuges, or preserves, if they may be adversely affected by plant or transmission line and pipeline building, or operation and maintenance.

- Habitats identified by state or federal agencies as unique, rare, or of priority for protection, if these areas may be adversely affected by plant or transmission line and pipeline building, operation, and maintenance, including areas that have been designated as habitat for an evolutionary significant unit, distinct population segment (DPS), critical habitat, or essential fish habitat (EFH).

3.7.1.1.1 *Onsite Aquatic Resources*

Cooling Canal System

See Section 3.7.3 for a discussion of the CCS (IWW facility) aquatic communities.

Other Onsite Waters

As part of the pre-application monitoring for proposed Units 6 and 7, a survey of fish species was conducted in June 2009 in areas that would be affected by building the proposed new units and in the canal leading into the plant, adjacent to Palm Drive. A variety of sampling gear was used, including minnow seines, cast nets, and minnow traps; entangling gear such as gill and trammel nets were avoided to protect resident American crocodile populations. Water quality measurements collected during sampling showed water temperatures ranged from 23.9 to 36.5°C, and salinity was above 50 ppt at six sampling stations and ≤ 1.5 ppt at two stations in sawgrass/mangrove habitats. Fish collection results showed the sheepshead minnow (*Cyprinodon variegatus*) to be the dominant species that occurred in seven of the eight sampling stations, representing 63 percent of the species composition. Sailfin molly (*Poecilia latipinna*) and goldspotted killifish (*Floridichthys carpio*) were present at the majority of the sampling stations and represented 20.8 percent and 9.9 percent of the species composition, respectively. The remaining species that occurred were less common and collectively represented about 6 percent of the species composition (Table 3.7-1). No fish were collected in the marsh/mangrove community adjacent to Palm Drive. All fish collected represented hardy species common to southern Florida; no rare, unusual, sensitive, or protected species were collected. (NRC 2016a, Section 2.4.2.1)

Turkey Point Nearshore Waters

Turkey Point is a narrow peninsula of land east of the Turkey Point facility that extends eastward into Biscayne Bay. Much of the area consists of previously filled areas and roadways with adjacent mangrove swamps. (NRC 2016a, Section 2.4.2.1)

Environmental studies in the vicinity of the Turkey Point site conducted by FPL in support of pre-application monitoring for proposed Units 6 and 7 have included a benthic macroinvertebrate study at three locations near the Turkey Point peninsula and three stations in Card Sound on March 18, 2009, and a seagrass study along 26 transects around the peninsula on August 11 and 12, 2009. (NRC 2016a, Section 2.4.2.1)

Methods used during the benthic invertebrate sampling study included the collection of three replicate benthic samples at each station using a diver-operated core sampler with a surface area of 225 square centimeters (cm^2). Samples were collected along a single transect line at 250, 500, and 750 feet from shore. Summary information shows that crustaceans, mollusks, and polychaetes accounted for 90 percent of the total individuals collected, and the highest abundances were generally observed at the sampling station 250 feet from shore (Table 3.7-2). Numerically predominant species at the Turkey Point transect stations included the polychaetes *Fabrinicinuda trilobata* and *Exogone dispar*, the mollusk *Caecum pulchellum*, and the amphipod *Shoemakerella cubensis.* (NRC 2016a, Section 2.4.2.1)

The seagrass survey around the Turkey Point peninsula was conducted on August 11 and 12, 2009, by FPL. The survey encompassed a total area of approximately 49 hectares and included

26 transects surrounding the Turkey Point peninsula. Transects were approximately 300 meters long and spaced approximately 50 meters apart. At each transect, divers recorded the seagrass conditions (species and percent cover) at the shoreward and seaward end of each transect and at 50-meter intervals in between, giving a total of seven observation locations per transect. At each location, seagrasses were identified to species, and their percent cover was visually estimated. The Braun-Blanquet method was used to estimate percent cover and species contribution. (NRC 2016a, Section 2.4.2.1)

Two species of seagrass were documented in the study area: turtle grass (*Thalassia testudinum*) and shoal grass (*Halodule wrightii*). Turtle grass was the more abundant of the two species. Turtle grass coverage was highest in areas immediately surrounding the peninsula and generally decreased with increasing distance from shore. Average Braun-Blanquet coverage was estimated to be 25 to 50 percent. Shoal grass was less abundant and generally more restricted in its distribution, occurring most often in shallow water near the shoreline. Braun-Blanquet coverage was estimated to be less than 5 percent and was completely absent at most sampling stations. Various species of macroalgae were also observed during the survey, including green microalgae (*Halimeda* spp.), *Penicillius* spp., ornate fan algae (*Udotea* spp.), and red algae (*Laurecia* spp.), which at times approached 100 percent coverage over some sampling locations. (NRC 2016a, Section 2.4.2.1)

During subsequent sampling events, conducted biannually by FPL for the purpose of post-uprate monitoring between 2013 and 2017, turtle grass and shoal grass remained the dominant species identified on the study transects. During the first fall event (2013), coverage on the inshore transect increased considerably, up to about 50 percent as abundant as grasses on the offshore transect. Thereafter, inshore coverage continued to increase, and differences between transects diminished; turtle grass was present in 95 percent of all quadrats during both the fall 2016 and spring 2017 sampling events. Shoal grass was less widespread than turtle grass. The percentage of quadrats containing shoal grass ranged from 34 to 56 percent.

Turkey Point Barge-Turning Basin

The barge-turning basin was developed in association with the original Units 1 and 2 and is used for transport of material and large components to the Turkey Point site. Historically the basin was also used for delivery of fuel oil to maintain existing units. The turning basin is 300 feet by 1,200 feet and approximately 18 feet deep, with entrance channel depths between 8 and 12 feet. When surveyed in 2008 for submerged aquatic vegetation, the turning basin was found to have sparse, patchy seagrass beds that primarily occur along the northern shore of the basin. FPL documented a total of 170 square feet (0.004 acres) of seagrass which was turtlegrass and shoal grass, with patch densities of 5 to 20 percent coverage in several small areas. Green algae (*Caulerpa paspaloides var. laxa*) and algae (*Acetabularia calyculus*) were also documented: green algae occurred along the southern edge of the basin and northeastern shore of the basin in areas of approximately 24 square feet, and the algae co-occurred with green algae in the same area of the northeastern shore. (NRC 2016a, Section 2.4.2.1)

FPL has submitted a joint application to the FDEP and USACE for fill activities within the barge canal. The canal was previously dredged to approximately -20 to -28 feet NAVD88 during the original construction of the plant to allow once-through cooling water from Units 1 and 2 to be discharged to the bay. The construction of the CCS replaced the need for the original cooling water discharge. Cooling water is no longer discharged, and the remnant canal has been plugged. The remnant canal and the adjacent area of scour are proposed to be backfilled to improve water quality in Biscayne Bay (FPL 2016d).

To support the permit application, FPL performed onsite surveys in May of 2016 in the turning basin and surrounding areas to document ecological communities, including submerged aquatic vegetation (SAV), mangroves, and adjacent uplands. The evaluation included the turning basin and the confluence of the turning basin with Biscayne Bay.

The results of the SAV surveys found that there is no SAV cover documented in the turning basin. In general, barren substrate or epibenthic cover (microalgae) of less than 1 percent was encountered in areas deeper than -7 feet. Microalgae cover was persistent in the -5 to -7 foot elevation range, while seagrass was generally encountered at -5 feet or less elevation. (FPL 2016d)

As recorded during the survey, two species of seagrass (*Thalassia testudinum* and *Halodule wrightii*) were identified as occurring outside of the turning basin. *Thalassia testudinum* is the dominant seagrass species within the survey area, with percent coverage ranging from less than 5 percent to greater than 75 percent. Minimal coverage of *Halodule wrightii* (less than 5 percent cover) was recorded along the fringe of the seagrass community. Additional epibenthic functional groups, such as stony corals, sponges, or gorgonians, were not observed in the survey area. (FPL 2016d)

Mature mangroves are present along the three banks of the Turtle Point Canal (TPC). Coverage is generally uninterrupted and is characterized by a narrow zone of red mangroves (*Rhizophora mangle*). Several narrow canopy openings were noted along the southern and western banks, allowing for access to the TPC. White mangrove (*Laguncularia racemosa*), black mangrove (*Avicennia germinans*), and buttonwood (*Conocarpus erectus*) were also noted along the narrow mangrove fringe. (FPL 2016d)

The uplands adjacent to the project site consist of shell rock roads constructed to provide access to the CCS. The uplands are historically filled lands that provide minimal habitat for native species. (FPL 2016d)

3.7.1.1.2 *Offsite Aquatic Resources*

Offsite aquatic resources consist of Biscayne Bay and its associated park and preserve; the Florida Keys National Marine Sanctuary; Card Sound and Canal; the Everglades Mitigation Bank, Model Lands Basin, and Southern Glades Addition; as well as Everglades National Park and the Crocodile Lake National Wildlife Refuge.

Biscayne Bay, Biscayne National Park, Biscayne Bay Aquatic Preserve

Biscayne Bay, including the regions encompassing Biscayne National Park and Biscayne Bay Aquatic Preserve, is a shallow subtropical saline lagoon that extends the length of Miami-Dade County (Figure 3.1-3). The eastern edge of the bay is bordered by a series of barrier islands that form the Florida Keys in Monroe County and (from north to south) Virginia Key, Key Biscayne, Soldier Key, and Boca Chita Key in Miami-Dade County. The western boundary of the bay is mainland, and the northern boundary of the bay near Miami is highly urbanized. Connection to the Atlantic Ocean is greatest north of Boca Chita where open access to the ocean is present in an area called "the Safety Valve," and most restricted in the southern bay at Card Sound and Barnes Sound due to the presence of Key Largo and associated barrier islands. The average depth of the bay is approximately 5 feet at mean lower low water; its maximum depth is approximately 13 feet. Salinity is highly variable, ranging from approximately 24 to 44 ppt, and highly influenced by rainfall and the point-source discharges of the existing canal systems. (NRC 2016a, Section 2.4.2.1)

Annual natural water temperatures range from approximately 59°F to 92°F (15°C to 33°C) at the surface. The shallow depths of the bay and maximum spring tidal range of 0.9 meters (3 feet) result in a vertically well-mixed system with weak stratification except in Biscayne Bay at the mouths of drainage canals. (NRC 2016a, Section 2.4.2.1)

Biscayne National Park, first established in 1968 as a national monument, was expanded in 1980 to approximately 173,000 acres of water, coastal lands, and 42 islands. Activities such as boating, snorkeling, and recreational and commercial fishing are allowed in the park, and numerous environmental studies are conducted or sponsored by the National Park Service (NPS) to assess the condition of natural resources within park boundaries and provide information to support preservation and restoration activities. The Biscayne Bay Aquatic Preserve includes 67,000 acres of sovereign submerged lands in Biscayne Bay and is managed by the FDEP's Office of Coastal and Aquatic Managed Areas. Waters within the preserve are designated as an Outstanding Florida Water, which affords special protection because of their natural attributes. A portion of the preserve is located approximately 0.5 miles east of Turkey Point. (NRC 2016a, Section 2.4.2.1)

As noted above, Biscayne Bay was hydrologically connected to the greater Everglades ecosystem through a series of tributaries, sloughs, and groundwater flow, and possessed both estuarine and marine habitats. Subsequent development of an extensive canal system has substantially changed the hydrodynamics, resulting in pulsed discharge of fresh water into the bay via point-sources at intervals that are dissimilar in timing and duration to pre-development patterns. As a result, large discharges now occur during the wet season (May through October), and less fresh water reaches the bay during the dry season (November through April). Freshwater discharge has contributed to bottom scouring, rapid salinity fluctuations, and changes in benthic and nearshore habitats that affect the growth, survival, and reproduction of many species. (NRC 2016a, Section 2.4.2.1)

Biscayne Bay in its present form supports a dynamic assemblage of fish, invertebrates, marine mammals, and extensive seagrass beds. At least seven species of seagrass occur in Biscayne Bay, and seagrass has been documented to cover up to 64 percent of the bay bottom. Common seagrass species include turtle grass, shoal grass, manatee grass (*Syringodium filiforme*), widgeongrass, and three species of *Halophila*, including *H. johnsonii*, which is a federally protected species. Coastal mangrove communities are also present and provide important habitat for many estuarine fish and invertebrate species. In a study from 1998 to 2005, mangrove-lined shorelines of Biscayne Bay were documented as used by subadult and adult gray snapper (*Lutjanus griseus*), juvenile great barracuda (*Sphyraena barracuda*), and adult goldspotted killifish. Species of special relevance and utility for monitoring and assessment of Biscayne Bay included pink shrimp (*Farfantenaeus duorarum*), blue and stone crabs (*Callinectes sapidus* and *Menippe mercenaria*), oysters (*Crassostrea* spp.), estuarine fish communities, common bottlenose dolphin (*Tursiops truncatus*), American crocodile, Florida manatee, and wading birds. (NRC 2016a, Section 2.4.2.1)

Representative marine species identified to assess the condition of marine resources in Biscayne National Park included spiny lobster (*Panulirus argus*), red grouper (*Epinephelus morio*), red drum (*Sciaenops ocellatus*), and gray snapper. (NRC 2016a, Section 2.4.2.1)

During the process of developing the salinity target for western portions of Biscayne Bay, the NPS identified six taxa considered to be highly dependent on estuarine salinities: the American crocodile, the spotted seatrout (*Cynoscion nebulosus*), mojarra (*Eucinostomus spp.*), silver perch (*Bairdiella chrysoura*), pink shrimp, and eastern oyster (*Crassostrea virginica*). Additional information about the spatial and temporal distribution, relative abundance, and life history characteristics of 40 fish and invertebrate species in 20 estuaries along the Atlantic coast of North Carolina, South Carolina, Georgia, and Florida (including Biscayne Bay) is provided in the NPS salinity targets for Biscayne Bay (NPS 2006). Of the 40 species included in the assessment, 20 were either not present or were considered rare in Biscayne Bay, including the blue mussel (*Mytilus edulis*), common ranga (*Rangia cuneata*), white shrimp (*Litopenaeus setiferus*, formerly *Penaeus setiferus*), Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), blueback herring (*Alosa aestivalis*), and alewife (*A. pseudoharengus*). Nineteen species were common or highly abundant as adults, spawning adults, juveniles, larvae, or eggs in salinities ranging from 0.5 to greater than 25 ppt (Table 3.7-3). This list, and the information above, represent a reasonable starting point for identifying ecologically, recreationally, or commercially important species in Biscayne Bay that may be affected by the operation of PTN (NRC 2016a, Section 2.4.2.1).

<u>Florida Keys National Marine Sanctuary</u>

The Florida Keys National Marine Sanctuary, designated on November 16, 1990, is one of 14 marine PAs in NOAA's National Marine Sanctuary System. Sanctuary borders encompass 2,900 square miles of water surrounding the Florida Keys extending from south of Miami to the Dry Tortugas, excluding Tortuga National Park (NRC 2016a, Section 2.4.2.1). The sanctuary includes all of Card Sound and a slender area of Biscayne Bay to the east of Biscayne National Park. Biscayne National Park's eastern and southern boundaries are sanctuary boundaries as well. Natural features within sanctuary boundaries include extensive seagrass beds, mangrove-fringed islands, and the world's third-largest barrier reef. NOAA estimates more than 6,900 species of marine life are found in the waters of this sanctuary. (NRC 2016a, Section 2.4.2.1)

Card Sound

Card Sound is a shallow bay south of the Turkey Point site (Figure 3.1-3) wholly within the Florida Keys National Marine Sanctuary with limited connection to the Atlantic Ocean. The mangrove forests surrounding Card Sound are part of the longest continuous stretches of mangroves remaining on the eastern coast of Florida, and they serve as food and refuge for approximately 70 percent of the area's commercially and recreationally important marine species. Both Biscayne Bay and Card Sound are nursery areas for the spiny lobster, and the area from Cape Florida near Key Biscayne south to Card Sound is designated as the Biscayne Bay-Card Sound Lobster Sanctuary by the State of Florida. (NRC 2016a, Section 2.4.2.1)

In 2008 and 2009, Ecological Associates, Inc. (EAI) conducted a study in Card Sound near the Turkey Point site to characterize fish and shellfish resources. Sampling was conducted every other week from March 4, 2008, to February 17, 2009, for a total of 26 sampling events at three locations along the western shore of Card Sound near the southern boundary of Biscayne Bay. Trawl samples were used to collect juvenile and adult fish and shellfish; towed nets were used to collect icthyoplankton and shellfish larvae. Table 3.7-4 provides a summary of the baseline aquatic resource sampling results for fish in Card Sound and Card Sound Canal in 2008–2009. During the fish survey, a total of 4,679 individual fish were captured; the overall catch per unit effort was 7.5 specimens captured per 100 meters trawled. Seventeen species accounted for 90 percent of the total captured in that study; pinfish were the most numerous (Table 3.7-4). (NRC 2016a, Section 2.4.2.1)

During the March 2008 to February 2009 sampling period, a total of 2,063 shellfish were collected with an overall catch per unit effort of 3.3 specimens per 100 meters trawled. Four species accounted for 90 percent of the total captured; pink shrimp were the most abundant, followed by other penaeid shrimp (*Farfantepenaeus* spp.), ornate blue crab (*Callinectes ornatus*), and Caribbean spiny lobster (*Panulirus argus*) (Table 3.7-5). (NRC 2016a, Section 2.4.2.1)

Icthyoplankton samples were collected from Card Sound between March 2008 and February 2009. For the assessment of fish egg abundance, a total of 26,277 eggs were collected from 3,991.6 cubic meters (m^3) of water, resulting in an overall density of 6.6 eggs per m^3. The majority of fish eggs were unidentified; approximately 12 percent were determined to be herring eggs. Fish larvae sampling identified a total of 3,152 fish larvae representing 47 taxa in plankton samples, resulting in an average of 0.8 larvae per m^3 of water. Larvae of gobies (family Gobiidae) accounted for approximately 22 percent of the total captured, followed by herring and blennies (family Labrisomidae and Chaenopsidae). In all, 10 taxa represented 90 percent of the total numbers collected (Table 3.7-6). (NRC 2016a, Section 2.4.2.1)

The March 18, 2009, invertebrate study also included collections from three transects in Card Sound near the southern end of the Turkey Point site. Crustaceans were the most numerically abundant taxa, followed by mollusks and polychaetes (Table 3.7-7). The 2008–2009 sampling of Card Sound was concluded to be comparable to previous studies in Biscayne Bay. (NRC 2016a, Section 2.4.2.1)

Everglades Mitigation Bank, Model Lands Basin, and Southern Glades Addition

The Everglades Mitigation Bank is a 13,000-acre expanse of freshwater and estuarine wetlands west and south of the CCS (Figure 3.1-5). The mitigation bank is owned and operated by FPL and is used as a commercial mitigation bank with wetland habitat credits that can be purchased to offset regional wetland impacts. The Model Lands Basin and Southern Glades Addition are also located to the west and south of the Turkey Point site. These areas represent a collaborative effort by the Environmentally Endangered Lands Program of Miami-Dade County and the Save Our Rivers (SOR) Program of the SFWMD to restore the natural environments of Biscayne Bay and its watershed. This area encompasses approximately 34,000 acres of freshwater and coastal wetlands, excluding the land reservations by RMC South Florida, Inc. and FPL for permitted industrial and/or mitigation uses. These areas serve as habitat and refuge for a variety of birds, fish, reptiles, amphibians, and mammals, including numerous federal and state threatened or endangered species. Key management issues in these locations include the continuing loss of habitat in adjacent areas due to land use conversion, the presence of invasive and exotic species, and damage associated with unauthorized public use, including the discharge of firearms and solid waste dumping. (NRC 2016a, Section 2.4.2.1)

Everglades National Park and Crocodile Lake National Wildlife Refuge

Everglades National Park is located south and west of the Turkey Point site and encompasses 2,353 square miles of wetlands, uplands, and submerged lands. The distance from the western border of the park to the boundary of the Turkey Point site ranges from 6 to 13 miles. The park was authorized by Congress in 1934 and established in 1947 to protect the biological resources of the southern Everglades ecosystem. Important ecosystem features of Everglades National Park include sawgrass sloughs, tropical hardwood hammocks, mangrove forests, and numerous lakes, ponds, and bays that sustain many state and federally listed threatened and endangered species. Nearly 300 species of fish inhabit the freshwater marshes and marine coastlines of Everglades National Park, and fishing is popular within park boundaries. American alligator (*Alligator mississippiensis*), American crocodile, and sea turtles are found in the park. Marine mammals documented within park boundaries include pilot whales (*Globicephala macrorhyncha*), common bottlenose dolphin, and Florida manatee. (NRC 2016a, Section 2.4.2.1)

The Crocodile Lake National Wildlife Refuge was established in April 1980 and currently covers 6,700 acres, including 650 acres of open water. It contains a mosaic of habitat types including tropical hardwood hammock, mangrove forest, and salt marsh. These habitats are vital for hundreds of plants and animals, including eight federally listed species, such as crocodiles and other wildlife requiring mangrove habitats. (USFWS 2015a)

3.7.1.1.3 *Ecologically, Commercially, and Recreationally Important Species*

Table 3.7-8 lists species considered to be ecologically, commercially, and recreationally important to Biscayne Bay in the vicinity of the Turkey Point site based on the data and information presented above and past studies. These species contribute to the structure and function of Biscayne Bay. Table 3.7-8 also includes non-native and invasive species that occur in Biscayne Bay and have the potential to influence ecosystem dynamics. Federally and state-listed species are discussed later in this section. Brief descriptions of the life histories of species presented in Table 3.7-8 follow below. The susceptibility of these species to adverse impacts associated with the continued operation of PTN is discussed in Chapters 4 and 5. Separate discussions are provided for federally or state-listed species, and for those species with designated EFH. (NRC 2016a, Section 2.4.2.3)

Marine Mammals

The Biscayne Bay stock of common bottlenose dolphins is bounded to the north by Haulover Inlet (north of Miami) and to the south by the Card Sound Bridge, south of the Turkey Point site. Population trend data are not available for the Biscayne Bay stock, but NOAA initiated a photo-identification project for this species in 1990. Threats to dolphins include coastal pollution, fatal interactions with crab and lobster pots, and entanglement in fishing gear. As discussed below, Florida manatee are also present in Biscayne Bay. Marine mammals may also be sensitive to noise and vibration associated with nearshore construction. (NRC 2016a, Section 2.4.2.3)

Game Fish

Examples of game fish common to Biscayne Bay in the vicinity of the Turkey Point site include common snook, tarpon, spotted seatrout, red drum, and red grouper (Table 3.7-8). Many of these species have been included in monitoring programs to assess the condition of Biscayne Bay or were numerically abundant in recent collections near the Turkey Point site. (NRC 2016a, Section 2.4.2.3).

Common Snook (*Centropomus undecimalis*)

Common snook can tolerate a wide range of salinities but cannot tolerate water temperatures below 60°F. The lower lethal limit of water temperatures is 48.2 to 57.2°F for juveniles and 42.8 to 53.6°F for adults. Primary prey of common snook include small fish, crabs, and mollusks. (NRC 2016a, Section 2.4.2.3)

Tarpon (*Megalops atlanticus*)

Tarpon are common in coastal waters from Virginia to central Brazil, inhabiting coastal waters, bays, estuaries, and mangrove-lined lagoons. Tarpon are also tolerant of low dissolved oxygen conditions and a wide range of salinities (0 to 47 ppt) but prefer water temperatures ranging from 72 to 82°F. Juveniles are planktiverous, while adults are carnivorous, feeding on a variety of smaller fish, shrimp, and crab. Only recreational tarpon fishing is allowed in Florida. (NRC 2016a, Section 2.4.2.3)

Spotted Seatrout (*Cynoscion nebulosus*)

The geographical range of spotted seatrout is limited to the western Atlantic from Cape Cod, Massachusetts, to southern Florida and the Gulf of Mexico. In Biscayne Bay, adults, spawning adults, juveniles, larvae, and eggs are present in salinities ranging from 0.5 to greater than 25 ppt. During the summer months, seatrout are found in seagrass beds, moving to deeper pockets of water in estuaries during the cooler months. Migration out of nursery estuaries is rare. (NRC 2016a, Section 2.4.2.3)

Red Drum (*Sciaenops ocellatus*)

The red drum is a euryhaline species found along the Atlantic and Gulf of Mexico coasts from Cape Cod, Massachusetts, to Tuxpan, Mexico. Red drum are found in a variety of habitats, including estuaries, river mouths, bays, and seagrass beds. Adults are generally found in salinities of 30 to 35 ppt and are tolerant of temperatures ranging from 39 to 83°F. A popular recreational species, the red drum is also harvested commercially and has been used in commercial aquaculture operations. (NRC 2016a, Section 2.4.2.3)

Red Grouper (*Epinephelus morio*)

The red grouper is found in the western Atlantic Ocean from North Carolina to southern Brazil, including the Gulf of Mexico and the Caribbean Sea. This species can be found in depths ranging from 16 to more than 1,000 feet on both rocky and muddy substrates. Juveniles are generally found in seagrass beds. Predators include larger fish, including sharks and great barracuda. Although red grouper are fished commercially and recreationally, they are considered overfished in the South Atlantic, and harvests in U.S. waters have decreased by 50 percent over the past 55 years. (NRC 2016a, Section 2.4.2.3)

Forage Fish

Aquatic areas within FPL property and in Biscayne Bay near the Turkey Point site support a diverse assemblage of forage fish. In addition to providing food for a variety of larger fish, turtles, birds, and marine mammals, many have been used as representative species to assess changes in Biscayne Bay. The following discussion focuses primarily on species included in monitoring studies as indicator species and those common or numerically dominant in areas at or near the Turkey Point site based on the recent investigations discussed above. (NRC 2016a, Section 2.4.2.3)

Gray Snapper (*Lutjanus griseus*)

Abundant along the Florida coast, gray snapper are found in the western Atlantic Ocean from Massachusetts to Bermuda. This species is utilized as a surrogate for assessing the condition of marine resources in Biscayne Bay. (NRC 2016a, Section 2.4.2.3)

Gray snapper adults, juveniles, and larvae were abundant to highly abundant in Biscayne Bay in salinities ranging from 0.5 to greater than 25 ppt. Young fish are found in nearshore seagrass beds and soft- and sand-bottom habitats. Adults tend to remain in the same area for long periods of time. Predators include sharks, barracudas, groupers, moray eels, and other larger fish. (NRC 2016a, Section 2.4.2.3)

Mojarras (*Eucinostomus* spp.) and Silver Jenny (*E. gula*)

Mojarras and silver jenny are forage fish common to Biscayne Bay and Card Sound. Mojarras were identified by NPS as an indicator for developing salinity targets for Biscayne Bay in the 2006 ecological targets for western Biscayne Bay National Park. Silver jenny were numerically abundant in nearby Card Sound during the 2008–2009 sampling by EAI and FPL. Optimal salinity ranges for mojarras are approximately 10 to 20 ppt. (NRC 2016a, Section 2.4.2.3)

Grunts (*Halemulon* spp.), Pipefishes (*Anarchopterus* spp.), and Pinfish (*Lagodon rhomboides*)

Grunts, pipefishes, and pinfish are common in the western Atlantic Ocean from South Carolina to Brazil and are often found in mangroves, reefs, and seagrass beds. Juvenile grunts are abundant in turtle grass. Bluestriped and white grunt (*H. sciurus*, *H. plumierii*), fringed pipefish (*A. criniger*), and pinfish were numerically abundant during the 2008–2009 EAI sampling in Card Sound, with pinfish exhibiting the highest abundance. Predators include snappers, groupers, Spanish mackerels, and sharks. Pinfish have also recently been considered as a candidate species for Florida aquaculture given their tolerance for a wide range of environmental conditions. (NRC 2016a, Section 2.4.2.3)

Sheepshead Minnow, Killifishes (*Fundulus* spp.), Mosquitofish (Genus *Gambusia*), Sailfin Molly (*Poecilia latipinna*), Needlefishes (*Strongylura* spp.), and Silver Perch (*Bairdiella chrysoura*)

Sheepshead minnow, killifishes, mosquitofish, sailfin molly, and needlefishes are hardy forage fish that are tolerant of high salinities, and occurrences of these fish in the Turkey Point CCS are documented. Most are not common to Biscayne Bay, but sailfin molly are often found in shallow surface waters along the edges of marshes, ponds, and swamps. Similar in appearance to sand seatrout, silver perch are found in seagrass beds, tidal creeks, rivers, and marshes. The NPS included silver perch as an indicator species for establishing ecological targets for western Biscayne National Park. (NPS 2006; NRC 2016a, Section 2.4.2.3)

3.7.1.1.4 *Crustaceans and Mollusks*

Pink Shrimp (*Farfantepenaeus duroarum*)

Pink shrimp is an ecologically, recreationally, and commercially important species in Biscayne Bay. A commercial industry that harvests shrimp for live bait has existed in Biscayne Bay for many years, and collection of shrimp for human consumption is expanding. Juvenile pink shrimp migrate to Biscayne Bay from offshore spawning areas and are found in seagrass beds near freshwater inputs. Pink shrimp juveniles and larvae are highly abundant in Biscayne Bay in salinities ranging from 0.5 to greater than 25 ppt. The NPS identified pink shrimp as an indicator species for Biscayne Bay with regard to evaluating and establishing salinity targets and specified the optimal salinity range for juveniles to be from approximately 10 to 20 ppt. (NRC 2016a, Section 2.4.2.3) Juvenile pink shrimp are included in the zooplankton of Biscayne Bay identified in Table 3.7-9.

Caribbean Spiny Lobster (*Panulirus argus*)

The Caribbean spiny lobster is the most common lobster in Biscayne Bay. In southern Florida, spawning occurs from April through October, when water temperatures exceed 23°C. Juvenile lobsters are found in nursery areas featuring seagrass meadows and algal beds; subadults and adults gradually migrate to offshore reef systems and ledges. Commercial landings of Caribbean spiny lobster in Florida have varied without trend since about 1970, with landings ranging from between 4.3 and 7.9 million pounds. Commercial landings are primarily from southern Florida in Monroe, Miami-Dade, Collier, Palm Beach, and Broward counties. (NRC 2016a, Section 2.4.2.3)

Blue Crab (*Callinectes sapidus*)

In the western Atlantic, blue crab are found from Nova Scotia to northern Argentina. This species is commonly found in the south-central portion of Biscayne Bay, and blue crab represents an important ecological, recreational, and commercial resource. Optimum blue crab hatching takes place in salinities ranging from 23 to 28 ppt, and juveniles use seagrass habitats where salinities range from 2 to 21 ppt. Commercial blue crab landings in Florida reached more than 18 million pounds in 1987 and 1996, then dropped to less than 8 million pounds in 2001 and 2002. (NRC 2016a, Section 2.4.2.3) Landings in 2009 were approximately 5 million pounds (NRC 2016a, Section 2.4.2.3), while landings in 2014 were approximately 6 million pounds (FFWCC 2015). Juvenile blue crabs are included in the zooplankton of Biscayne Bay identified in Table 3.7-9.

American Oyster (*Crassostrea virginica*)

The American oyster is present in south-central Biscayne Bay where suitable conditions are available. The presence of planktonic food and substrate for attachment of veligers is needed for oysters to survive and thrive; optimum salinity is between 12 and 28 ppt. Oyster reef systems are an important part of nearshore estuarine food webs and provide food for other species, substrate and habitat for benthic invertebrates and fish, and the ability to filter 4 to 34 liters of water per hour, which removes suspended materials (including phytoplankton, suspended organic carbon, and pollutants) from the water column. Dozens to hundreds of species depend directly or indirectly on oyster reef systems for survival. Because this species is sensitive to salinity and turbidity, it has been included in ecosystem conceptual models as an indicator species for water quality and was used as a species of interest by the NPS during the development of ecological targets for western Biscayne National Park. Although oysters are capable of surviving in salinities of 4 to 40 ppt, the optimum salinity range for supporting reef systems is believed to be 10 to 20 ppt. (NRC 2016a, Section 2.4.2.3) American oyster larvae are included in the zooplankton of Biscayne Bay identified in Table 3.7-9.

3.7.1.1.5 *Coral*

In addition to the marine mammal, fish, and invertebrate species discussed above, coral reef systems are present in Biscayne Bay. These systems generally consist of a limited number of species in comparison to those present at offshore locations composing the Florida reef tract. Both staghorn (*Acropora cervicornis*) and elkhorn (*A. palmata*) corals are currently federally threatened reef-building corals found primarily along the Atlantic coast of Florida and the Caribbean and occur in some portions of Biscayne Bay. In 2009, the Center for Biological Diversity petition requested threatened or endangered listing of 83 species of coral occurring in U.S. waters of the Caribbean and Indo-Pacific. In a subsequent 90-day finding published on February 10, 2010, NOAA determined that listing actions may be warranted for 82 of the 83 species. On August 27, 2014, NOAA listed 20 new coral species as threatened. Of these, the following are known to occur in the Florida Atlantic region (NRC 2016a, Section 2.4.2.3):

- *Acropora cervicornis* (Staghorn coral)
- *Acropora palmata* (Elkhorn coral)
- *Mycetophyllia ferox* (Cactus coral)
- *Dendrogyra cylindrus* (Pillar coral)
- *Montastraea (Orbicella) annularis* (Boulder star coral)
- *Montastraea (Orbicella) faveolata* (Mountainous star coral)
- *Montastraea (Orbicella) franksi* (Star coral)

In its 2011 status review report, NOAA indicated that all seven species have been reported in Biscayne Bay and noted that temperature, acidification, disease, predation, land-based sources of pollution, and collection or trade as major threats to all coral species. Hard-bottomed areas near Turkey Point peninsula are generally considered a marginal habitat for coral, with fewer species occurring in the western portion of Biscayne Bay than in the central bay, eastern bay, and offshore locations. This is likely because of the variability in both temperature and salinity that occurs in these areas in comparison to conditions present in the central and eastern bay and offshore oceanic environments. Thus, the listed species described above are not likely to be present near the Turkey Point site. (NRC 2016a, Section 2.4.2.3)

3.7.1.1.6 *Submerged Aquatic Vegetation*

Submerged aquatic vegetation in Biscayne Bay includes a variety of seagrasses and calcareous algae. Seagrass beds play a key role in estuarine community dynamics, providing habitat and food sources to many vertebrate and invertebrate species, stabilizing bottom substrate, acting as nutrient and sediment traps, and contributing to primary and secondary productivity. At least seven seagrass species are found in Biscayne Bay, including turtle grass, shoal grass, manatee grass, widgeon grass, and three species of the genus *Halophila*, including Johnson's seagrass, a federally protected species discussed in Section 3.7.8.1. The distribution and health of seagrass beds in Biscayne Bay are influenced by a variety of natural and anthropogenic factors, including sediment depth, water depth, natural precipitation cycles, and light attenuation. In addition, the discharge of fresh water from canal systems and groundwater seepage into Biscayne Bay can influence distribution. For instance, turtle grass is often absent where groundwater seepage is present, and present where it is not. The general condition of Biscayne Bay seagrass communities suggests some areas of the bay have experienced a slow decline in seagrass biomass, while other areas near freshwater canal outputs or areas where dredging has occurred have lost seagrass or experienced a shift to more freshwater-tolerant species, such as *Ruppia* spp.

As discussed in Section 3.7.1.1, seagrass studies conducted by FPL in August 2009 near the Turkey Point site found turtle grass and shoal grass were present at varying levels of coverage along all study transects. Turtle grass was generally highest in areas immediately surrounding the Turkey Point peninsula and generally decreased with increasing distance from shore. Shoal grass was much more restricted in distribution, occurring in the shallow-water areas near the peninsula. EAI also found that the algae *Batophora* spp. were abundant in the shallower areas along the periphery of the peninsula and approached 100 percent coverage at some locations over small spatial scales. (NRC 2016a, Section 2.4.2.3)

During subsequent sampling events, conducted biannually between 2013 and 2015, turtle grass and shoal grass remained the dominant species identified on the study transects. During the first fall event (2013) coverage on the inshore transect increased considerably, up to about 50 percent as abundant as grasses on the offshore transect. Thereafter, inshore coverage continued to increase, and differences between transects diminished; turtle grass was present in 95 percent of all quadrats during both the fall 2016 and spring 2017 sampling events. Shoal grass remained restricted to the shallow water areas near the peninsula. Calcareous algae and drift algae were ubiquitous throughout the study transects.

3.7.1.1.7 *Zooplankton and Phytoplankton*

Numerous species of microalgae have been identified in marine habitats in the vicinity of Biscayne Bay National Park (NPS 2017a). Table 3.7-9 includes common phytoplankton found in Biscayne Bay.

3.7.1.1.8 *Fish Consumption Advisories*

Fish consumption advisories are published periodically by the State of Florida to alert consumers about the possibility of chemically contaminated fish in Florida waters. The advisories are meant to inform the public of potential health risks of specific fish species from specific water bodies. Table 3.7-10 includes the eating guidelines for marine and estuarine fish from Florida waters, based on mercury levels for the years 2016 and 2017. (FDH 2017b)

3.7.1.1.9 *Non-Indigenous Species*

See Section 3.7.5.

3.7.2 Terrestrial and Wetland Communities

This section identifies terrestrial and wetland ecological resources and describes species composition and other structural and functional attributes of terrestrial biotic assemblages that could be affected by the continued operation and maintenance of the existing PTN. The purpose of this section is to describe current ecological communities and existing conditions.

Some of the information presented in this section is based on land use/land cover codes introduced in Section 3.2.2. Maps displaying these codes provide useful information about the composition and distribution of terrestrial habitats and wetlands. However, the codes and maps serve primarily to reflect land use and land cover and provide only an approximation of terrestrial habitat. The distribution of codes indicative of wetlands (the 600-series codes) does not necessarily align with the presence or distribution of jurisdictional wetlands as defined by the USACE.

3.7.2.1 Terrestrial Communities of the Turkey Point Site and Vicinity

The Turkey Point site is on the western shore of Biscayne Bay, which opens to the Atlantic Ocean. It is in the Mangrove and Coastal Glades physiographic province. This province occurs along the southern Florida coast in a band that narrows significantly northward from Biscayne Bay. The Mangrove and Coastal Glades province is defined as a broad band of wetlands at or near sea level that is often flooded by tides or freshwater runoff. The name of this province is derived from its abundance of three species of mangrove trees: black (*Avicennia germinans*), white (*Laguncularia racemosa*), and red (*Rhizophora mangle*). The descriptions of terrestrial habitats provided in this section are derived from different data sources. Florida land use, cover, and forms classification system maps were used to characterize lands of the Turkey Point site and lands within the vicinity (6-mile radius of PTN). (NRC 2016a, Section 2.4.1.1)

The ecology in southern Florida is directly tied to the hydrology and natural seasonal hydrologic fluctuations that occur in this region. Wetlands are the predominant landscape feature of southern Florida. The low and flat elevation, proximity to Biscayne Bay, and high average rainfall result in the predominance of wetlands. Terrestrial land cover on the Turkey Point site is presented in Table 3.2-2. Land on the Turkey Point site is used primarily for electric power facilities, and facilities for existing Turkey Point Units 1−5 occupy approximately 5,672 acres, composing almost half of the Turkey Point site. Freshwater marsh is the predominant natural land cover on the Turkey Point site. (NRC 2016a, Section 2.4.1.1)

Land cover classes in the vicinity of the PTN site are presented in Table 3.2-2. The PTN site is in a relatively undeveloped and rural area where most lands within a 6-mile radius have not been developed into agriculture or urbanized. The land cover classes occupying the greatest area within a 6-mile radius of PTN are open water (40.32 percent), emergent herbaceous wetlands (35.38 percent), and woody wetlands (15.42 percent). Vegetated uplands, composed of evergreen forest, shrub/scrub, and grassland/herbaceous, represent a total of 0.36 percent of the land cover, with 0.23 percent classified as barren land. The remainder of the land within a 6-mile radius of PTN is classified as developed (4.62 percent) or cultivated crops (3.67 percent). (MRLC 2017)

Physiographic Province

The Turkey Point site sits atop the intersection of three physiographic provinces: the Atlantic Coastal Ridge, the Everglades, and the Mangroves and Coastal Glades. The Atlantic Coastal Ridge province extends along the eastern coast as a low ridge of sand over limestone that ranges in altitude from about 10 to 50 feet above sea level. The ridge averages about 5 miles wide and is breached in places by shallow sloughs or transverse glades. (USGS 2013)

The Everglades province, located west of the Atlantic Coastal Ridge province, is slightly lower in altitude than the ridge or the flatwoods and extends southward from Lake Okeechobee to the Mangrove and Coastal Glades province near Florida Bay. The Everglades province has an almost imperceptible slope to the south, which averages less than 2 inches per mile. Altitudes range from 14 feet near Lake Okeechobee to sea level at Florida Bay. Under predeveloped conditions, the Everglades was seasonally inundated. (USGS 2013)

The Mangrove and Coastal Glades province consists of a broad band of swamps and marshes south of the Everglades and the Big Cypress Swamp. The land is at or near sea level and is often flooded by tides or by freshwater runoff. Salinities range from fresh water to hypersaline, depending on tide levels and the amount of rainfall and runoff. The gradual slope of the land continues offshore across the broad west Florida platform into the Gulf of Mexico. Much of the southern Florida Gulf Coast receives low wave energy, which is favorable to the development of tidal marshes, seagrass beds, and mangrove forests. (USGS 2013)

Ecoregion

The Turkey Point site is located within the South Florida Coastal Plain ecoregion and contains portions of three sub-ecoregions within the property boundaries: the Everglades, the Miami Ridge/Atlantic Coast Strip, and the Southern Coast and Islands.

South Florida Coastal Plain

The South Florida Coastal Plain ecoregion covers an area of approximately 8,651 square miles across the lower portion of the Florida peninsula, from Lake Okeechobee southward through the Florida Keys. It comprises flat plains with wet soils, marshland and swamp land cover with Everglades and palmetto prairie vegetation types. The climate of the plain is generally frost-free and subtropical, consisting of a dry and a wet season. About 140 centimeters (55 inches) of rain falls annually in the ecoregion, with approximately 106 centimeters (42 inches) of rainfall occurring in the wet season from June through September. The warm dry season, from October through May, allows for year-round crop production and has been instrumental in the cultivation of winter vegetables. Tomatoes, beans, squash, peppers, and other crops are grown during the winter for shipment to northern markets. Sugarcane is also widely grown and has formed the basis of the domestic sugar industry since the early 1960s. In addition, the region has a large nursery industry and grows a variety of exotic fruits. All these forms of agriculture rely to varying degrees on irrigation. (Kambly and Moreland 2009)

Steady population increases and concomitant expansion of developed lands have occurred in coastal areas of the South Florida Coastal Plain ecoregion, especially along the Atlantic coast where urbanization extends from southern Miami-Dade County to Palm Beach County. Population in the ecoregion grew from approximately 2.3 million to 5.3 million between 1970 and 2000, with 92 percent of the growth concentrated in the coastal counties of Miami-Dade, Broward, and Palm Beach. By contrast, the ecoregion's interior, which is dominated by the state and federal parks and refuges and by agricultural lands, is sparsely populated. (Kambly and Moreland 2009)

Everglades

The Everglades subregion is a subtropical wetland ecosystem that hosts an extremely rich variety of plant and animal habitats. Its nutrient-poor environment has been subject to surface water runoff from urban and agricultural sources, which has led to changes in habitat health and diversity. Moreover, surface water levels and sheet flow in the Everglades are very sensitive to any differences in topography because of the ecoregion's exceedingly expansive and flat terrain. As a result, water level changes of only a few centimeters in elevation may have significant impact on the distribution of plant and animal communities. (Kambly and Moreland 2009)

The historical flow through the Everglades originated from the Kissimmee River in central Florida and drained into shallow Lake Okeechobee about 5 meters (16 feet) above sea level. An expansive sheet flow of water, more than 64 kilometers (40 miles) wide, would then pass through the Everglades, providing sustenance to plant and animal life and feeding freshwater aquifers, and eventually exit into the Florida Bay and the Gulf of Mexico. The water would move slowly across Lake Okeechobee and overflow its southern lip into the marshes of the northern Everglades. The flow was much less or nonexistent in the dry season when the water would concentrate in the sloughs, the deepest part of the Everglades. Tree islands developed in elevated areas. (Kambly and Moreland 2009)

In the decades after World War II, the interruption of the natural hydrology by newly constructed levees, canals, and other water control measures led to a disconnected hydrological regime. This has resulted in a spatial redistribution of water that has severely reduced the size and biotic diversity of the Everglades. Approximately 50 percent of the original extent of the Everglades has been lost since the beginning of the 20th century. (Kambly and Moreland 2009)

With the establishment of Everglades National Park in 1947, Loxahatchee National Wildlife Refuge in 1951 (which serves as a water conservation area), and additional water conservation areas, most of the remaining Everglades ecosystem was protected from further development, though it continues to be vulnerable to impacts from urban and agricultural uses that lie beyond park and refuge boundaries (Kambly and Moreland 2009).

Miami Ridge and Atlantic Coastal Strip

The Miami Ridge and Atlantic Coastal Strip subregion, a highly urbanized area, lies on the eastern side of the ecoregion which extends 161 kilometers (100 miles) from central Miami-Dade County through Broward and into Palm Beach County. Its western extent consists of flat terrain with urban and agricultural lands that have replaced the original wet and dry prairie marshes and rockland and saw-grass marshes. The Miami Ridge lies to the east and ranges in height from 2 to 7 meters (8 to 24 feet) and is from 6 to 16 kilometers (4 to 10 miles) wide. It is about 64 kilometers (40 miles) in length, extending along the Atlantic coast from southern Miami-Dade County to Broward County. (Kambly and Moreland 2009)

Due to its relatively high elevation, the ridge acted as an eastern barrier to water flow through the Everglades and was the site of early commercial and residential development in southeastern Florida. It now forms the backbone for much of the heavily urbanized Atlantic coast. Agriculture also gained a foothold but moved westward as it was displaced by encroaching development. Early developers cleared the forested ridge and, as a result, eliminated most of the rockland pines, which formed the dominant habitat of the southern part of the ridge and one of the most diverse plant habitats in the ecoregion. About 7,689 hectares (19,000 acres) of the remaining rockland pines are found in Everglades National Park. Outside the park's boundaries, only about 1.5 percent of the original 65,424 hectares (161,660 acres) still exists. (Kambly and Moreland 2009)

Southern Coastal Islands

The southern coast and islands extend over the extreme southern portion of the Florida Peninsula, Florida Bay, and the Florida Keys. Reserved federal lands, including Everglades National Park, and several national wildlife refuges cover much of its area. Mangrove swamps, upland forests, coastal marshes, and coral reefs characterize the region. Native animals include alligators, crocodiles, Key deer, manatees, and a variety of birds, fish, and turtles. Many of these species are endangered or threatened, including the crocodile, Key deer, and manatee. Some of the Keys have experienced increasing urbanization largely driven by tourism. In 1974, the State of Florida designated the Keys as an "Area of Critical Concern" to protect environmental assets and provide oversight on local land use decisions. (Kambly and Moreland 2009)

Upland Vegetative Communities

The Turkey Point property contains highly disturbed upland habitats including roadways raised with fill and spoil piles. The raised fill areas contain maintained grasses as well as poisonwood (*Metopium toxiferum*), buttonwood, wild sage (*Lantana involucrata*), ground orchid (*Bletia species*), sea grape (*Coccoloba uvifera*), and the exotics Brazilian pepper (*Schinus terebinthifolius*) and Australian pine. Miami-Dade County Code (Part III, Chapter 24, Section 24.49) mandates protection of specific native tree species. These protections do not include poisonwood, Brazilian pepper, Australian pine, or Melaleuca. Trees generally occur on artificial raised fill areas created by past construction activities that constitute most uplands areas on the site, including raised roadsides, canal berms, and undeveloped portions of raised areas. FPL tree survey results do not include wetland areas, in accordance with Miami-Dade County regulations. Mangroves and other wetland trees, discussed in Section 3.7.2.2, are protected by regulations. (NRC 2016a, Section 2.4.1.1) Important vegetative communities known to occur in Miami-Dade County are discussed in Section 3.7.4.

3.7.2.2 Wetlands

Wetlands are defined as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.(USACE 1999)

Thirteen functions and values are typically considered by regulatory and conservation agencies when evaluating wetlands are used: groundwater recharge/discharge, floodflow alteration, fish and shellfish habitat, sediment/toxicant/pathogen retention, nutrient removal/retention/ transformation, production export (nutrient), sediment/shoreline stabilization, wildlife habitat, recreation (consumptive and nonconsumptive), educational/scientific value, uniqueness/ heritage, visual quality/aesthetics, and threatened or endangered species habitat. (USACE 1999)

The USFWS maintains the National Wetlands Inventory (NWI), which integrates digital map data along with other resource information to produce current information on the status, extent, characteristics, and functions of wetlands, riparian, and deepwater habitats in the United States.

Based on a review of USFWS NWI maps of the site (USFWS 2017a), there are approximately 64,247 acres of wetlands within a 6-mile radius of PTN composed of the following types (Figure 3.7-1):

- Estuarine and marine deepwater habitat covering approximately 37,115 acres (57.77 percent of total wetland habitat).
- Estuarine and marine wetlands covering approximately 9,950 acres (15.49 percent of total wetland habitat).
- Freshwater emergent wetlands covering approximately 10,543 acres (16.41 percent of total wetland habitat).
- Freshwater forested/scrub shrub wetlands covering approximately 6,190 acres (9.64 percent of total wetland habitat).
- Freshwater pond covering approximately 76 acres (0.12 percent of total wetland habitat).
- Lake covering approximately 71 acres (0.11 percent of total wetland habitat).
- Riverine covering approximately 302 acres (0.47 percent of total wetland habitat).

The Turkey Point property is roughly rectangular in shape and is bounded by Biscayne Bay to the east and Card Sound to the southeast. Based on the NWI data (USFWS 2017a) a total of 7,996 acres of wetland, lake and riverine waters are located on the Turkey Point site.

Based on the NWI data, the following wetland and water types are located on the Turkey Point site:

- Estuarine and marine deep water wetlands covering approximately 2,607 acres (32.77 percent of total wetland habitat).
- Estuarine and marine wetlands covering approximately 3,611 acres (45.38 percent of total wetland habitat).
- Freshwater emergent wetlands covering approximately 1,546 acres (19.44 percent of total wetland habitat).
- Freshwater forested/scrub shrub wetlands covering approximately 171 acres (2.14 percent of total wetland habitat).

- Freshwater pond covering approximately 4 acres (0.05 percent of total wetland habitat).
- Riverine covering approximately 17 acres (0.21 percent of total wetland habitat).

Wetlands on the Turkey Point property (Figure 3.7-2) include mudflats, dwarf mangrove, mangrove heads, open water, canals, and wetland spoil areas. Mudflats are inundated annually for 3 to 4 months and are sparsely vegetated with saltwort (*Batis maritime*), sea-oxeye (*Borrichia frutescens*), wood glasswort (*Salicornia virginica*), and dwarf glasswort (*Salicornia begelovii*). Dwarf mangrove habitats contain stunted red mangroves (*Rhizophora mangle*) of the three species present (black, white, and red), but individual plants are stunted due to high salinities and fluctuating water levels. Mangroves that occupy portions of the Turkey Point property south of the Turkey Point plant include remnant mangrove populations found within historical tidal creeks that were disconnected from Biscayne Bay during previous development; they are known as mangrove heads. (NRC 2016a, Section 2.4.1.1)

Open waters adjoining cooling canals in the CCS occupy approximately 8 acres and contain scattered widgeon grass (*Ruppia maritima*) and shoal grass (*Halodule wrightii*) patches. Wetland spoil areas totaling about 9 acres occur adjacent to remnant canals and contain mangrove species as well as buttonwood (*Conocarpus erectus*) and non-native Australian pine (*Casuarina equisetifolia*). (NRC 2016a, Section 2.4.1.1)

Wildlife

Ecosystems within southern Florida support rich wildlife diversity, including approximately 360 bird, 60 reptile, 40 mammal, and 15 amphibian species (Table 3.7-11). Surveys to characterize wildlife on the Turkey Point site and in the vicinity were conducted in 1972 and in 2005 through 2009. The most recent surveys included limited pedestrian and vehicular surveys to determine the relative abundance of migratory and resident bird species. Most of the project area was surveyed, including the CCS, the plant area, two mangrove areas immediately north of the plant area, the radial collector well site, the originally proposed reclaimed water treatment site, and a small portion of the proposed access road west of the CCS. (NRC 2016a, Section 2.4.1.1)

Wildlife species observed during these surveys were those expected to occur in the types of habitats present in southern Florida. Most of the site is composed of wetlands, and wetland birds are the predominant fauna. Forty-six species of birds within 11 bird families were observed, 35 of which are commonly associated with wetlands. Wading birds (Pelicaniformes) are common and abundant on the mudflats and along the canals on the site and include various herons, egrets, and ibis. Shorebirds (Charadriiformes) are also strongly represented by sandpipers, plovers, and numerous others. Historical data and other observations indicate at least 38 additional bird species have been observed on the site. (NRC 2016a, Section 2.4.1.1)

During April 2009, prior to the preparation of the NRC's Environmental Impact Statement (EIS) for the proposed Units 6 and 7, surveys were conducted to determine small mammal, amphibian, and reptile presence and relative abundance within areas that would be disturbed by building proposed Units 6 and 7. Small mammals were trapped and identified using baited live traps. Reptiles and amphibians were captured using coverboards, minnow traps, and dip nets, and were also recorded during pedestrian searches. Habitats surveyed included marsh, mangrove, and ditches. Reptiles were observed, including the American crocodile (*Crocodylus acutus*), eastern diamondback rattlesnake (*Crotalus adamanteus*), the non-native green iguana (*Iguana iguana*), and an unidentified gecko (*Hemidactylus sp.*). In addition, three species of anole lizards (*Anolis sp.*), the Florida softshell turtle (*Apalone ferox*), and five snake species were observed. Amphibians were also observed, including nine frog species. An eastern narrow-mouthed toad (*Grastrophryne carolinensis*) was found in April 2009 and the southern toad (*Bufo terrestris*) was also observed. (NRC 2016a, Section 2.4.1.1)

Four mammal species, the cotton rat (*Sigmodon hispidus*), black rat (*Rattus rattus*), raccoon (*Procyon lotor*), and marsh rabbit (*Sylvilagus palustris*), were observed. White-tailed deer (*Odocoileus virginianus*), opossum (*Didelphis virginiana*), and eastern cottontail (*Sylvilagus floridanus*) have also been observed on the Turkey Point site. Although numerous bat species occur in southern Florida, no bats were observed in 2009 during a single 2-hour bat survey conducted between mangrove habitat and the existing facilities, and bat distribution and abundance is unknown. As in most areas of southern Florida, bats presumably occur within the 6-mile vicinity of PTN. (NRC 2016a, Section 2.4.1.1)

Immediately to the east and adjoining the boundary of the Turkey Point site is Biscayne National Park, which encompasses approximately 270 square miles and includes the mangrove forests along the mainland shoreline, the southern portion of Biscayne Bay, barrier island keys, and the nearshore waters out to approximately 14 miles from the shoreline. Biscayne National Park is recognized for both terrestrial and aquatic resources as well as cultural history, and management of the park is focused on preservation of natural and cultural resources while providing recreation. The Everglades National Park, the largest subtropical wilderness in the United States, is approximately 12 miles west of the Turkey Point site. The Everglades National Park encompasses almost 1.5 million acres and is recognized for its rich biological diversity. It has been designated an International Biosphere Reserve, World Heritage Site, and Wetland of International Significance. Management of the Everglades National Park balances the preservation of these resources while providing recreation. (NRC 2016a, Section 2.4.1.1).

Extensive canal and levee systems constructed for agricultural purposes have altered surface water flow and changed the ecology of southern Florida, including Biscayne National Park and Everglades National Park. Goals of the CERP include restoration of the Everglades ecosystem. (NRC 2016a, Section 2.4.1.1)

Migratory Birds

Southern Florida is located along one of the primary migratory routes for bird species that breed in temperate North America and winter in the tropics of the Caribbean and South America. Many species of neotropical migrants have been recorded in southern Florida. Large numbers of species like the bobolink (*Dolichonyx oryzivorus*), a species of management concern, migrate through southern Florida as they fly from their breeding grounds in southern Canada and the northern Great Plains on their way to the marshes of Argentina and Brazil. Virtually the entire North American population of blackpoll warblers (*Dendroica striata*) migrates to South America along a route that passes through Florida to the West Indies. Other migratory species like the tanagers (*Pirange* spp.), chimney swifts (*Chaetura pelagica*), tree swallows (*Iridoprocne bicolor*), nighthawks (*Chordeiles minor*), royal terns (*Sterna maxima*), and blue-winged teal (*Anas discors*) also have major migratory pathways through southern Florida. More than 129 bird species migrate to southern Florida to overwinter. Another 132 bird species breed in southern Florida. Because southern Florida is located near Cuba and the West Indies, it draws Caribbean species that rarely appear elsewhere in North America (USFWS 1999).

3.7.3 Potentially Affected Water Bodies

The CCS is an IWW facility used to cool and provide the UHS for Units 3 and 4, cool the repurposed PTN Units 1 and 2, and receive process water from Unit 5, stormwater and small volumes of process water from the operating units. The CCS is located within the Florida Southeast Coast Watershed (HUC 03090206). The Florida Southeast Coast Watershed is an approximately 8,102 square kilometer (5,034 square miles) watershed that drains to Biscayne Bay (USGS 2017e).

The cooling canals at PTN are a closed system and are not considered waters of the U.S. or the state. Onsite surface water habitats inclusive of the CCS include active and remnant canals, rainwater-filled freshwater ponds located on the berm, dwarf mangrove wetlands, and hypersaline mudflats. (NRC 2016a, Section 2.4.2.1)

The CCS IWW facility contains an extensive system of canals and berms, and it has historically supported a variety of species of fish, mollusks, crustaceans, and submerged aquatic vegetation that are tolerant of subtropical, hypersaline environments. Table 3.7-1 provides a list of species historically known to occur in the CCS based on previous FPL monitoring studies. Many of these species were eaten by the federally threatened American crocodiles that live in the CCS. Adult American crocodiles were first observed in the CCS in 1976, and nesting was first documented on the cooling canal berms in 1978. As a result, FPL developed a crocodile management plan that focused on the creation and enhancement of habitat and long-term population monitoring. (NRC 2016a, Section 2.4.2.1)

Historically, large game species such as common snook (*Centropomus undecimalis*) and tarpon (*Megalops atlanticus*) have been reported as occurring in the CCS. These were most likely older individuals that have persisted in the system since it was isolated from Biscayne Bay in 1973. Recruitment of fish and invertebrates could also potentially occur from hurricane storm surge overtopping CCS canal berms. (NRC 2016a, Section 2.4.2.1)

Changes in water quality in the CCS wastewater facility have resulted in elevations of peak water temperature, salinity, and nutrient levels. Prior to 2010, the CCS operated as a seagrass-based biological system with healthy seagrass meadows covering an estimated 50 percent of the CCS, providing habitat, natural filtration, and utilization of nutrients from the water column. The ecosystem helped maintain good water quality and low nutrient concentration in the water column. During this time period, nutrient sources to the CCS water column primarily included berm vegetation biomass and soil erosion, groundwater inflows, and atmospheric deposition (of nitrogen) along with relatively low levels of effluents from power plant operations. Nutrient mass removal from the CCS included the seagrass photosynthesis and growth, harvesting of seagrasses as an CCS maintenance activity, removal of biological material impinged on the plant intake screens, and groundwater outflows.

Salinity levels in the CCS have always been subject to seasonal variation, peaking at the end of the dry season (normally June), and at a minimum at the end of the wet season (normally December). Between 2000 and late 2009, the peak seasonal salinities steadily increased to close to 70 PSU. By 2010, seagrass meadows were stressed by the high salinities and dying off in the CCS. By 2012, few if any seagrass beds remained. The system-wide seagrass die-off and subsequent decomposition of the seagrasses released a significant volume of the previously bound and sequestered nutrients into the CCS water column over a multi-year period.

The increase in nutrient levels in the CCS water column facilitated seasonal algae blooms, resulting in high water turbidity and generally degraded water quality. Initial reports of algal blooms date back to isolated observances in 2011 and 2012, with multiple verified events in 2013, followed by continuously elevated and sustained algae concentrations from the summer of 2014 to the present. This phenomenon, initiated by increased salinities, closely resembles similar events observed with the Florida Bay algal blooms in the 1980s.

In its current state, the CCS can be characterized as an algal-based biological system; however, FPL is working to implement a series of actions to reduce the average annual CCS salinity to 34 PSU, improve the thermal efficiency of the CCS, reduce nutrients, and re-establish the seagrass meadows and associated ecosystem that occurred in the CCS as a natural nutrient management system. To achieve this, FPL has developed the nutrient management plan, which includes both near-term and long-term initiatives.

Discussions of sediment removal activities are included in Section 3.6.1.4.4. Discussions of the implementation of short- and long-term efforts for salinity reduction are included in Sections 3.6.1.4.5 and 3.6.3.2.

3.7.4 Places and Entities of Special Ecological Interest

3.7.4.1 <u>Other Important Species and Habitats</u>

Important species and habitats are characterized as those that serve as biological indicators and those that are commercially valuable, recreationally valuable, essential to the maintenance or survival of commercially or recreationally valuable species, and critical to the structure and function of local terrestrial ecosystems. Important habitats include wildlife refuges, sanctuaries, preserves, USFWS-designated critical habitat, other federally or state-protected habitats, wetlands, and floodplains, including EPA-designated Aquatic Resources of National Importance (ARNI). Factors that determine if an aquatic resource is an ARNI include economic importance, rarity or uniqueness, and the importance of the resource to protect, maintain, or enhance the quality of the Nation's waters. (NRC 2016a, Section 2.1.4.3)

Mangroves

Mangrove forests play a key role in the ecosystems where they occur and are the most biologically productive ecosystems in the world. Mangroves represent the link between upland and marine ecosystems in many tropical and subtropical areas, contributing significant organic material to coastal and estuarine waters and provide a nursery to many aquatic and terrestrial animal species. An integral part of southern Florida's ecology, mangrove forests support an incredible number of bird species and provide vital habitat for many neotropical migrant songbirds, raptors, and estuarine birds. The red mangrove (*Rhizophora mangle*) is an important indicator of this highly valuable forest type in southern Florida. Listed species that depend on or use mangroves include the Florida panther, wood stork, eastern indigo snake, Florida black bear, Everglades mink, white-crowned pigeon, brown pelican, tricolored heron, little blue heron, white ibis, snowy egret, reddish egret, and roseate spoonbill. Much of southern Florida's mangrove forests have been lost to coastal urbanization and alteration of freshwater hydroperiod from impoundment. (NRC 2016a, Section 2.1.4.3).

Pine Rocklands

Pine rocklands are unique to southern Florida and the Bahamas. In Florida they are found on limestone substrates on the Miami Rock Ridge, in the Florida Keys, and in the Big Cypress Swamp. Pine rocklands are dominated by a single canopy tree species, the South Florida slash pine (*Pinus elliottii var. densa*), with a diverse subcanopy layer of hardwood and palm and a very rich herbaceous layer. The flora of pine rocklands is composed of a diverse assemblage of tropical and temperate taxa. Many endemic plant taxa are also found in this community. It is a fire-maintained community, requiring periodic fires to eliminate invading hardwoods, assist in nutrient cycling, and to reduce duff layers. Pine rocklands also provide critical foraging and nesting habitat for a diverse array of wildlife, including five federally listed animal species. While significant areas of pine rocklands are now protected within preserves such as Everglades National Park, Big Cypress National Preserve, and the National Key Deer Refuge, pine rockland fragments are still threatened on the Miami Rock Ridge and in the Florida Keys. Pine rocklands have been heavily impacted by outright destruction, conversion to agriculture, fire suppression, exotic plant and animal invasions, collecting pressure on plants and animals, and alterations to hydrology. Significant work has now been initiated to control exotic plant taxa in pine rocklands, although much research needs to be conducted on restoring heavily degraded sites. (USFWS 1999, page 3-161)

Pine rockland supports diverse shrub and herb layers that include more than 370 different plant species. Many endemic plant and animal species are dependent upon pine rocklands, and many federally and state-listed plants and wildlife use pine rockland, including Blodgett's silverbush, Carter's small-flowered flax, Florida lantana, Garber's spurge, deltoid spurge, tiny polygala, small's milkpea, crenulate lead-plant, Kirtland's warbler, eastern indigo snake, Florida panther, and both Florida leafwing and Bartram's scrub-hairstreak butterflies. More than 90 plant Species of Concern have been recorded in pine rocklands. Because pine rocklands occur at relatively high elevations in the southern Florida landscape, they are also ideal for urbanization and rural development, which has resulted in extensive loss and fragmentation. On the Florida peninsula, pine rockland fragments persist in Miami-Dade County from Florida City north to Southwest 32nd Street, northern Monroe County, and southeastern Collier County. (NRC 2016a, Section 2.1.4.3)

Marl Prairie

Marl prairie is a sparsely vegetated, grass-dominated community that is seasonally flooded. It occurs on marl substrates, which are impermeable fine white muds deposited on limestone. Unlike similar marsh habitat, marl prairie supports a very high diversity of native plants including federally and state-listed species. Marl prairie is the primary habitat of the Cape Sable seaside sparrow. Historically, marl prairie was maintained by fire. (NRC 2016a, Section 2.1.4.3)

Wetlands

Wetlands in various forms are the dominant land cover in southern Florida. Likewise, most of the Turkey Point site consists of wetlands, including open water, mud flat, remnant canals, wetland spoil, and mangroves. (NRC 2016a, Section 2.1.4.3) Wetlands are discussed further in Section 3.7.2.2.

State and Federal Parks, Reserves, and Sanctuaries

Everglades National Park, immediately west of the Turkey Point site, encompasses more than 1.5 million acres in Miami-Dade, Monroe, and Collier counties in southern Florida. It is recognized as a World Heritage Site, a Biosphere Reserve, a Wetland of International Significance, and an Outstanding Florida Water. The Everglades Mitigation Bank is an FPL-owned wetland mitigation area that links Everglades National Park with Biscayne Bay. It borders the Turkey Point site immediately west and south of the IWW canal system and encompasses more than 13,000 acres. Biscayne National Park, bordering much of the eastern side of the Turkey Point site, encompasses 172,000 acres. Included within this national park is the southern expanse of Biscayne Bay, northern portion of Card Sound, the mangroves along the mainland shore, northernmost Florida Key islands, and extensive offshore coral reefs. Crocodile Lake National Wildlife Refuge, 10 miles south of the Turkey Point site, occupies 6,700 acres near Key Largo, Florida. (NRC 2016a, Section 2.1.4.3) These areas are discussed further in Section 3.7.1.1.

Designated Critical Habitat

USFWS-designated critical habitat for the American crocodile is located in the CCS on the Turkey Point site (Section 3.7.8.1 for discussion of the American crocodile designated critical habitat). The designated critical habitat for American crocodile includes the majority of the Turkey Point CCS and other adjacent canals and aquatic habitats west and south of the Turkey Point site. No other federally designated critical habitat is located on the Turkey Point site; however, critical habitat for the West Indian manatee is located in Card Sound, southeast of the PTN location (Figure 3.7-3 – 6-mile radius). Critical habitat for 13 additional species (Bartram's scrub-hairstreak butterfly, Florida leaf-wing butterfly, Cape Sable thoroughwort, Cape Sable seaside sparrow, Carter's small-flowered flax, Florida's brickell-bush, elkhorn coral, staghorn coral, Everglades snail kite, Johnson's seagrass, the piping plover, the West Indian manatee, and the smalltooth sawfish) is located within a 50-mile radius of PTN (Figure 3.7-4). (ESRI 2017)

3.7.4.2 Commercially and Recreationally Valuable Species

Although numerous game species, including white-tailed deer (*Odocoileus virginianus*), mourning dove (*Zenaida macroura*), and cottontail rabbit (*Sylvilagus floridanus*) are present, public access for harvest of game animals is prohibited on the Turkey Point site. Waterfowl habitat is present and waterfowl are likely to occur in local wetlands and open water habitats. As with other game animals, public waterfowl hunting on the site is prohibited, and if hunting occurs in the immediate vicinity of the Turkey Point site, waterfowl may be artificially concentrated on the site during hunting seasons. (NRC 2016a, Section 2.1.4.3)

Biological Indicators

Wading birds are an important part of the southern Florida ecosystem and have been identified as an indicator of ecosystem health for the Everglades and a primary goal of the CERP. Listed wading bird species include the federally threatened wood stork and state-listed little blue heron, tricolored heron, reddish egret, snowy egret, white ibis, and roseate spoonbill. Additional southern Florida wading bird species in the project vicinity include the double-crested cormorant (*Phalacrocorax auritus*), great egret (*Ardea alba*), cattle egret (*Bubulcus ibis*), green heron (*Butorides virescens*), great blue heron (*A. herodias*), and black- and yellow-crowned night-herons (*Nicticorax nicticorax* and *Nictanassa violacea*). (NRC 2016a, Section 2.1.4.3)

Historic wading bird population estimates, although controversial, were estimated to be approximately 125,000−150,000 attempted nests in the 1930s. Populations have since declined. An estimated 26,676 wading bird nests (excluding cattle egrets, which do not rely on wetlands) were initiated in southern Florida during the 2016 nesting season (December 2015 to July 2016). This is a relatively poor nesting effort compared to the 10-year annual average (42,023.9 nests) and the lowest count since 2008 (18,669 nests). This reduced nesting effort continues a trend of relatively poor to moderate nesting since 2010. The average nest count during the current decade (2010 to 2016) is 35,146 nests per year, which is a 27-percent decline from the period 2000–2009 (47,910 nests per year). (SFWMD 2017b) Four wading bird species are used to monitor ecosystem restoration and health: the great egret, snowy egret, white ibis, and wood stork. Generally, populations of these species are trending upward since the 1990s, with the exception of snowy egrets, which have declined recently. (NRC 2016a, Section 2.1.4.3).

3.7.5 Invasive Species

3.7.5.1 Invasive Terrestrial Species

Non-indigenous species, including those identified by resource managers as exotic, non-native, alien, and introduced, are a growing concern in Florida, because their presence has the potential to alter existing food webs and alter species composition through competition, predation, or disease (NRC 2016a, Section 2.4.2.3). When aggressive in nature, exotic plant species can displace or eliminate native plant species. The Florida Exotic Pest Plant Council maintains a list of invasive plant species. Melaleuca (*Melaleuca quinquenervia*), Old World climbing fern (*Lygodium microphyllum*), and Burma reed (*Neyraudia reynaudiana*) have been observed during off-site surveys of proposed corridors for out-of-scope transmission lines. Brazilian pepper and Australian pine also occur in these corridors. The NPS funds efforts to control the spread of Melaleuca in the East Everglades Expansion Area. (NRC 2016a, Section 2.4.1.3). Non-indigenous plant species identified on the berms within the CCS are systematically removed during ongoing berm vegetation maintenance activities

The tropical climate of southern Florida has enabled the establishment of numerous reptile species in the region. The Burmese python (*Python molurus ssp. bivittatu*s) is probably the most well-known exotic reptile that now inhabits southern Florida. The establishment of this snake species has coincided with a dramatic decrease in medium-sized mammals within Everglades National Park, and control efforts to limit the Burmese python population in Florida are ongoing. Burmese pythons found at Turkey Point are captured and removed from the property The Argentine black-and-white tegu (*Tupanimbis merianae*) is a relatively new arrival but has spread rapidly in the vicinity of Turkey Point. This egg-eating omnivore has the potential to affect many species, including alligators and crocodiles, and is the subject of a multi-agency control effort in the immediate vicinity of the Turkey Point site. (NRC 2016a, Section 2.4.1.3) FPL conducted a tegu trapping program in 2016 and in 2017

Descriptions of common Florida invasive species are provided below.

Melaleuca (Melaleuca quinquenervia)

Melaleuca, also known as paperbark tree, punk tree, cajeput tree, and white bottlebrush tree, is a subtropical tree in the eucalyptus family, with spongy, white, paper-like bark that can grow to 50 feet in height. Paperbark tree is an aggressive invader that spreads rapidly, converting native plant communities such as sawgrass marshes, wet prairies, and aquatic sloughs into impenetrable paperbark thickets. Introduced into southern Florida in the early 1900s, paperbark tree was widely planted for landscaping and for "swamp drying". In a single year, one paperbark tree can produce a dense island hammock nearly 600 feet in diameter. Its greatest threat is to the

Florida Everglades ecosystem, which faces extreme and possibly irreversible alteration as a result of intrusion by paperbark tree. (NPS 2005a)

Old World Climbing Fern (Lygodium microphyllum)

Old World climbing fern is an aggressive nonnative invasive fern of moist habitats in southern Florida. This rapidly spreading fern invades new areas without the need of habitat disturbance and often completely dominates native vegetation by forming a dense canopy. The fern, first found to be established in 1965 in Martin County, now infests more than 200,000 acres in southern Florida. Although primarily a weed of public conservation areas, Old World climbing fern infests residential landscapes, horticultural nurseries, rangelands, and other managed lands near infested natural vegetation. The fern’s ability to grow up and over trees and shrubs and to form dense horizontal canopies allows it to cover whole communities of plants, reducing native plant diversity. Old World climbing fern can grow in bald cypress stands, pine flatwoods, wet prairies, saw grass marshes, mangrove communities, and Everglades tree islands. Some Everglades tree islands are so completely blanketed by the fern that it is not possible to see trees and other vegetation beneath the fern canopy. The fern poses management problems for both wildfires and prescribed burns because it can serve as a fire ladder that carries fire into the tree canopy, killing native trees. Also, portions of burning fern can frequently break free and spread fire to surrounding areas. (FFWCC 2017a)

Burma Reed (Neyraudia reynaudiana)

Burma reed, also known as silk reed, cane grass, and false reed, is a tall, perennial, large-plumed grass that grows in clumps in sunny upland areas. Burma reed damages native ecosystems by crowding and shading out understory plant species and by creating conditions for extremely hot and destructive wildfires. In southern Florida (Miami-Dade County), it is a serious threat to the globally imperiled pine rocklands community, whose pine canopy was largely destroyed in 1992 by Hurricane Andrew. Burma reed is a highly combustible fuel source because of its overall plant mass, its large feathery flower plumes, and the dense, hay-like leaf litter it produces. This hay-like litter enhances the fire's movement along the ground, while the flower plumes carry the flames high into the air. With the aid of winds, these plumes often detach and fly through the air like torches, providing the potential for additional spread. (NPS 2005b)

Brazilian Pepper (Schinus terebinthifolius)

Brazilian pepper is a medium-sized evergreen shrub-like tree native to Brazil and Paraguay. It was first introduced during the 19th century and has invaded many habitats in central and southern Florida. This small shrub-like tree, typically 15 to 30 feet in height, is the most widespread of Florida’s nonnative invasive plant species, occupying more than 700,000 acres. Although primarily an invader of landscapes in which the soil has been disturbed and fire excluded, it has formed large dense forests in relatively undisturbed areas adjacent to mangroves along the southwestern portion of Everglades National Park and within the coastal areas of west-central and southern Florida. Brazilian pepper is related to poisonwood, poison oak and poison ivy. This shrub-like tree produces dense clusters of small berries that change from green to bright red as they ripen. Local dispersal of this species is primarily by raccoons and opossums; long-distance spread is facilitated by fruit-eating birds, such as migratory American robins. Brazilian pepper berries have been reported to produce a narcotic or toxic effect on native birds and wildlife during some parts of the year. (FFWCC 2017b)

Australian Pine (Casuarina species)

Australian pine trees threaten native central and southern Florida beach plant communities by quickly invading newly accreted beaches, beaches where dredge spoil has been deposited, and beaches where a storm has destroyed existing vegetation. Australian pine trees have also invaded southern Florida's hammock and tree island communities in the Everglades. These trees outcompete native vegetation by producing a dense leaf litter beneath them. Because of shallow root systems, Australian pine trees tend to uproot and topple during high winds and pose a significant hazard to coastal storm evacuation routes. (FFWCC 2017c)

Several species of *Casuarina* were introduced from Australia to Florida during the 1890s. Although commonly called pines, these plants are angiosperms, not conifers. Australian pines were widely planted in Florida to form windbreaks around canals, agricultural fields, roads, and houses. Habitats disturbed by both human activities and natural events seem particularly prone to invasions by Australian pine. Because Australian pine trees are resistant to salt spray and can grow close to sea water, they have invaded thousands of acres of southeastern and southwestern coastal areas of Florida. (FFWCC 2017c)

Burmese python (Python molurus ssp. bivittatus)

The Burmese python is one of the largest snakes in the world. Adult Burmese pythons caught in Florida average between 1.8 meters (6 feet) and 2.7 meters (9 feet); the largest Burmese captured in Florida measured more than 5 meters (17 feet) in length. A population of Burmese pythons is established in southern Florida, mainly within the Florida Everglades. Individuals have been found near Naples, suggesting that the population may be moving northwest. Python observations outside of southern Florida are escaped or released pets. Burmese pythons have been reported from the saline glades and mangroves at the southern end of Everglades National Park since the 1980s. The actual mechanism of introduction is not known; however, it is likely that Burmese pythons escaped from a breeding facility that was destroyed during Hurricane Andrew. It is also likely that pet pythons have been released in and around the Everglades. (FFWCC 2017d)

Because of its large size, adult Burmese pythons have few predators, with alligators and humans being the exceptions. They prey upon native species, possibly reducing those populations locally. Research is underway to ascertain the impacts pythons have on native mammal species. While pythons will eat common native species and exotic species such as Norway rats, they can also consume threatened or endangered native species. (FFWCC 2017d)

Argentine Black-and-White Tegu (Tupanimbis merianae)

The Argentine black-and-white tegu is a large, nonnative lizard that has been introduced to Florida. Tegus are black and white in color with banding along the tail. They can reach up to 4 feet in length. In Florida, tegus can be seen on roadsides or other disturbed areas. They spend most of their time on land, though they can swim and may submerge themselves for long periods of time. Like many reptiles, they are primarily active during the day and will burrow or hide overnight. (FFWCC 2017e)

It is believed that tegu populations in Florida were founded by escaped or released pets. Tegus could potentially compete with and prey upon Florida's native wildlife, including some threatened species. (FFWCC 2017e)

3.7.5.2 Invasive Aquatic Species

Non-indigenous species released into aquatic systems via the pet trade have the potential to use the existing canal systems to move into different aquatic environments, including nearshore areas of Biscayne Bay. Species used to support nearshore aquaculture industries may also be introduced intentionally or unintentionally into freshwater or nearshore ecosystems. (NRC 2016a, Section 2.4.2.3)

Fish species of concern to the NPS include the lionfish species (*Pterois volitans*, and *P. miles*) that are now common and increasing in occurrence in the bay, and Oscar (*Astronotus ocellatus*) and Mayan Cichlid (*Cichlasoma urophthalamus*), which are now found in canal systems. (NRC 2016a, Section 2.4.2.3)

These species are discussed further in the sections below.

Lionfish species (Pterois volitans, and P. miles)

Lionfish are a marine species that are primarily red, brown and white with a striped, zebra-like appearance. While there are two distinct but visually identical species found in their non-native range, about 97 percent are red lionfish. (FFWCC 2017f)

Lionfish are a predatory reef fish. They eat native fish, which can reduce native populations and have negative effects on the overall reef habitat and health as species are eliminated that serve important ecological roles, such as fish that keep algae in check on the reefs. Lionfish also compete for food with native predatory fish such as grouper and snapper. (FFWCC 2017f)

Oscar (Astronotus ocellatus)

This species is superficially similar to North American native sunfishes and black basses (Nico and Neilson 2017). This species is most abundant in canals of water conservation areas and Everglades habitats of Collier, western Miami-Dade, Broward, and Palm Beach counties.

Although it occurs throughout southern Florida, it is typically not as abundant as in marsh-related canals. The native range of this species includes the Orinoco, La Plata, and Amazon river basins in South America. (FFWCC 2017g)

The first Florida records were the result of deliberate stockings from an aquarium fish farm in southeastern Dade County in the late 1950s. Impacts resulting from this species are largely unknown, although Oscars are considered to be potential competitors with native sunfish. (Nico and Neilson 2017)

Mayan Cichlid (Cichlasoma urophthalamus)

This species is superficially similar to sunfishes and black basses. This species was first documented in Florida when specimens were observed and collected in Everglades National Park in 1983. It is established in several areas in and around the park and Big Cypress National Preserve. Mayan cichlids are tolerant to a wide range of salinity and temperature and can withstand virtual anoxia for greater than 2 hours. This species is widely distributed in rivers, lakes, ponds, marshes, and estuaries in its native range. (Schofield et al. 2017)

Studies have shown native fish population reductions when Mayan cichlids increase in number, possibly through competition pressures for food and space, or alternatively through predation effects (Schofield et al. 2017).

Disease Vector and Pest Species

In epidemiology, a vector does not cause a disease but instead spreads infection from one host to another. Numerous disease vectors exist in the animal kingdom. Blood-sucking insects such as mosquitoes, ticks, and fleas are widely known to transmit disease to both animals and humans. Mammals such as bats, raccoons, and skunks (*Mephitidae*) have also been implicated in the spread of disease (NRC 2016a, Section 2.4.1.3). No known occurrences of vector-borne illness have been associated with disease vectors and pests on the Turkey Point site.

3.7.6 Procedures and Protocols

FPL relies on administrative controls and other regulatory programs to ensure that habitats and wildlife are protected during changes in plant operations (i.e., water withdrawal increase, new NPDES discharge point, wastewater discharge increase, air emissions increase), or prior to ground-disturbing activities. The administrative controls, as discussed in Section 9.5, involve reviewing the change, identifying effects, if any, on the environmental resource area (i.e., habitat and wildlife), establishing best management practices (BMPs), modifying existing permits, or acquiring new permits as needed to minimize impacts. Existing regulatory programs that the site is subject to, as discussed in Chapter 9, also ensure that habitats and wildlife are protected. These are related to programs such as the following:

- Stormwater management for controlling the runoff of pollution sources such as sediment, metals, or chemicals.
- Spill prevention to ensure that BMPs and structural controls are in place to minimize the potential for a chemical release to the environment.
- Management of herbicide applications to ensure that the intended use will not adversely affect the environment.

As discussed in Section 2.2.5, the in-scope transmission lines at Turkey Point are restricted to the fenced industrial area adjacent to and connecting PTN, with limited ecological features. Therefore, there are no vegetation or species management plans or procedures applicable to the in-scope transmission lines.

FPL administrative procedures designed to minimize impacts to wildlife and natural communities include the following:

- Routine/Non-Routine Environmental Reporting and Significant Event (ENV AD-079DOA)
- Scheduling of Crocodile Surveillances (ENV AD-080DOA)
- NRC-Required Non-Routine Notifications and Reports (ENV AD-081DOA)
- Turkey Point Maintenance and Improvement Program

3.7.7 Studies and Monitoring

3.7.7.1 Site Certification Ecological Monitoring

Ecological monitoring was required by the State of Florida site certification process for Units 3 and 4 at the Turkey Point site. Site certification for Units 3 and 4 was granted in 2009. FPL's groundwater, surface water, and ecological monitoring plan calls for ecological monitoring to be conducted to establish the current status of ecological baseline conditions and biotic components. FPL proposed a broad-scale vegetation assessment to characterize distribution and density of vegetation. The plan calls for transects to be established within freshwater marshes, mangroves, sawgrass, pond, and nearshore habitats within the Turkey Point site to record patterns of plant community status and environmental conditions in consultation with relevant State of Florida agencies. Various vegetation characteristics, such as species composition, canopy height, and the number of sawgrass culms, would be recorded within plots at predetermined intervals. Measurements would be recorded annually, twice annually, and quarterly depending on the plot type. Leaves would be sampled twice a year for morphological and physiological characterization to document change over time. Surface and pore-water levels and attributes would also be measured at plots and within plants. (NRC 2016a, Section 2.4.6.1)

Assessment methodologies differed slightly between freshwater and saline wetland habitats. All proposed methodologies were to be consistent with those used in the Everglades National Park by the National Science Foundation-funded Long-Term Ecological Research Program. Two years of data collection were conducted before the PTN 2012 uprate. (NRC 2016a, Section 2.4.6.1)

After review of the comprehensive pre-uprate report, the agencies agreed to a reduction in sites and parameters. Samples continued to be collected and analyzed for sodium, chloride, and tritium every quarter, and ions and nutrients were measured twice a year during the semiannual events for both groundwater and surface water. TDSs in groundwater and silica in surface water continued to be collected in the post-uprate semiannual events. Post-uprate monitoring began in 2013 and has continued through 2016.

3.7.7.2 American Crocodile Monitoring and Protection

As described in the USFWS 2006 Biological Opinion, the terms and conditions regarding American crocodile monitoring and protection related to the operation of PTN are as follows (USFWS 2006):

- The installation of four warning signs labeled as "Slow Crocodile Crossing" along Bechtel Road near the test canals on the Turkey Point site.
- Distribution of an informational bulletin on the American crocodile to all employees at the Turkey Point site every 6 months that includes photographs of a crocodile, information about hatchlings, and reminders to use caution when driving or conducting actives on the site.
- Inclusion of a presentation on American crocodiles twice a year at monthly safety meetings attended by all plant personnel. The presentations are to be made during the crocodile mating season when the activity of crocodiles at the site is greatest.
- USFWS notification if a dead or injured crocodile is found.

3.7.7.3 Threatened and Endangered Species Evaluation and Management Plan

The FPL Turkey Point Units 6 and 7 Threatened and Endangered Species Evaluation and Management Plan provides the expected extent of impacts on aquatic, wetland, and terrestrial communities within site boundaries. The Threatened and Endangered Species Evaluation and Management Plan also describes the existing American crocodile management program, including the current status of the species, likely effects of the proposed action, proposed mitigation activities, and assessment of potential cumulative effects. The existing crocodile management program is independent of the construction and operation of Units 6 and 7. Specific activities described in the plan include the following (NRC 2016a, Section 2.4.2.2):

- Preservation and creation of crocodile habitat.
- Use of exclusion zones at known nest sites.
- Daytime and nighttime monitoring surveys to document nests in the CCS.
- Capture and tagging of hatchlings using microchip technologies.
- Relocation of hatchlings to low-salinity habitats to improve survival.
- Recapture, monitoring, and release of individuals to assess growth and survival.

As described in the plan, crocodile monitoring occurs throughout the year, and specific activities are based on known seasons for mating, egg incubation, and hatching. The plan also describes strategies for reducing the risk of vehicle/crocodile collisions during routine maintenance activities onsite and during construction events. Section 7 of the plan describes specific actions that would be taken during preconstruction, construction, and post-construction to ensure minimal disturbance of this species.

3.7.7.4 Pre-Application Monitoring for Units 6 and 7

Surveys of onsite surface water habitats that could be affected by the construction and operation of proposed Units 6 and 7 were conducted in August and November 2007. Survey areas included hypersaline mudflats, remnant canals, channels, dwarf mangrove wetlands, and open water areas within the Turkey Point site. Other than the American crocodile, no federally or state-listed aquatic or semi-aquatic species were observed within the area proposed for the construction of Units 6 and 7. Florida manatee and smalltooth sawfish may occur, however, in nearshore areas of Biscayne Bay adjacent to the Turkey Point site, including the proposed location for the radial collector well system and the equipment barge unloading facility. During the summer of 2009, fish surveys occurred in areas of the site that would be affected by construction, including two remnant canals, the dead-end canal area where construction laydown would occur, pools within the mangrove areas where buildings and parking areas were planned, a portion of the return canal, shallow flats in the east-central part of the nuclear island, and two locations along the cooling canals within the CCS (NRC 2016a, Section 2.4.2.4).

In addition, a 1-year baseline aquatic characterization study was completed in March 2009 to characterize aquatic biota in Card Sound and the Card Sound Canal and included studies of benthic invertebrates and fish and shellfish (NRC 2016a, Section 2.4.2.4).

3.7.7.5 Least Tern Monitoring

Annual monitoring for least tern nest success is conducted by the Florida Fish and Wildlife Conservation Commission (FFWCC) on the berms located within the CCS (IWW facility). This survey effort is part of the statewide shorebird monitoring program. The results of the 2016 survey indicate that the Turkey Point site appears to host the largest ground-nesting colony of least terns on the eastern coast of Florida between Key West and Melbourne, with high rates of nest success.

3.7.7.6 Indigo Snake Studies

Permits for the collection of indigo snake genetic material at the Turkey Point site as part of a large-scale population study have been in place since 2011. This permit authorizes the non-lethal collection of the federally endangered indigo snake for the purposes of scientific research (Orianne Society 2011). However, as of June 2017, FPL has halted all further indigo snake collection at Turkey Point.

3.7.8 Threatened, Endangered, and Protected Species, and Essential Fish Habitat

This section describes federally and state-listed species, proposed threatened and endangered terrestrial species, candidate species for listing, commercially and recreationally valuable species, species critical for ecological structure and function, and biological indicatory species as defined as important by the NRC in NUREG-1555 and NUREG-2176. Designated and proposed critical habitat that may occur in the vicinity of the site is also discussed. Only species with recorded occurrences in Miami-Dade County and species having the potential to occur in Miami-Dade County are discussed. Species identified by FPL as being commercially or recreationally valuable are also included in this section. (NRC 2016a, Section 2.4.2.4) Habitat for nine federally listed species may occur on or adjacent to the Turkey Point site: American alligator (*Alligator mississippiensis*), American crocodile (*Crocodylus acutus*), eastern indigo snake (*Drymarchon corais couperi*), rufa red knot (Calidris canutus), piping plover (*Charadrius melodus*), wood stork (*Mycteria americana*), snail kite (*Rostrhamus sociabili*), Florida bonneted bat (*Eumops floridanus*), and Florida panther (*Puma concolor coryi*).

3.7.8.1 Federally Listed Species

Fifty-two species listed or proposed to be listed by the USFWS as federally threatened, endangered, or candidates for listing as threatened or endangered are known to occur in Miami-Dade County (USFWS 2017b; FNAI 2017b). Almost half (21) of this list consists of plants, and the rest of the list includes six invertebrates, four fish, ten reptiles, eight birds, and three mammals (Table 3.7-12). Species listed as endangered or threatened under the federal Endangered Species Act (ESA) of 1973, as amended [16 U.S.C. § 1531 et seq.], are under the jurisdiction of the USFWS.

3.7.8.1.1 *Plants*

Crenulate Lead-Plant (*Amorpha herbacea var. crenulata*)

This federally and state-listed endangered species is a perennial, deciduous shrub that inhabits marl prairies and wet pine rocklands in a small area of Miami-Dade County (USFWS 2017b;

FNAI 2017b). As discussed in Section 3.7.4.1, pine rockland community is maintained by periodic fires. Greater than 98 percent habitat loss, fire suppression, drainage, and exotic pest plant invasions threaten the species, which was federally listed as endangered on July 18, 1985.

The crenulate lead-plant occurs in plant communities that were historically associated with seasonally hydrated soils and frequent burning, including wet pinelands, transverse glades, and hammock edges. It can be found growing in poorly-drained Opalocka sands within pine rocklands or in wet prairies with Opalocka-rock outcrop complex soils. It requires open sun to partial shade. (USFWS 1999, page 4-789)

The crenulate lead-plant is known from a 20 square-mile area from Coral Gables to Kendall, Miami-Dade County. Its historic range was only slightly greater, extending south to Cutler (based on an entry of *Amorpha caroliniana* on an unpublished plant list by John Kunkol Small of Addison Hammock) and north to the Little River in northeastern Miami-Dade County. This range encompasses an area 5 miles east to west and 12 miles north to south. Currently, eight locations are known for this plant. (USFWS 1999, page 4-789)

This species is known to occur in six conservation areas near the Turkey Point site, although none occur within a 6-mile radius of the site (NRC 2016a, Section 2.4.1.3).

<u>Blodgett's Silverbush [Blodgett's Wild-mercury] (*Argythamnia blodgettii*)</u>

This species is federally threatened and a state-listed endangered species (USFWS 2017b; FNAI 2017b). It is a forb that occurs in sunny gaps and edges in pine rockland, rockland hammock, and coastal berm habitats. This spurge is found in 18 conservation areas in Miami-Dade and Monroe counties (FNAI 2000a), including Biscayne National Park and Everglades National Park, which are adjacent to the Turkey Point site. This species has been observed in the vicinity of the Turkey Point property. (NRC 2016a, Section 2.4.1.3)

<u>Florida Brickell-Bush (*Brickellia eupatorioides [mosieri] var. floridana*)</u>

This plant is a federally and state-listed endangered species (USFWS 2017b; FNAI 2017b). The Florida brickell-bush is a forb that inhabits pine rocklands with an open shrub layer, exposed limestone, and minimal leaf litter. It is endemic to the Miami Rock Ridge and has been observed in the vicinity of the Turkey Point property. Critical habitat for this species has been designated within Miami-Dade County (Figure 3.7-4); however, no critical habitat for this species has been designated within 6 miles of PTN. (NRC 2016a, Section 2.4.1.3)

<u>Hairy Deltoid Spurge (*Chamaesyce deltoidea* ssp. *adhaerens*)</u>

This federally and state-listed endangered species (USFWS 2017b; FNAI 2017b) is a perennial forb endemic to Miami-Dade County and occurs in pine rocklands with scattered shrubs and exposed limestone. This subspecies is the rarest of the deltoid spurge complex. There are 12 sites known and only 6 are on protected lands. *C. adhaerens* occurs in the southern Biscayne pine rocklands, in the area known as the Redlands of Miami-Dade County (USFWS 1999, page 4-840). Berms within the CCS created with limestone fill may provide suitable habitat. However, plant surveys have not been conducted within the CCS. It is unknown if this species occurs on the FPL site.

Deltoid Spurge (*Chamaesyce deltoidea* ssp. *deltoidea*)

This federally and state-listed endangered species (USFWS 2017b; FNAI 2017b) is a perennial forb endemic to Miami-Dade County and occurs in areas with open shrub canopy, exposed limestone, and minimal litter. It is most often associated with the edges of sand pockets; the plants grow both in sand and on oolitic (composed of minute rounded concretions resembling fish eggs) limestone. (NRC 2016a, Section 2.4.1.3)

Deltoid spurge is found in 10 conservation areas in Miami-Dade County north and west of the Turkey Point site. The deltoid spurge has been observed in the Turkey Point property vicinity, and habitat preferences indicate berms within the CCS created with limestone fill may provide suitable habitat. However, plant surveys were not conducted within the CCS. It is unknown if this species occurs on the FPL site. (NRC 2016a, Section 2.4.1.3)

Pineland Sandmat [Pineland Spurge] (*Chamaesyce deltoidea* ssp. *pinetorum*)

This plant is a federally threatened species and is also a state-listed endangered species (USFWS 2017b; FNAI 2017b). It is a perennial forb found in pine rocklands with scattered shrubs and exposed limestone. It is endemic to southern Florida and has been observed in the vicinity of the Turkey Point property. (NRC 2016a, Section 2.4.1.3)

C. deltoidea ssp. pinetorum was historically known from only the southern portions of the Miami Rock Ridge in southern Miami-Dade County. The northernmost occurrences were found at SW 296 Street and possibly as far north as SW 248 Street. It extended south through Long Pine Key in Everglades National Park. (NRC 2016a, Section 2.4.1.3).

The current range is similar to the historical range, although most of the former habitat outside of Everglades National Park has been lost and only small remnants remain. The area outside of Everglades National Park represents nearly half of the range. An April 2011 Florida Natural Areas Inventory (FNAI) survey of the privately-owned Pine Ridge Sanctuary confirmed the plant remains at this site. However, in a recent survey of Larry and Penny Thompson Park, no individuals were found (NRC 2016a, Section 2.4.1.3).

The total population size is estimated to be between 14,500 and 146,000 individuals. The population of the pineland sandmat is likely declining due to threats. However, since that time, several additional occurrences have been found. (NRC 2016a, Section 2.4.1.3)

Wedge Spurge (*Chamaesyce deltoidea* ssp. *serpyllum*)

This federally and state-listed endangered species is listed as occurring in Miami-Dade County (USFWS 2017b; FNAI 2017b). However, *Chamaesyce deltoidea* ssp. *serpyllum* is historically known from only Big Pine Key in the Florida Keys in Monroe County, Florida. The current range of *Chamaesyce deltoidea* ssp. *serpyllum* is on Big Pine Key. Small groups of plants are scattered widely across the island. (80 FR 188)

The wedge spurge occurs in pine rocklands and adjacent disturbed sites on Big Pine Key, including roadsides. It most often grows directly from crevices in the oolitic limestone substrate. Within pine rocklands, this species is associated with areas of relatively higher elevation with extensive exposed rock substrate where the understory is open, hardwood and palm density is low, and native herbaceous species cover and richness are high. Roadsides dominated mostly by native herbs and grasses where exotic lawn grasses are not established are a potentially important habitat for *C. deltoidea* ssp. *serpyllum* (80 FR 188). Due to its restricted range, this species is not likely to occur on the Turkey Point site.

Garber's Spurge (*Chamaesyce garberi*)

This plant is a federally listed threatened species and a state-listed endangered species (USFWS 2017b; FNAI 2017b). The plant is a short-lived, perennial forb. It requires open sunny areas where frequent fires have maintained an open canopy. It has been found in the following four habitats: beach dune, coastal rock barren, hammock edge, and pine rockland. (NRC 2016a, Section 2.4.1.3)

Garber's spurge was listed in 1985 because of habitat loss from increased residential and commercial development. A complete status survey has not been performed for Garber's spurge since 1980. In the status survey, five sites were found: three on Cape Sable (Everglades National Park), one on Long Pine Key (Everglades National Park), and one on Big Pine Key. Only the Long Pine Key site has been resurveyed, and it was found to contain approximately 150 plants. The status of the three Garber's spurge populations on the Cape is not known. A new population was found in 1988 at the Charles Deering Estate, Miami-Dade County, after a burn. It had 250 to 500 plants in 1991, but the population size appears to be getting smaller. Two other sites have been added, Bahia Honda State Park and Long Key SRA. The population sizes and trends at these sites are unknown. Habitat for the Garber's spurge has been lost to development, fire suppression, and invasive exotics. In addition, the remaining habitat is relatively fragmented and most populations are small. These small, disjunct populations are more susceptible to extirpation from a single disturbance, natural or manmade, without the chance of recruitment from a nearby population. Fire suppression and the invasion of exotic plants can result in over-shading of the understory, reducing the quality of the habitat. Over time this could lead to the extirpation of Garber's spurge at these sites, (USFWS 1999, page 4-851)

Garber's spurge occurs in a few PAs where it is being managed. The National Key Deer Refuge uses prescribed fire to manage pineland habitats on the refuge. The main focus of their management is for the key deer, but it may benefit Garber's spurge. In Everglades National Park, fire is used as a management tool in pine rocklands. However, management at Cape Sable has been limited by the available manpower and funding. Garber's spurge occurs in a variety of habitats in the Florida Keys and Miami-Dade County and will require management practices specific to each habitat. Although there are differences between the habitats, they are all early successional and require some type of disturbance (i.e., fire or wash over). The habitats in the Florida Keys have a slower growth rate than similar habitats in Miami-Dade County and require less frequent disturbance. (USFWS 1999, page 4-893)

This species is not known to occur within the vicinity of the Turkey Point property. Due to the absence of appropriate management practices, this species is unlikely to occur on the Turkey Point site. (NRC 2016a, Section 2.4.1.3)

Cape Sable Thoroughwort (*Chromolaena frustrata*)

This plant is a federally listed endangered species with no state listing status (USFWS 2017b; FNAI 2017b) that is found at rockland hammock edges, in coastal rock barrens, and in the ecotone between buttonwood hammock and coastal hardwood hammock. It does not occur in disturbed habitats.

The Cape Sable thoroughwort is endemic to the southern tip of Florida and the Florida Keys. The estimated rangewide population was 6,500 to 7,500 plants when the eight known populations were last surveyed. Four of eight extant *C. frustrata* populations consist of fewer than 100 individuals. These populations may not be viable in the long term due to their small number of individuals. The Cape Sable thoroughwort was historically known from Monroe County, both on the Florida mainland and the Florida Keys, and in Miami-Dade County along Florida Bay in the Everglades National Park. In the Florida Keys, *C. frustrata* was historically observed on Big Pine Key, Boca Grande Key, Fiesta Key, Key Largo, Key West, Knight's Key, Lignumvitae Key, Long Key, Upper Matecumbe Key, and Lower Matecumbe Key. This species has been extirpated from half of the islands where it occurred in the Florida Keys but appears to occupy its historical distribution in the Everglades National Park. Although remaining *C. frustrata* populations occur mostly within public conservation lands, threats to the species from a wide array of natural and anthropogenic sources remain. Habitat loss and modification, recreation impacts, and competition from nonnative plant species still exist in all remaining populations. Additionally, much of the species' habitat is projected to be lost to sea-level rise over the next century. (79 FR 5)

This species does not occur in disturbed habitats. The Cape Sable thoroughwort is not known to occur on the Turkey Point property. Land cover information indicates hammock habitats are not present on the Turkey Point property. Therefore, suitable habitat for this species is not likely to occur on the Turkey Point site (NRC 2016a, Section 2.4.1.3).

Florida Semaphore Cactus (*Consolea [Opuntia] corallicola*)

This cactus is a federally and state-listed endangered species (USFWS 2017b; FNAI 2017b). It is found in the buttonwood zone between rockland hammocks and coastal swamps.

Plants in the wild may all be functionally male. All plants are severely threatened by a deadly exotic moth (FNAI 2000b).

Consolea corallicola was known historically from three islands of the Florida Keys in Monroe County (Key Largo, Big Pine Key, and Little Torch Key) and from Swan Key, a small island in Biscayne Bay in Miami-Dade County. The current range of *Consolea corallicola* includes two naturally occurring populations, one on Swan Key in Biscayne National Park, Miami-Dade County, and one at the Nature Conservancy's Torchwood Hammock Preserve on Little Torch Key. These naturally occurring populations account for fewer than 1,000 plants. All of the attempted reintroductions of *Consolea corallicola* have experienced high mortality (50 to 100 percent) due to Cactoblastis moth predation and crown rot. (78 FR 206)

Due to its restricted range, this species is not likely to be located on the Turkey Point site.

Okeechobee Gourd (*Cucurbita okeechobeensis* ssp. *okeechobeensis*)

This species is a federally listed endangered species; it is not listed as occurring in Miami-Dade County by the FNAI (USFWS 2017b; FNAI 2017b). The Okeechobee gourd is an annual or perennial, fibrous-rooted, high-climbing vine with tendrils, belonging to the gourd family (USFWS 1999, page 4-933).

The Okeechobee gourd was historically found on the southern shore of Lake Okeechobee, in Palm Beach County, and formerly in the Everglades. The relative abundance of the Okeechobee gourd in the Everglades region south of the original pond apple forest along the southern rim of Lake Okeechobee is not known. In 1965, this species was seen north of Homestead in an agricultural area of Dade County. A population on a disturbed roadside north of Andytown, Broward County, was discovered in 1978 and was destroyed by road construction the following year. (USFWS 1999, page 4-933)

In recent surveys, the species was found to be restricted to nine sites along the middle St. Johns River in Volusia County and around Lake Okeechobee in Glades and Palm Beach counties. It was present at 11 sites along the southeastern shore of Lake Okeechobee, including Torry Island, Ritta Island, Kreamer Island, Bay Bottom Dynamite Hole Island, South Shore Dynamite Hole Island, and the southern shore of the Lake Okeechobee Rim Canal. (USFWS 1999, page 4-933)

The documented population of Okeechobee gourd around the southeastern shore of Lake Okeechobee is strongly associated with Torry muck, a soil formed in the extensive pond apple forests that once surrounded Lake Okeechobee. However, successful growth and reproduction of the gourd under cultivation suggests that the species can grow in a wider range of soils. (USFWS 1999, page 4-933)

Due to its restricted range, this species is not likely to be located on the Turkey Point site.

Florida Prairie-Clover (*Dalea carthagenensis floridana*)

This plant is a federally listed endangered species and a state-listed endangered species (USFWS 2017b; FNAI 2017b). It is a shrub that inhabits pine rocklands, edges of rockland hammocks, coastal uplands, and marl prairies. Currently, there are only nine known populations, many of which are found on conservation lands north and west of the Turkey Point site, including Everglades National Park. The species was not found during a 2-year project intended to survey and map rare and exotic plants along Florida Department of Transportation (FDOT) rights-of-way (ROWs) within Miami-Dade and Monroe counties (USFWS 2013a).

Most of the Florida prairie-clovers habitat outside of the Big Cypress region has been destroyed by human activity. Residential and commercial development and agriculture have drastically reduced the habitat for this species throughout pine rockland habitats in southern Florida (USFWS 2013a).

Suitable habitat is likely not present within the project sites within the Turkey Point site, and due to its restricted range, this species is not likely to be located on the Turkey Point site.

Florida Pineland Crabgrass (*Digitaria pauciflora*)

This plant is a federally listed threatened species and a state-listed endangered species (USFWS 2017b; FNAI 2017b). This grass species is endemic to southern Florida where it is found in marl prairie and pine rockland habitats. Currently, this species is found only in the Big Cypress National Preserve and Everglades National Park. (NRC 2016a, Section 2.4.1.3)

Habitat loss continues to occur in this species historical range, and most remaining suitable habitat has been negatively altered by human activity. As discussed in Section 3.7.4.1, pine rocklands within Miami-Dade County have largely been destroyed. Pine rocklands in the county (including patches of marl prairie) have been reduced to about 11 percent of their former extent. Of the estimated historical extent of 182,780 acres (74,000 hectares), only 20,106 acres (8,140 hectares) of pine rocklands remained in 1996. Outside of Everglades National Park, only about 1 percent of the Miami Pine Rock Ridge pinelands remain, and much of what is left is in small remaining blocks isolated from other natural areas. (USFWS 2013b)

FPL has reported Florida pineland crabgrass was observed in the vicinity of the Turkey Point site (NRC 2016a, Section 2.4.1.3).

Small's Milkpea (*Galactia smallii*)

This plant is a federally and state-listed endangered species (USFWS 2017b; FNAI 2017b). Small's milkpea is a small, perennial legume with small purple flowers and a prostrate habit. *Galactia smallii* occurs in the Redland pine rocklands of southern Miami-Dade County, Florida. Its distribution is spotty because of the limited habitat available. The type locality is listed as near Silver Palm, Miami-Dade County, in an area now encompassed by Redland pine rocklands. (USFWS 1999, page 4-1024)

Preliminary results of a study of the abundance, distribution, and habitat preferences of Galactia species in Miami-Dade County pine rocklands indicate that Small's milkpea prefers higher elevations and lower shrub cover than the more common *Galactia* species. The distribution of Small's milkpea is correlated with soil depth and color in Redland pine rocklands. It does not occur in sites with a high amount of exotic plant cover, specifically, *Schinus terebinthifolius* and *Neyraudia reynaudiana.* (USFWS 1999, page 4-1024)

Small's milkpea was listed as endangered because of the loss of pine rockland habitat to residential and commercial development (USFWS 1999, page 4-1024). As of 2007 this species was only known at two sites near Homestead. A 1994 survey found the plant at seven conservation areas, and it may occur in two additional conservation areas. None of these areas are within a 6-mile radius of PTN. (NRC 2016a, Section 2.4.1.3)

Johnson's Seagrass (*Halophila johnsonii*)

Johnson's seagrass is a federally threatened species that is known to occur near Sebastian Inlet to Virginia Key (USFWS 2017b; FNAI 2017b). This species may occur near Key Biscayne north and east of Turkey Point peninsula and to the south in Card Sound, but it has not been observed near the Turkey Point site or in the CCS. Physical habitat requirements for this species are variable, including both shallow intertidal and deeper subtidal zones in water that is clear and deep or turbid and shallow. In tidal channels, this seagrass is found in coarse sand substrates. Johnson's seagrass was not reported to occur near the Turkey Point peninsula by EAI. Primary threats include propeller and anchor scouring, effects of dredging, overwater structure construction and shading, water pollution, and shoreline development. Critical habitat for Johnson's seagrass designated on April 5, 2000, in Florida, includes the central portion of Biscayne Bay extending from Virginia Key north to Miami. (NRC 2016a, Section 2.4.1.3)

A Johnson's Seagrass Recovery Plan was prepared in 2002 by the Johnson's Seagrass Recovery Team for NOAA/National Marine Fisheries Service (NMFS). Actions included the identification and protection of populations and habitat, range-side mapping and monitoring, studies to understand life histories, genetic traits, development of management and restoration techniques, and education and outreach. Recovery goals were designed to ensure (1) the present geographic range remains stable or increases for at least 10 years; (2) self-sustaining populations are present throughout the range at distances that allow for stable vegetative recruitment and genetic diversity; and (3) long-term protection on populations and supporting habitat. In 2007, a 5-year review was completed. The major findings suggested that although the populations in the northern range of the species appeared to be stable and self-sustaining, longer-term monitoring data were needed to confirm the status and stability of the population in the southern range (Jupiter Inlet to Biscayne Bay). The final conclusions of the report stated that Johnson's seagrass populations continue to remain vulnerable to natural and anthropogenic stressors, and the species continues to meet the definition of threatened under the ESA because it is still likely to become endangered in the foreseeable future throughout its range. (NRC 2016a, Section 2.4.1.3)

Beach Jacquemontia (*Jacquemontia reclinata*)

This federally and state-listed endangered species (USFWS 2017b; FNAI 2017b) is a member of the morning glory family. It is restricted to beach coastal strand and maritime hammock habitats and requires open areas generally found on the crest and lee side of stable dunes. It is also found in disturbed openings in maritime hammocks, coastal strand, and coastal scrub habitat (NRC 2016a, Section 2.4.1.3). *Jacquemontia reclinata* may also invade and restabilize maritime hammock or coastal strand communities that have been disturbed by tropical storms, hurricanes, and possibly fire (USFWS 1999, page 4-1049).

Loss of habitat to urbanization and beach erosion led to the listing of *J. reclinata* as endangered on November 24, 1993. The vast majority of beach coastal strand and maritime hammock vegetation, the primary habitat of this species, has been destroyed by residential and commercial construction. Habitat within public lands has also been destroyed or degraded due to construction of parking lots, pedestrian routes, picnic areas, and other modifications for recreational uses. Additional habitat has been lost to beach erosion at some sites. (USFWS 1999, page 4-1049)

Fewer than 500 plants of this species are known from nine sites, all of which are more than 6 miles from PTN. Beach jacquemontia was not observed during previous surveys for threatened and endangered species on the Turkey Point site. (NRC 2016a, Section 2.4.1.3)

Sand Flax (*Linum arenicola*)

A federally and state-listed endangered species (USFWS 2017b; FNAI 2017b), this forb is found in pine rockland, marl prairie, and disturbed areas on rocky soils adjacent to these habitats. This species grows in thin soil over limestone or in small soil patches caught in surface irregularities of exposed limestone. Sites most likely to support *L. arenicola* have a grass- and herb-dominated understory, abundant pine regeneration, and high cover of exposed rock. The pine rocklands and marl prairies where this species occurs require periodic fire to maintain an open, shrub-free subcanopy and to reduce litter levels. While pine rocklands historically were the primary habitat of *L. arenicola*, the species is currently rare in relatively undisturbed pine rocklands, with the exception of plants on Big Pine Key. Several occurrences are in scraped (scarified) pine rocklands remnants that are dominated by native pine rocklands species but have little or no pine canopy or subcanopy. Two populations in Miami-Dade County occur entirely on levees composed of crushed oolitic limestone that are surrounded by sawgrass marsh. Roadsides and other disturbed sites are important habitat for *L. arenicola* because they imitate upland herbaceous habitat. (80 FR 188)

The current range of *L. arenicola* consists of eight extant populations in Miami-Dade County and four extant populations in the Florida Keys. In Miami-Dade County, the current distribution of *L. arenicola* is from just north of SW 184 Street (in the Richmond Pinelands), south to the intersection of Card Sound Road and the C-102 Canal, and west to SW 264 Street and 177 Avenue (Everglades Archery Range at Camp Owaissa Bauer). This distance is approximately 30 kilometers (19 miles) north to south, and 14 kilometers (9 miles) east to west. In the Florida Keys (Monroe County), the current distribution of *L. arenicola* includes four islands: Big Pine Key, Upper and Lower Sugarloaf Keys, and Big Torch Key. (80 FR 188)

Based on a compilation of all survey work through 2013 of 26 historical population records for *L. arenicola*, 12 populations are extant and 14 are extirpated, a loss of roughly 54 percent of known populations from the early 1900s to the present (80 FR 188).

A comprehensive field survey of *L. arenicola* sites in Miami-Dade was conducted in 2013. *L. arenicola* populations were found at six sites containing an estimated total of 107,060 plants. Populations ranged in size from 23 plants to 74,000 plants, with a median population size of approximately 4,500. All but one of the Miami-Dade *L. arenicola* populations occur on public lands, but only the Martinez Pineland site is managed for conservation. The remaining sites are owned by the U.S. Department of Defense (military bases), State of Florida (canal banks; SFWMD), and Miami-Dade County (a public archery range). A seventh small population located in 2014 at the Richmond pinelands is located on private land that is currently slated for development. (80 FR 188)

Sand flax occurs in Homestead Bayfront Park, which is less than 1 mile north of the Turkey Point site boundary. FPL has noted sand flax was observed in the vicinity of the Turkey Point site (NRC 2016a, Section 2.4.1.3). Based on the proximity of observed populations to Turkey Point, this species may be located on the site.

<u>Carter's Small-Flowered Flax (*Linum carteri* var. *carteri*)</u>

This federally and state-listed endangered species is found in Miami-Dade County (USFWS 2017b; FNAI 2017b). This annual herb grows exclusively on the Miami Rock Ridge in Miami-Dade County outside the boundaries of Everglades National Park. Its known populations are found at elevations ranging from approximately 1.6–4.8 meters (5.2–15.9 feet), with occurrences distributed fairly regularly throughout this range. All known occurrences are within either scarified pine rockland, disturbed areas adjacent to or within pine rocklands, or in completely disturbed areas having a limestone substrate. (78 FR 192)

This species is found in several conservation areas north of the Turkey Point site (Camp Owaissa Bauer, Deering Estate at Cutler, R. Hardy Matheson Preserve, and Rockdale Pineland)

(NRC 2016a, Section 2.4.1.3). In 2012, the Institute for Regional Conservation conducted a status survey for *Linum carteri var. carteri* to include extant occurrences, historical locations, and new survey stations. Because they had previously conducted a comprehensive survey of all pine rockland habitat during 2004–2005 (during which, *L. c. var. carteri* was not found on any new sites), this habitat was excluded from new surveys. Canals within urban Miami-Dade County that intersected with the pine rockland soils of the Miami Rock Ridge were surveyed, as were additional disturbed sites with remnant native vegetation in close proximity to existing sites. This species was found at seven locations containing approximately 1,313 individuals; populations ranged in size from a single plant to 700 plants, with a median of 18 plants. One occurrence (at Gifford Arboretum Pineland), which had not been observed since the 1990s but whose habitat was still extant, was deemed ''Historical'' and may reappear there. Of the seven extant occurrences, five populations are on publicly owned lands, but only three of these are managed for the conservation of natural resources. Four of the populations occur near the north end of the variety's range (near R. Hardy Matheson Preserve), and three occur near the southern end (near Camp Owaissa Bauer), with an approximately 16-kilometer (10-mile) gap between the closest populations of these groups. Within each grouping, populations are approximately 1.3–4.3 kilometers (0.8–2.7 miles) apart. (78 FR 192)

Critical habitat for this species has been designated within Miami-Dade County (Figure 3.7-4); however, no critical habitat for this species has been designated within a 6-mile radius of the Turkey Point site. This species has been observed in the vicinity of the Turkey Point site (NRC 2016a, Section 2.4.1.3), and therefore may occur on the site.

<u>Tiny Polygala (*Polygala smallii*)</u>

The tiny polygala is a short-lived forb that is a federally and state-listed endangered species (USFWS 2017b; FNAI 2017b).

Tiny polygala occurs in four distinct habitats with similar characteristics: pine rockland, scrub, high pine, and open coastal spoil. All of these habitats are pyrogenic (i.e., extremely dry and prone to periodic natural fire). Pine rocklands historically burned every 2 to 15 years. Sand pine scrub and sandhill burn less frequently, possibly every 10 to 50 years. Miami-Dade County populations of tiny polygala occupy sand deposits within the pine rocklands that are primarily in the southern portion of the county. The depth of the sand deposits ranges from 2 millimeters to greater than 90 centimeters. No plants have been found in soil shallower than 2.0 centimeters. *Polygala smallii* occurs in areas with significantly shallower litter deposits than the surrounding pine rockland habitat. (USFWS 1999, page 1135)

This species is known to occur on the Atlantic Coastal Ridge of southeastern Florida, from the Perrine area of Miami-Dade County north to southeastern St. Lucie County. Tiny polygala is currently known from 11 populations. Seven of these populations are on public land and are protected. Population sizes of tiny polygala can exhibit annual fluctuations as much as several hundred percent (season to season). MDC DERM has been monitoring six populations in Miami-Dade County for 3 years and has not found any clear population trends (USFWS 1999, page 1135). This species has been observed in the vicinity of the Turkey Point property (NRC 2016a, Section 2.4.1.3).

Everglades Bully (*Sideroxylon reclinatum* ssp. *austrofloridense*)

A federally listed threatened species within Miami-Dade County, with no state listing status (USFWS 2017b; FNAI 2017b), the Everglades bully is a thorny shrub that is endemic to Miami-Dade County.

Everglades bully is restricted to pinelands with tropical understory vegetation on limestone rock (pine rocklands), mostly in the Long Pine Key area of Everglades National Park, which is an area of pine rockland surrounded by wetlands. In Everglades National Park, Everglades bully is found in pinelands, pineland/prairie ecotones, and prairies. Plants are found in low elevation pinelands and pineland/marl prairie ecotones that flood each summer. Plants are also present in Big Cypress National Preserve, south of Loop Road, but the habitat has not been described and surveys have not been conducted. The species was locally common at the edges of pine rockland and prairie when plants were collected at the very southern end of Lostman's Pines, close to the Everglades National Park boundary, in 2003. Occurrences in Miami-Dade County are within remnant pine rocklands (USFWS 2010a).

Everglades bully is extant at nine sites, including Long Pine Key in the Everglades National Park, Big Cypress National Preserve, Larry and Penny Thompson Park, Pine Ridge Sanctuary, Lucille Hammock, South Dade Wetlands, natural forest community (NFC) #P-300, NFC #P-310, and Quail Roost Pineland (USFWS 2010a). The Everglades bully has not been observed growing in the Turkey Point site vicinity (NRC 2016a, Section 2.4.1.3).

Florida Bristle Fern (*Trichomanes punctatum* ssp. *floridanum*)

This fern is a federally and state-listed endangered species (USFWS 2017b; FNAI 2017b). In Miami-Dade County, *Trichomanes punctatum ssp. floridanum* is generally epipetric (a plant that grows on rocks) or epiphytic (a plant that grows nonparasitically upon another plant), typically growing in rocky outcrops of rockland hammocks, in oolitic limestone solution holes, and occasionally on tree roots in limestone-surrounded areas (80 FR 193).

Habitat modification and destruction, caused by human population growth and development, agricultural conversion, regional drainage, and canal installation, have impacted the range and abundance of *Trichomanes punctatum ssp. floridanum*. Secondary effects from hydrology and canopy changes have resulted in changes in humidity, temperature, and existing water levels; loss of natural vegetation; and habitat fragmentation. (80 FR 193)

The four populations that constitute the Miami-Dade County metapopulation are located in urban preserves managed by the county's Environmentally Endangered Lands Program and the Natural Areas Management Division of Miami-Dade County's Parks, Recreation and Open Spaces Department. No comprehensive survey has been conducted in rockland hammocks in

Miami-Dade County where suitable *Trichomanes punctatum ssp. floridanum* habitat has been identified. (80 FR 193)

Based on the habitat needs and restricted range of this species, it is not likely to be located on the Turkey Point site.

3.7.8.1.2 *Invertebrates*

Stock Island Tree Snail (*Orthalicus reses reses*)

This snail is federally listed as threatened (USFWS 2017b; FNAI 2017b). It is found in tropical hardwood hammock (rockland hammock). Host trees are gumbo limbo (*Bursera simarouba*), strangler fig (*Ficus aurea*), stoppers (*Eugenia spp.*), pigeon plum (*Coccoloba diversifolia*), Jamaican dogwood (*Piscidia piscipula*), poisonwood (*Metopium toxiferum*), and other smoothbarked hardwoods. This species is found only on Stock Island, just east of Key West. The very similar subspecies *O. r. nesodryas* is found throughout the Keys and extreme southern mainland Florida (FNAI 2001a). Due to the extremely restricted range of this species, the probability of its occurrence on the Turkey Point site is low.

Florida Leafwing (*Anaea troglodyta floridalis*)

This species is federally listed as endangered; it has no state listing status (USFWS 2017b; FNAI 2017b). This species is native to the pine rockland habitat of southern Florida. The Florida leafwing once occurred in pine rockland habitat throughout Miami-Dade and Monroe counties. Leafwing populations have declined throughout their historic range and their distribution is now extremely limited. The reasons for this decline may include destruction of pine rockland habitat, introduction of exotic plant and insect species, fire suppression or exclusion, use of insecticides for mosquito control, and collecting. Until very recently, leafwings were still found in a few pine rockland fragments near Everglades National Park and on Big Pine Key in the lower Florida Keys. This species has not been observed outside of Everglades National Park since 2007 (NPS 2017b). Due to the proximity of known habitat of this species, it is possible that it may occur on the Turkey Point property.

Miami Blue (*Cyclargus thomasi bethunebakeri*)

This species is federally listed as endangered (USFWS 2017b; FNAI 2017b). The Miami blue butterfly inhabits tropical hardwood hammocks, tropical pine rocklands, and beachside scrub in Florida. It was historically known from coastal mainland Florida as far north as Hillsborough County on the Gulf and Volusia County on the Atlantic, but it had disappeared from the mainland by the 1980s. The Miami blue was thought extinct until it was rediscovered in 1999 in Bahia Honda State Park in the Lower Florida Keys. Although subject to significant fluctuations, the Bahia Honda population persisted until 2010, when it disappeared, possibly due to a combination of drought, cold temperatures, and predation by non-native green iguanas. Additional populations of Miami blues were discovered in Key West National Wildlife Refuge in 2006

(FFWCC 2017h). Due to its limited range, this species is not likely to occur on the Turkey Point site.

Schaus' Swallowtail (*Papilio aristodemus ponceanus*)

This species is federally listed as endangered (USFWS 2017b; FNAI 2017b). Schaus' swallowtail inhabits tropical hardwood hammocks in Key Largo and the islands in Biscayne National Park that support the species primary habitat. Habitat for this species consists of tropical hardwood hammocks (rockland hammocks). Their host plant is torchwood (*Amyris elemifera*), but wild lime (*Zanthoxylum fagara*) is utilized in rare occurrences (FNAI 2001b). The diet of Schaus' swallowtail primarily consists of guava nectar, wild tamarind, and cheese shrubs (FFWCC 2017i). Due to the restricted range of this species, it is not likely to occur on the Turkey Point site.

Bartram's Scrub-Hairstreak (*Strymon acis bartrami*)

This species is federally listed as endangered (USFWS 2017b; FNAI 2017b). The Bartram's scrub-hairstreak occurs only within pine rocklands, specifically those that retain the subspecies' only known larval host plant, pineland croton. Once occurring throughout the pine rocklands of the lower Florida Keys, pineland croton now occurs only on Big Pine Key. The last reports of the host plant from other keys were from No Name and Little Pine Keys. Surveys conducted in 2010 of relict pine rockland habitat throughout the Lower Keys failed to locate the plant on any island other than Big Pine Key. Big Pine Key retains the largest undisturbed tracts of pine rockland habitat in the keys. (USFWS 2015b)

The Bartram's scrub-hairstreak is endemic to southern Florida including the lower Florida Keys. The butterfly was locally common within pine rockland habitat that once occurred within Miami-Dade and Monroe counties and less common and sporadic within croton-bearing pinelands in Collier, Palm Beach, and Broward counties. Populations of the Bartram's scrub-hairstreak have become increasingly localized as pine rockland habitat has been lost or altered through anthropogenic activity. Recent surveys and natural history studies indicate that the Bartram's scrub-hairstreak is extant on Big Pine Key (Monroe County), in the Long Pine Key region of the Everglades National Park, and locally within pine rockland habitat fragments on mainland Miami-Dade County, particularly those adjacent to Everglades National Park, such as Navy Wells Pineland Preserve and the Richmond Pine Rocklands. (USFWS 2015b)

The Bartram's scrub-hairstreak is rarely encountered more than 5 meters (16.4 feet) from its host plant–pine rockland interface, indicating that the Bartram's scrub hairstreak may have limited dispersal abilities (USFWS 2015b). Due to the limited dispersal range of this species, it is unlikely to occur on the Turkey Point site.

Miami Tiger Beetle (*Cicindelidia floridana*)

This species is federally listed as endangered (USFWS 2017b; FNAI 2017b). The Miami tiger beetle is a pine rockland obligate species and was believed to be extinct until its rediscovery in

2007. These tiger beetles are very habitat specific in that they are only found in open sand microhabitat within pine rocklands of the Miami Rock Ridge. The historical range of the Miami tiger beetle is not completely known, and available information is limited based on the single historical observation prior to the species' rediscovery in 2007. It was initially documented in 1934 from the northern end of the Miami Rock Ridge, within pine rocklands characterized by extensive sandy pockets of quartz sand, a feature that is necessary for the Miami tiger beetle. It is likely that the Miami tiger beetle historically occurred throughout pine rockland habitat on the Miami Rock Ridge, including outside the boundaries of Everglades National Park. (USFWS 2016)

The species is found outside the boundaries of Everglades National Park on the pine rocklands of the Miami Rock Ridge in Miami-Dade County, Florida. The Miami tiger beetle is known to occur in two populations separated by urban development that are within 3.1 miles (5 kilometers) of each other. Based upon available information from survey data, it appears that the species occurs in a very limited range. Surveys and observations conducted at Long Pine Key in Everglades National Park have found no Miami tiger beetles, and habitat conditions there are considered unsuitable for the species. (USFWS 2016) This species is unlikely to be located on the Turkey Point site due to the distance of the site from available habitat for this species.

3.7.8.1.3 *Fish*

Shortnose Sturgeon (*Acipenser brevirostrum*)

This species is federally listed as endangered (FNAI 2017c; NOAA 2017a). The shortnose sturgeon is one of seven species of sturgeons found in North America. Sturgeons are benthic feeders consuming organisms on, in, or near the bottom of a water body. Preferred prey includes worms, crustaceans, insect larvae, and mollusks. (FFWCC 2017j)

Shortnose sturgeon are classified as anadromous, living in the estuarine reaches of most Atlantic seaboard rivers and ascending to flowing fresh water to spawn. They tend to congregate in the main river channels and only use smaller tributaries to a lesser extent. While shortnose sturgeons only occasionally frequent marine habitats, they can tolerate full sea water and do migrate between rivers. The shortnose sturgeon can be found from New Brunswick, Canada, to the St. Johns River in Florida. (FFWCC 2017j)

Now that rampant overharvest has been stopped, the main threat to shortnose sturgeon survival is the dams located on Atlantic Seaboard rivers, which prevent sturgeon from reaching historic spawning areas, thereby decreasing the spawning rate of the species. Habitat destruction is also a threat to the sturgeon population. Shortnose sturgeon habitat has increased vulnerability because they inhabit areas that are at risk of dredging. The dredging of river channels is a practice that can destroy or suffocate sturgeon eggs located on objects in the benthic layer (bottom, sediment layer) of the river. Dredging of rivers also affects the food source of sturgeons as they are benthic feeders. Other threats to the sturgeon population include lethal by-catch and declining water quality. Water quality can be affected by pollution reaching the floodplains of the river and excessive water withdrawals from the rivers. Sturgeons are slow breeders, which makes any loss of breeders or spawning habitat a serious problem for the species. (FFWCC 2017j) Based on the range of this species, it not likely to occur in the vicinity of the Turkey Point site.

Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*)

This species is federally listed as endangered (FNAI 2017c; NOAA 2017a). The Atlantic sturgeon is one of seven species of sturgeons found in North America. The Atlantic sturgeon is considered a homestream-spawner, which means it will usually return to the freshwater river that it was born in to spawn. Spawning occurs during the spring in freshwater rivers, when temperature, flow, and pH are at optimum levels. Atlantic sturgeon are also considered skip-spawners, which roughly means that if conditions are not optimum for a successful spawn, set, and hatch, they will skip that spawning season and absorb their eggs. After a missed spawning attempt, Atlantic sturgeon often wait three years before spawning again. When spawning does occur, the eggs are ejected, fertilized, and rapidly adhere to objects that are located in or near the bottom of the river. The egg mass for a mature Atlantic sturgeon female (sow) ranges between 250,000 to 1,000,000 eggs. Eggs hatch roughly four days post-spawn when water temperatures range from 61°F-64°F (16-17°C). Most of the larvae will not survive due to reasons such as deformity, disease, fungus, predation, lack of food, ill-timed floods or droughts, and random chaos. (FFWCC 2017k)

The Atlantic sturgeon inhabits both salt and freshwater habitats, cycling between the two. Some migrate into brackish and saltwater during the fall and feed there throughout the winter months, and migrate into freshwater rivers during the spring and hold there through the summer months, while others remain at sea for years. This species of sturgeon can be found from Labrador, Canada, south to the St. Johns River in Florida. (FFWCC 2017k)

The main threat to the Atlantic sturgeon's survival is dams located on Atlantic Seaboard rivers, which prevent sturgeons from reaching historic spawning areas, therefore decreasing the spawning rate of the species. Habitat destruction is also a threat to the sturgeon's population. Atlantic sturgeon habitats have increased vulnerability since they inhabit areas that are at risk of dredging. The dredging of river channels is a practice that can destroy or suffocate the sturgeon eggs located on objects in the benthic layer of the river. Dredging of rivers also affects the food source of sturgeons as they are benthic feeders. Other threats of the sturgeon population include lethal by-catch and declining water quality. Water quality can be affected by pollution reaching the floodplains of the river, and excessive water withdrawals from the rivers. Sturgeons are slow breeders, which makes any loss of breeders or spawning habitat a serious problem for the species. (FFWCC 2017k). Based on the range of this species, this species is not likely to occur in the vicinity of the Turkey Point site.

Nassau Grouper (*Epinephelus striatus*)

This species was federally listed as threatened in 2016 (FNAI 2017c; NOAA 2017a; 81 FR 125). Adults are often found in coral reef or rocky bottom habitats. Fishing pressure in the twentieth century led to the commercial extinction of the species in the U.S. Caribbean by the mid-1980s; Florida populations declined from the 1950s to very low levels in the early 1990s. Currently, Nassau grouper are considered overfished in Florida, and fishing for this species is prohibited within U.S. waters. This species is a solitary, diurnal predator that is found from inshore water to depths of about 100 meters in waters of the South Atlantic Ocean and Caribbean Sea and is known to occur in Biscayne Bay. Nassau grouper reach maturity at about 5 years of age and may live several decades, reaching a maximum size of about 39 inches (100 centimeters). Prey items include a wide variety of fish and invertebrates. This species is primarily gonochoristic (exhibiting separate sexes) and is known to congregate in very large numbers at specific nearshore locations to spawn. This species has been reported in Biscayne Bay and likely occurs near the Turkey Point site. (NRC 2016a, Section 2.4.2.3)

Smalltooth Sawfish (*Pristis pectinate*)

The smalltooth sawfish is a federally endangered (FNAI 2017c; NOAA 2017a) tropical marine and estuarine fish with a circumtropical distribution. The largest populations in the United States are south and southwest of Florida, from Charlotte Harbor to the Dry Tortugas. Peninsular Florida has the largest number of capture records within U.S. waters and probably contained the largest historic populations. The preferred habitat of smalltooth sawfish is shallow nearshore areas with muddy or sandy bottoms. Limited life history information is available for this species. Smalltooth sawfish have been observed in Biscayne Bay and Card Sound and at nearshore locations near Turkey Point peninsula, but have not been observed in the CCS. Primary threats to this species are incidental catch in commercial and recreational fisheries and habitat loss or degradation. Critical habitat for the smalltooth sawfish consists of two units: the 221,459-acre Charlotte Harbor Estuary Unit and the 619,013-acre coastal habitat of the Ten Thousand Islands/Everglades Unit, both located on the west coast of Florida (Figure 3.7-4). No critical habitat for this species has been designated in Biscayne Bay or Card Sound. (NRC 2016a, Section 2.4.2.3)

FPL has indicated that smalltooth sawfish have been observed in Biscayne Bay and the Biscayne Bay Aquatic Preserve, but no individuals were collected during the Card Sound study described in Section 3.7.7.4. This species is considered to be relatively scarce along the eastern coast of Florida in comparison to documented occurrences on the west coast of Florida, Florida Bay, and the Florida Keys. Sawfish sighting data provided by the Florida Museum of Natural History from approximately 1890 to 2012 show only 18 sightings in the southern portion of Biscayne Bay. Of these, only one occurred near Turkey Point peninsula in 1975–1976. Given the habitat preferences for this species described by NOAA, sawfish, if present near the Turkey Point site, would likely be juveniles using the nearshore mangrove communities to avoid predation. (NRC 2016a, Appendix F)

3.7.8.1.4 *Reptiles*

American Alligator (*Alligator mississippiensis*)

American alligators are considered federally threatened because of their resemblance to American crocodiles (USFWS 2017b; FNAI 2017c). The American alligator is found in swamps, rivers, streams, lakes, and ponds throughout the southeastern United States where fresh or brackish water is present. Alligators are opportunistic feeders, eating fish, turtles, wading birds, snakes, frogs, and small mammals. Threats to this species include habitat loss, pollution, and interactions with humans. Alligators can be harvested only by individuals with approved licenses and permits. (NRC 2016a, Section 2.4.1.3)

The main threat facing the American alligator is the destruction and degradation of its wetland habitat. Destruction of wetlands usually occurs in conjunction with human development. With increased development in their habitat, more alligators are removed at the request of the new property owners; these alligators are usually harvested when removed. Alligators are also vulnerable to increased predation. Alligator eggs face predation from raccoons, bears, and otters, and juveniles also face danger from wading birds and bigger alligators. (FFWCC 2017l)

Alligators are found in both Biscayne Bay and Card Sound and are known to occur on the Turkey Point property (NRC 2016a, Section 2.4.1.3).

American Crocodile (*Crocodylus acutus*)

This species was downlisted by USFWS from federally endangered to threatened for the Florida DPS in 2007 (72 FR 13027; USFWS 2017b; FNAI 2017c).

American crocodiles are commonly found in coastal areas throughout the Caribbean Sea in both brackish and saltwater habitats, including ponds, coves, creeks, and mangrove swamps. Crocodiles are opportunistic feeders, eating a variety of fish, snails, crustaceans, crabs, turtles, snakes, birds, and mammals. Southern Florida is considered the northern edge of their range. Optimum nesting requirements include the presence of elevated, well-drained substrate near water greater than 1 meter deep, salinity ranging from 10 to 20 ppt, and locations that are protected from wind and wave action and free from human disturbance and predators. The use of artificial substrates to promote nesting has contributed to the increase of nests in southern Florida and at the Turkey Point site. (NRC 2016a, Section 2.4.2.3)

The designated critical habitat for American crocodile includes the majority of the Turkey Point CCS (IWW facility) and other adjacent canals and aquatic habitats west and south of the Turkey Point site (NRC 2016a, Section 2.4.2.3).

Crocodiles were first observed at the Turkey Point site in 1976, and nesting was first documented in 1978. FPL subsequently developed a crocodile management plan that described activities for creating and enhancing crocodile habitat and for monitoring reproductive success, growth, and survival of hatchlings. The current plan describes monitoring procedures as well as maintenance procedures for the CCS, including timing the method of vegetation clearing to result in minimal disturbance of nests, hatchlings, and adults. As discussed in Chapter 4, FPL has also developed a threatened and endangered species evaluation and management plan to ensure construction-related effects on listed species are minimized. As described in the 2006 Biological Opinion by USFWS, FPL's 5,900-acre CCS has become particularly important nesting habitat for this species, and nesting activity has increased since it was first documented in 1978. FPL is one of three nesting locations in the state of Florida. (NRC 2016a, Section 2.4.2.3)

FPL conducts annual crocodile monitoring. Table 3.7-13 summarizes the number of nests observed and the number of hatchlings captured between 2000 and 2016. Successful nests from 2000 to 2016 have ranged from a low of 8 in 2016 to a high of 28 in 2008; hatchlings captured have ranged from 127 in 2015 to 548 in 2009. (NRC 2016a, Section 2.4.2.3)

In 2013 and 2014, 25 successful nests produced 429 and 409 tagged hatchlings, respectively. Nesting activity observed in the CCS was similar to that observed in the Everglades National Park. However, the 2015 monitoring report described lower observed nesting with only 9 successful nests and 119 tagged hatchlings (NRC 2016a, Section 2.4.2.3), and the 2016 monitoring report logged 8 successful nests and 127 hatchlings. The general conclusions of the 2016 monitoring report were as follows:

(1) The American crocodile population continues to remain in a much stronger position than before the Turkey Point CCS was established. Today, crocodiles continue to migrate in and out of the system and call the system home.

(2) Despite the environmental changes taking place within the Turkey Point CCS, the American crocodiles had eight successful nests and 127 hatchlings were released at Turkey Point, outside of the CCS.

As discussed in Section 3.7.3, FPL is working with FDEP and Miami-Dade County to reduce the average annual salinity in the canals to 34 PSU. In 2015, FPL used controlled sources from the L-31 Canal, marine wells, and flow from the Floridan Aquifer wells to reduce the salinity in the CCS. In future years, it is anticipated that Floridan wells, limited to 14 MGD, will be the controlled water source to be utilized for salinity reduction.

With regard to crocodile nest distribution within the CCS, FPL data shows that from 1978 to 2010, the majority of the nesting sites were in the southern end of the canal system (identified as Sections 4 and 5 in yearly monitoring reports) and throughout the return canal. In addition, clusters of nests were observed in the eastern portion of the CCS (NRC 2016a, Section 2.4.2.3).

The primary threats to this species in southern Florida include destruction or modification of nesting habitat, changes in nesting behavior or nest location from repeated interactions with humans, dramatic changes in weather patterns or temperature extremes, and fatal encounters with motor vehicles along major highways. Deaths occurring during 2005–2006 on the Turkey

Point site resulted in increased signage warning drivers to watch for crocodiles on the roads at all times and to observe posted speed limits. A crocodile death was reported in November 18, 2011. The November 2011 death involved a young crocodile found onsite in the vicinity of the current work on the exploratory undergroung injection control well. The cause of death was determined to be physical trauma. Another death was reported on July 25, 2014. The 2014 death involved an adult crocodile discovered inside the intake well for Units 3 and 4 within the CCS. Based on visual evidence of no physical injury or trauma, the crocodile's death was not attributed to plant operations. In both cases, the USFWS and the FFWCC were notified. A third dead American crocodile was also reported on an access road outside of the Turkey Point controlled area in July 2014 and attributed to a vehicle collision. Additional American crocodile deaths were reported inside the Turkey Point controlled area in August 2015 and November 2015. These deaths were not caused by existing Turkey Point plant operations. (NRC 2016a, Section 2.4.2.3) Two American crocodile deaths were reported in the ID canal, one in January 2016 and one in February 2016. These deaths were not caused by existing Turkey Point plant operations. One American crocodile death was reported in July 2016 on Palm Drive leading to the plant entrance. This death was the result of vehicle collision by plant personnel. A total of two crocodile deaths have been reported as of August 2017. One crocodile death in May and one in June were reported in areas of low plant activity, and not caused by existing plant operations. In both cases, the crocodiles appeared to have been fed on by other animals.

Loggerhead Sea Turtle (*Caretta caretta*)

This species is federally listed as threatened (USFWS 2017b; FNAI 2017c). The loggerhead sea turtle is commonly found near the Turkey Point site. The loggerhead's large head and powerful jaws enable the turtle to feed on hard-shelled prey, including whelks and conchs. A circumpolar species, loggerheads occur throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian oceans, and loggerheads make extensive migrations between feeding and nesting grounds. In the southeastern United States, approximately 80 percent of nesting occurs in six Florida counties. Loggerhead turtles are also known to nest on Elliot Key in Miami-Dade County. Suitable beach habitat for nesting is not known to be present in the vicinity of the Turkey Point site. (NRC 2016a, Section 2.4.2.3)

In 2010, the loggerhead turtle listing was changed to identify nine DPSs, with four DPSs listed as threatened and five listed as endangered. The loggerhead population in Biscayne Bay is included in the Northwest Atlantic DPS and considered federally threatened. In 2014, NOAA designated critical habitat for the loggerhead sea turtle that includes oceanic areas east of Biscayne Bay but does not include nearshore areas near Turkey Point. Loggerhead turtles are of particular interest to the Biscayne National Park because they are the most common sea turtle observed within park boundaries. Loggerhead turtles have not been reported in the CCS, but nests have been reported on Elliott Key approximately 7 to 9 miles east and north of the Turkey Point facility. (NRC 2016a, Section 2.4.2.3)

Green Sea Turtle (*Chelonia mydas*)

This species is federally listed as threatened (USFWS 2017b; FNAI 2017c). The green sea turtle is the largest of the hard-shelled turtles and unique among sea turtles in that adults are exclusively herbivorous. The species is found in the open ocean and in coastal areas and uses beaches for nesting. Green sea turtles are relatively common in Biscayne Bay and Card Sound; they visit these areas at various times of the year to feed. Green turtles have not been reported in the CCS but are commonly observed in Biscayne Bay. Nests have occasionally been reported on Elliott Key, approximately 7 to 9 miles east and north of the Turkey Point facility. NOAA's NMFS branch and USFWS have joint jurisdiction for sea turtles: NOAA is the lead agency in marine environments, and USFWS is the lead for nesting beaches. Critical habitat was designated in 1998 to include the coastal waters around Culebra Island, Puerto Rico (Figure 3.7-4). General threats to green sea turtles that apply to all sea turtle species include loss of habitat associated with anthropogenic or natural stressors, harvest of eggs, and mortality associated with incidental capture or entanglement in fishing nets and gear. (NRC 2016a, Section 2.4.2.3)

Leatherback Sea Turtle (*Dermochelys coriacea*)

Leatherback turtles are federally listed as endangered (USFWS 2017b; FNAI 2017c). The leatherback sea turtle is the largest reptile in the world, reaching an adult weight of 2,000 pounds and a total length exceeding 6 feet. This species is unique in that it lacks a hard, bony shell. Leatherback turtles are common in open-ocean environment but also forage in coastal waters, eating soft-bodied prey. Critical habitat that included the coastal waters adjacent to Sandy Point, St. Croix, in the U.S. Virgin Islands, was designated in 1998; NMFS is also proposing to revise the critical habitat to include areas off the U.S. west coast. Nests have been observed on Miami Beach and Key Biscayne. Leatherback turtles have been observed in Biscayne Bay but have not been observed in the CCS. (NRC 2016a, Section 2.4.2.3)

Eastern Indigo Snake (*Drymarchon corais couperi*)

This species is a federally and listed threatened species (USFWS 2017b; FNAI 2017c). The eastern indigo snake is a large, black, non-venomous snake found primarily in upland habitats. They have also been found in pinelands, tropical hardwood hammocks, and mangrove forests. The eastern indigo snake needs a mosaic of habitats to complete its annual cycle. In extreme southern Florida (the Everglades and Florida Keys), eastern indigo snakes are found in tropical hardwood hammocks, pine rocklands, freshwater marshes, abandoned agricultural land, coastal prairie, mangrove swamps, and human-altered habitats. (NRC 2016a, Section 2.4.1.3) USFWS permits to collect indigo snakes for the purposes of scientific research have been authorized since 2011, indicating that occurrences of the indigo snake on the Turkey Point property are likely (Orianne Society 2011).

Hawksbill Sea Turtle (*Eretmochelys imbricata*)

This species is federally listed as endangered (USFWS 2017b; FNAI 2017c). The hawksbill sea turtle is a medium-sized sea turtle most commonly found in coral reef systems, where the ledges and caves provide shelter. NMFS and USFWS have joint responsibility for this species. Critical habitat was designated in the coastal waters of Mona and Monito Islands, Puerto Rico, in 1998, but no critical habitat for this species is located within 50 miles of PTN. Hawksbill are less common in Biscayne Bay than green or loggerhead turtles, but nests have been recorded along the outer keys of the bay. Hawksbill turtles have not been reported in the CCS. (NRC 2016a, Section 2.4.2.3)

Gopher Tortoise (*Gopherus Polyphemus*)

This species is a candidate to be federally listed as threatened (USFWS 2017b; FNAI 2017c). The gopher tortoise is typically found in dry upland habitats, including sandhills, scrub, xeric oak hammock, and dry pine flatwoods; it also commonly uses disturbed habitats such as pastures, oldfields, and road shoulders. Tortoises excavate deep burrows for refuge from predators, weather, and fire. This species is found statewide but is absent from the Everglades and the Keys. Despite widespread occurrence of this species throughout Florida, there is considerable concern about the declining abundance of this species. Much of its native habitat has been lost to agriculture, citriculture, forestry, mining, and urban and residential development. (FNAI 2001c) Due to the lack of optimal habitat, this species is not likely to occur on the Turkey Point site.

Kemp's Ridley Sea Turtle (*Lepidochlys kempii*)

This species is federally listed as endangered (USFWS 2017b; FNAI 2017c). The Kemp's ridley sea turtle is the smallest species of sea turtle and is the most endangered turtle in the world. The diet of Kemp's ridley sea turtle primarily consists of crabs and other crustaceans. (FFWCC 2017m)

Kemp's ridley sea turtles develop nests in sand along beaches. The nesting season is between April and July. Nesting females are mainly found on the beaches of Rancho Nuevo, Mexico; however, they can be found on Texas and Florida beaches also. Kemp's ridley sea turtles inhabit marine waters of the Gulf of Mexico and the western North Atlantic Ocean. (FFWCC 2017m)

The main threat to the Kemp's ridley sea turtle is accidental capture (bycatch) in shrimp and fishing nets such as longlines, finfish trawls, beach seines, and drift and set gill nets. When captured in these nets, the sea turtle cannot escape and will usually drown. Increased development will bring an increase in lighting in the area, which is detrimental to sea turtles as hatchlings will migrate towards the light instead of the ocean. The potential for eggs and hatchlings being crushed or disturbed is increased with the increase of human presence along beaches. Beach sand renourishment can bury Kemp's ridley sea turtle nests along beaches. Beach armoring (e.g., seawalls) is a threat as the structures prevent the natural maintenance of beaches and sand dunes. Other threats include habitat degradation from contaminants and pollutants. (FFWCC 2017m) While this species may not occur on the Turkey Point site, it is likely to occur in adjacent waters, including Card Sound and Biscayne Bay.

3.7.8.1.5 *Birds*

Cape Sable Seaside Sparrow (*Ammodramus maritimus mirabilis*)

A federally listed endangered species (USFWS 2017b; FNAI 2017c) and a bird of conservation concern, this medium-sized sparrow has a range that is restricted to the southern Florida peninsula. They are non-migratory residents of freshwater to brackish marshes of the Everglades region of Miami-Dade and Monroe counties. Their preferred nesting habitat appears to be a mixed marl prairie community that often includes muhly grass (*Muhlenbergia filipes*). This species tends to avoid tall, dense, sawgrass-dominated communities and sites with permanent water cover. (NRC 2016a, Section 2.4.1.3)

The species includes six subpopulations, and the total estimated population is approximately 2,900 individuals. Critical habitat designated for this species includes suitable habitat contained within five polygons that range in size from 4,800 to 39,000 acres that are south and west of the Turkey Point site. No critical habitat is located within 6 miles of PTN. No Cape Sable seaside sparrows were observed during surveys at the Turkey Point site during monitoring efforts preceding the Unit 6 and 7 COL application process. Their well-known distribution and ecologically narrow habitat preference of this species very likely excludes the potential for this species to occur at any of the proposed project areas, as land cover classification information indicates suitable habitat is not present. (NRC 2016a, Section 2.4.1.3)

Rufa Red Knot (*Calidris canutus rufa*)

The rufa red knot is a federally listed threatened species (USFWS 2017b; FNAI 2017c). As of 2008, the rufa subspecies is thought to have three biogeographically distinct populations, one of which winters in the southeastern United States including Georgia, South Carolina, and Florida. During the winter of 1993–1994, the FFWCC evaluated wintering shorebird distribution and abundance along the entire coast of Florida. It determined the most important shorebird wintering areas in Florida are along the Gulf Coast and there are no important sites for wintering shorebirds along the Atlantic Coast of Miami-Dade County. Like other shorebirds, red knots winter in Florida primarily along the central Gulf Coast, and that is where survey efforts are focused. (NRC 2016a, Section 2.4.1.3)

Approximately 550 red knots were observed during the winter of 2007–2008 along a portion of the west coast of Florida between Anclote Key and Cape Romano. More than 3,000 red knots were counted in Florida in 2006, and more than 1,000 were counted again in 2011. A single red knot was observed during March 2009 in the vicinity of the existing CCS. Red knot migration flight has been observed to be very long, including flight over the open ocean directly to South America from coastal Massachusetts. However, during migration red knots can occur at suitable habitats all along the coast and could be expected to occasionally occur in small numbers at the Turkey Point site. (NRC 2016a, Section 2.4.1.3)

Habitats used by red knots in winter include coastal beaches, tidal mudflats, salt marshes, and peat banks; they also use mangrove and brackish-water lagoons. Roosting habitat that provides areas above the highest tides that is free from excessive human disturbance may also be important. Beach habitat along the eastern border of the Turkey Point property could be suitable for wintering red knots. (NRC 2016a, Section 2.4.1.3)

<u>Piping Plover (*Charadrius melodus*)</u>

A federally listed threatened species (USFWS 2017b; FNAI 2017c), the plover is a small, migratory shorebird that breeds only in three geographic regions of North American. Piping plovers do not breed in Florida, but individuals from all three breeding populations do winter there and have been observed in Miami-Dade County. Their winter habitats include beaches, mudflats, and sandflats as well as barrier island beaches and spoil islands. Piping plovers seem to prefer landforms that provide tidal flats for foraging and open beaches for roosting within close proximity of each other. The migration pattern of piping plovers is not well documented, but birds should appear in Florida any time after late July through September and leave from late February to early April. The piping plover is not known to occur on the Turkey Point property, and no piping plovers were seen during surveys of the Turkey Point site conducted prior to the COL application for Units 6 and 7. Although the piping plover has not been observed on the Turkey Point property, the probability of occurrence in the vicinity is moderate. The FFWCC has determined that piping plovers may occur on the Turkey Point site, and the area located south of the plant area could provide suitable mudflat habitats for wintering piping plovers. (NRC 2016a, Section 2.4.1.3)

<u>Wood Stork (*Mycteria americana*)</u>

This large, long-legged wading bird is a federally listed threatened species (USFWS 2017b; FNAI 2017c). This species breeds in southern Florida using a variety of wetlands including freshwater and estuarine habitats for nesting, roosting, and foraging. Wood storks typically construct their nests in medium to tall trees that occur in stands either in swamps or on islands surrounded by relatively broad expanses of open water and often reuse colony sites many years. Wood storks have abandoned colony locations when water-management practices removed surface water from beneath nesting trees that afforded protection from land-based predators. During the non-breeding season, wood storks occur in a wide variety of wetland habitats including freshwater marshes, stock ponds, shallow, seasonally flooded roadside or agricultural ditches, narrow tidal creeks, or shallow tidal pools. Foraging occurs in almost any shallow, open water where prey items become concentrated. (NRC 2016a, Section 2.4.1.3)

Wood storks do not nest at the Turkey Point site but have been observed there as recently as June 2008 using shallow portions of the CCS to forage and roost during winter. Three storks were also observed using shallow wetlands of the mangrove area located south of the Turkey Point plant area (NRC 2016a, Section 2.4.1.3). Wood storks nest within Everglades National

Park, the closest being approximately 20 miles southwest of the Turkey Point site (USFWS 2010b). Wood stork colony use varies among years relative to hydrologic conditions and food availability. Although in some years no storks may nest at any of these colonies, nesting was observed at one or more of them during 4 out of every 5 years. Although there is no designated critical habitat for the wood stork, the USFWS Southeast Florida Ecological Services Office recognizes a 0.47-mile nest colony buffer and an 18.6-mile core foraging area buffer around all known wood stork colonies that have had active nests within the last 10 years in southern Florida. No portion of the Turkey Point site occurs within the designated core foraging area for any wood stork colony. (NRC 2016a, Section 2.4.1.3)

Everglades Snail Kite (*Rostrhamus sociabilis plumbeus*)

The Everglades snail kite is federally listed as endangered (USFWS 2017b; FNAI 2017c). The snail kite is a subspecies of a wide-ranging New World raptor found primarily in lowland tropical freshwater marshes in Central and South America. In the United States, it is restricted to peninsular Florida in the watersheds of the Everglades, lakes Okeechobee and Kissimmee, and the upper St. Johns River. The Everglade snail kite was first listed as endangered in 1967 when the entire population was estimated to number in the dozens. Population estimates approached 300 individuals in the late 1970s and 1,000 individuals in 1994. Recent Everglade snail kite population modeling indicates the population may have peaked at approximately 3,500 individuals in the late 1990s. More recently, the entire Florida population was dramatically decreasing in size and last estimated to number approximately 700 individuals in 2008. Most of the Florida lands occupied by Everglade snail kites are located north and west of the Turkey Point site. A snail kite has been observed within the Everglades Mitigation Bank adjacent to the Turkey Point site. USFWS-designated critical habitat for the snail kite exists in western Miami-Dade County beginning about 22 miles west of the Turkey Point site. None of the proposed project areas occur within USFWS-designated critical habitat. The USFWS has also established a snail kite consultation area that includes much of southern Florida; however, the Turkey Point site is excluded from this consultation area. (NRC 2016a, Section 2.4.1.3)

Audubon's Crested Caracara (*Polyborus plancus audubonii*)

This species is federally listed as threatened (USFWS 2017b; FNAI 2017c). The caracara is a resident, diurnal, and non-migratory species that occurs in Florida and parts of the southwestern United States. The Florida population commonly occurs in dry or wet prairie areas with scattered cabbage palms (*Sabal palmetto*) or in lightly wooded areas. Caracaras prefer to nest in cabbage palms surrounded by open habitats with low ground cover and a low density of tall or shrubby vegetation. Observation and radio-telemetry suggest there are three congregation areas in south-central Florida: one along the Kissimmee River north of State Route (SR) 98, one north of US27 in Glades County, and one in the vicinity of Eagle Island Road in northern Okeechobee County. The USFWS has also established a crested caracara consultation area that includes a portion of Miami-Dade County; however, the PTN site is excluded from this consultation area. Suitable habitat for this species is not present within the Turkey Point site. (NRC 2016a, Section 2.4.1.3)

Kirtland's Warbler (*Dendroica kirtlandii*)

This bird is a federally listed endangered species (FNAI 2017c; USFWS 2017b). The warbler nests in a relatively small area of central Michigan and migrates south to the Bahamas in winter. Its migratory pattern brings it to the eastern coast of Florida in spring and fall. Migrating Kirtland's have been observed in a variety of habitats including woodlands, scrub, fencerows, and vegetated yards. They appear to prefer dense vegetation less than 1.5 meters in height. (NRC 2016a, Section 2.4.1.3)

Sightings in Florida have occurred between late April and early May, and early September and late November. No Kirtland's warblers have been observed during surveys of the Turkey Point site. Their preference of a range of low shrub habitats, including landscaping in urbanized areas, indicates suitable habitat is not present on the operational portions of Turkey Point. (NRC 2016a, Section 2.4.1.3)

Bachman's Warbler (*Vermivora bachmanii*)

This bird is a federally listed endangered species (USFWS 2017b; FNAI 2017c). Bachman's warbler breeds in the southeastern United States and winters in western Cuba and the Isle of Pines. There are no breeding records for Florida where this species is an early spring and fall transient. (NRC 2016a, Section 2.4.1.3)

Bachman's warbler has not been observed in Florida since 1977 and not anywhere in the United States since 1988. Migratory records of this species are scarce, especially since its rapid decline in the early 1990s; as a result, habitat information is almost nonexistent. It is not expected to occur at any of the proposed project locations due to its apparent extirpation from the United States. (NRC 2016a, Section 2.4.1.3)

3.7.8.1.6 *Mammals*

Florida Bonneted Bat (*Eumops floridanus*)

This bat is a federally endangered species (USFWS 2017b; FNAI 2017c). The bat is a year-round resident and roosts in palms and hollow trees, and may also use building roofs covered with Spanish tiles. They forage high in the air over natural and manmade landscapes. Florida bonneted bat calls were recorded near Homestead, Florida, along the L-31 Canal, and at Zoo Miami located approximately 10 miles north of Turkey Point, indicating this species is known to occur in highly urbanized landscapes in eastern Miami-Dade County. Very little is known about the distribution and abundance of this bat at any of the proposed project locations, but the Florida bonneted bat has been observed in the Turkey Point vicinity. PTN is not located within a Florida bonneted bat focus area. Species focal areas are used to determine whether formal consultation is required for a listed species, and specific guidance is provided in focal areas for making effect determinations. Suitable habitat (palms, hollow trees, and buildings roofed with Spanish tiles) is present on the Turkey Point site, as palms planted for landscaping are present around existing facilities within the Turkey Point site. (NRC 2016a, Section 2.4.1.3)

Florida Panther (*Puma concolor coryi*)

This subspecies of the mountain lion is a federally endangered species (USFWS 2017b; FNAI 2017c). A small population of 120 to 230 individuals in southern Florida represents the only known remaining wild population of this subspecies (USFWS 2017c). The panther presently occupies one of the least-developed areas in the eastern United States: a contiguous system of large private ranches and public conservation lands in Broward, Collier, Glades, Hendry, Lee, Miami-Dade, Monroe, and Palm Beach counties totaling more than 809,400 hectares. The largest contiguous tract of panther habitat is in the Big Cypress Swamp/Everglades physiographic regions. Telemetry surveys indicated panthers use a mosaic of habitats, and while they prefer upland and wetland forested habitats during daylight hours, they also use grassland/prairie, marsh-shrub, and agricultural habitats. Understory thickets of tall, almost impenetrable saw palmetto (*Serenoa repens*) have been identified as important denning cover for panthers. The USFWS recognizes much of Miami-Dade County and southern Florida as a Florida panther focus area. Although most of the FPL Turkey Point site lies outside of the focus area, lands immediately adjacent to the south and west of the site are contained within the focus area and are also considered to be within the panther's primary zone. In October 2013 an adult and kitten were observed traveling east along the corridor approximately 2 miles west of the Turkey Point site boundary in the Model Lands Area. (NRC 2016a, Section 2.4.1.3)

Florida [West Indian] Manatee (*Tricechus manatus latirostris*)

The Florida manatee, a subspecies of the West Indian manatee, is a large marine mammal found in coastal and freshwater systems on both coasts of Florida. Manatees are federally listed as threatened (USFWS 2017b; FNAI 2017c), and their critical habitat includes "all waters of Card [Sound] between portions of Biscayne Bay, Card Sound adjacent to the Turkey Point site, and the nearby streams, rivers, and canals" (Figure 3.7-4). Manatees have been observed in the barge-turning basin at the northern end of the Turkey Point site and in nearby state canals but not in the CCS. Areas defined by the USFWS as "manatee consultation areas" include coastal regions of southern Florida and large inland water bodies such as Lake Okeechobee. Thus, the Turkey Point site would be included in the manatee consultation area. (NRC 2016a, Section 2.4.1.3)

Manatees are general herbivores that are able to feed on a variety of vegetation types. They are tolerant of changes in salinity but sensitive to temperature variations because they lack a thick insulating layer of blubber common to other marine mammals. Several anthropogenic activities pose threats to manatees. Deaths are attributable to the management of water-control structures and navigational locks, loss of habitat associated with coastal development, and several other activities. (NRC 2016a, Section 2.4.1.3) During the winter of 2008–2009, researchers reported a disproportionately high number of manatee deaths related to cold stress; 261 carcasses were reported statewide and 1 death was reported in Biscayne Bay. The number of deaths (51) due to watercraft strikes during the winter of 2008–2009 was also relatively high statewide. Approximately 33 percent and 31 percent of the total deaths occurred in the southeastern and southwestern regions, respectively (NRC 2016a, Section 2.4.1.3). Annual manatee deaths in Miami-Dade County from 2000 to 2016 ranged from 4 to 22, with the highest mortality observed in 2010. Of the 22 deaths reported in 2010, 1 was attributed to perinatal death, 3 were caused by watercraft, 2 were attributed to natural causes, and 16 were undetermined/unrecovered; however, statewide, cold stress was the primary cause of manatee mortality in 2010. FFWCC reported that as of August 2017, the last reporting period available on their website, a total of seven manatee deaths have been reported in Miami-Dade County. Of the seven deaths reported, one was due to watercraft, three were perinatal, and three were undetermined. (FFWCC 2017n)

3.7.8.2 State-Listed Species

The FFWCC is responsible for maintaining lists of rare species in Florida. Southern Florida is a biologically rich area with many endemic species (species naturally occurring nowhere else). In addition to federally listed species, there are 104 plant species and 14 animal species (Table 3.7-14) in Miami-Dade County that the FFWCC has listed as endangered, threatened, or as species of concern.

Although many of the state-listed plants are found in either pine rockland or marl prairie habitats, neither of which occurs on the Turkey Point site, the range of habitats in which they occur indicates unreported species and populations likely occur within other proposed project areas. For instance, Small's flax (*Linum carteri var. smallii*) and the Bahama ladder brake (*Pteris bahamaensis*) are known to occur in disturbed habitat, much of which has not been surveyed. The banded wildpine (*Tillandsia flexuosa*) is another epiphyte that grows on a variety of other plants that occur in a wide range of habitat conditions. The full extent of which state-listed plant species occur within all proposed project areas is undetermined. (NRC 2016a, Section 2.4.1.3) Habitat requirements for state-listed plant species in Miami-Dade County are included in Table 3.7-15.

The FFWCC determined that the 2 reptile, 11 bird, and 1 mammal species described below and listed by the State of Florida are either known or likely to be present on the Turkey Point site (Table 3.7-14). Species and habitat descriptions for state-listed animals in Miami-Dade County are provided below.

3.7.8.2.1 *Reptiles*

Pine Snake (*Pituophis melanoleucus*)

The pine snake is a state-listed threatened species (FNAI 2017c). This species occurs in relatively open canopies and dry sandy soils, in which it burrows, in particular sandhill and former sandhill, including oldfields and pastures, but also sand pine scrub and scrubby flatwoods. This species often coexists with pocket gophers and gopher tortoises. In Florida, this species is found throughout the panhandle and peninsula south to Lake Okeechobee, extending southward along the eastern ridge to Miami-Dade County, but is absent from the Keys (FNAI 2001d). The diet of the Florida pine snake primarily consists of moles, rabbits, mice, rats, squirrels, lizards, and other snakes and their eggs. (FFWCC 2017o)

Threats to this species include habitat loss and fragmentation resulting from commercial and residential development, silviculture (controlling the growth and quality of forests through timber management), mining, and road construction. The alteration of its fire-dependent habitat can cause less favorable living conditions for the Florida pine snake due to the encroachment of hardwoods. The removal of stumps can threaten the pine snake because it decreases the amount of underground habitat structures. Pine snakes might be experiencing increased rates of predation of adults, hatchlings, or eggs from nine-banded armadillos, feral hogs, and red imported fire ants. Other threats include mortality caused by roads, humans, and domesticated pets. (FFWCC 2017o) Pine snakes once occurred along the Atlantic Coastal Ridge as far south as Miami, but urban development in southeastern Florida has eliminated some of these populations. There are no recent museum or FNAI records south of Martin County, but the species still occurs in Palm Beach County. (FFWCC 2011) Due to the lack of recent documentation of this species in Miami-Dade County and the absence of preferred habitat, this species is not likely to occur on the Turkey Point site.

Rim Rock Crowned Snake (*Tantilla oolitica*)

This species is a state-listed threatened species (FNAI 2017c). Rim rock crowned snakes inhabit pine rockland and tropical hardwood hammocks near fresh water. They can be found in holes and depressions in the oolitic limestone (formed by calcium carbonate), but they can also be found periodically in rotten logs and trash and under rocks. Rim rock crowned snakes are known from various localities in Miami, including Brownsville, Coconut Grove, Coral Gables, Cutler, Cutler Ridge, Kendall, Leisure City, North Miami, and Perrine. The species also occurs in the upper, middle, and lower Florida Keys. (FFWCC 2017p)

The main threat to the rim rock crowned snake is the fragmentation of their habitat. This is a threat for the population in and around Miami, as their habitat is mixed in with agricultural and residential lands. The population in the Florida Keys faces a threat from severe storms such as hurricanes and tropical storms because they can cause flooding in the species' habitat. The threat of global climate change also may threaten the species as the rise of sea level would also flood its habitat. (FFWCC 2017p) Due to the lack of available habitat on the Turkey Point site, this species is not likely to occur on the Turkey Point site.

3.7.8.2.2 *Birds*

Florida Burrowing Owl (*Athene cunicularia floridana*)

This species is state-listed as threatened (FNAI 2017c). Florida burrowing owls are named for their propensity to nest in underground burrows. They prefer sparsely vegetated, sandy, upland habitats including dry prairies and sandhills. They have taken advantage of disturbances that create open habitats and use pastures, airports, parks, ROWs, and vacant residential lots. (NRC 2016a, Section 2.4.1.3) The largest populations occur in southwestern and southeastern Florida. Depending on habitat availability, small, patchily distributed populations occur in the Keys and along the interior ridges of Florida from Highlands County to Madison County. A single disjunct population occurs at Eglin Air Force Base in Okaloosa County. (FNAI 2001e)

Human activities have increased the range of this species in Florida but have exposed owls to additional threats. The largest concentrations of owls now reside in ruderal grasslands and lawns of residential and industrial areas. One of the largest populations of this species is in Cape Coral, a large city in Lee County. Intensive cultivation and development of grasslands pose major threats. Human harassment, predation by domestic animals, and vehicle collisions take toll on urban/ruderal birds. Predation by fire ants is also implicated in owl mortality. (FNAI 2001e)

A single burrowing owl was observed in 2010 on a roadway within the CCS (NRC 2016a, Section 2.4.1.3). Vacant upland lots and canal berms along on the Turkey Point site may provide suitable burrowing habitat.

Little Blue Heron (*Egretta caerulea*)

This species is state-listed as threatened (FNAI 2017b). Little blue herons inhabit fresh, salt, and brackish water environments in Florida including swamps, estuaries, ponds, lakes, and rivers. In the United States, the little blue heron can be found from Missouri, east to Virginia, down to Florida, and west to Texas. In peninsular Florida they are relatively common and widespread. The diet of the little blue heron primarily consists of fish, insects, shrimp, and amphibians. Little blue herons feed alone, usually along freshwater systems and on floating vegetation. The little blue heron nests in colonies, often with other species of long-legged waders. (FFWCC 2017q)

The current threats to the little blue heron are not well understood. Threats may include coastal development, disturbance at foraging and breeding sites, environmental issues, degradation of feeding habitat, reduced prey availability, and predators. Other threats may include exposure to pesticides, toxins, and infection by parasites. (FFWCC 2017q) Little blue herons have been observed throughout the Turkey Point site where appropriate habitat is present (NRC 2016a, Section 2.4.1.3).

Reddish Egret (*Egretta rufescens*)

This species is state-listed as threatened (FNAI 2017b). Reddish egrets inhabit coastal areas, mainly on estuaries near mangroves, and lagoons, but they can also be found on dredge spoil islands (islands developed from dredged material). This species can be found year-round on the coasts from Florida. The diet of the reddish egret primarily consists of small fish. (FFWCC 2017r)

Reddish egrets breed within large colonies of different species, in small groups, or in rare cases, as isolated couples. In mainland Florida, they nest between the months of February and June, with the Florida Bay and Keys populations nesting from November to May. Nests are constructed in a platform of sticks on mangrove keys and dredge spoil islands. (FFWCC 2017r)

Current threats to reddish egrets are not well understood, but coastal development, recreational disturbance at foraging and breeding sites, habitat degradation, loss of genetic diversity, and increased pressure from predators are of primary concern (FFWCC 2017r). Reddish egrets have been observed throughout the Turkey Point site where appropriate habitat is present (NRC 2016a, Section 2.4.1.3).

Tricolored Heron (*Egretta tricolor*)

This species is state-listed as threatened (FNAI 2017b). Tricolored herons inhabit fresh and saltwater marshes, estuaries, mangrove swamps, lagoons, and river deltas. Tricolored herons are widespread, permanent residents in Florida, although they are less common in some parts of the panhandle. (FFWCC 2017s)

This species nests in mangroves and willows as well as other woody vegetation over standing water or in islands. Tricolored herons prefer to feed in coastal wetlands including seasonally flooded habitats, mangrove swamps, ditches, and tidal creeks. Seasonal water level fluctuation is critical to nesting success (NRC 2016a, Section 2.4.1.3). The tricolored heron faces many threats to its population, such as the continued development of wetlands. As with other birds that inhabit estuaries, the exposure to pollutants and pesticides are a threat to the tricolored heron population. Other threats include alterations to the hydrology of foraging areas and reduced prey abundance. (FFWCC 2017s)

Tricolored herons have been observed throughout the Turkey Point site where appropriate habitat is present (NRC 2016a, Section 2.4.1.3).

Southeastern American Kestrel (*Falco sparverius paulus*)

This species is state-listed as threatened (FNAI 2017b). The southeastern American kestrel's habitat in Florida includes open woodlands, sandhill, and fire-maintained savannah pine habitats. However, it will also use alternative habitats, including pastures and open fields located in residential areas. Within these habitats, kestrels will nest in cavities excavated in large dead trees by woodpeckers. Nest boxes are also used by kestrels and have become an important artificial habitat for the kestrel due to the loss of primary habitats. Any of the habitats used by kestrels must be able to support their nesting and ability to prey on potential food efficiently. The southeastern American kestrel can be found throughout Florida. Unlike the kestrels that breed in the rest of North America, the southeastern American kestrel is a non-migratory subspecies. It lives year-round in Florida and is fairly sedentary, with short dispersal distances. (FFWCC 2017t)

The main threat to the southeastern American kestrel is the loss of nesting and feeding habitat. These habitats are destroyed during the development of new residential areas and farmlands, removal of trees in agriculture fields, and the alteration of fire-maintained pine habitats by suppressing fire. Kestrels are also vulnerable to pollutants such as polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethane, and heavy metals. Other potential threats include increased predation, collisions with vehicles and aircraft, and the West Nile virus. (FFWCC 2017t) Habitat for this species may be located on the Turkey Point site.

Florida Sandhill Crane (*Grus canadensis pratensis*)

This species is state-listed as threatened (FNAI 2017b). Florida sandhill cranes inhabit freshwater marshes, prairies, and pastures. They occur throughout peninsular Florida north to the Okefenokee Swamp in southern Georgia; however, they are less common at the northernmost and southernmost portions of this range. Florida's Kissimmee and Desoto prairie regions are home to the state's most abundant populations. The diet of the Florida sandhill crane primarily consists of grain, berries, seeds, insects, worms, mice, small birds, snakes, lizards, and frogs. Florida sandhill cranes are a non-migratory species that nests in freshwater ponds and marshes. Degradation or direct loss of habitat due to wetland drainage or conversion of prairie for development or agricultural use are the primary threats facing Florida sandhill cranes. (FFWCC 2017u) Due to the lack of freshwater wetlands, and the distance of Turkey Point from abundant sandhill crane population areas, this species is not likely to occur on the Turkey Point site.

American Oystercatcher (*Haematopus palliates*)

This species is state-listed as threatened (FNAI 2017b). The American oystercatcher inhabits beaches, sandbars, spoil islands, shell rakes, salt marsh, and oyster reefs. Oystercatchers can be found from the coasts of the northeastern United States down to Florida's Gulf Coast. Florida is home to both a resident breeding population and a large wintering population of American oystercatchers. The American oystercatcher is one of a few bird species that feed primarily on mollusks, although they will also eat jellyfish, worms, and insects. Because of their preference for mollusks, oystercatchers inhabit coastal areas that support intertidal shellfish. (FFWCC 2017v)

Many factors threaten the Florida population of American oystercatchers. Coastal development and shoreline armoring have resulted in widespread habitat loss, leaving few suitable breeding sites. Where breeding occurs, nests are vulnerable to disturbance by beachgoers, boaters, pets, predators, and severe weather events. When breeding adults are disturbed, they will fly from their nest, leaving eggs and chicks vulnerable to the elements and predators. American oystercatchers are largely dependent on marine mollusks, which are particularly sensitive to changes in water quality. Oil spills and pollutants can affect distribution and abundance of mollusks, which subsequently affects prey availability for oystercatchers. (FFWCC 2017v)

Due to the proximity of Turkey Point to the coastal habitat preferred by American oyster catchers, this species may occur on the Turkey Point site.

White-Crowned Pigeon (*Patagioenas leucocephala*)

This species is state-listed as threatened (FNAI 2017b). White-crowned pigeons inhabit low-lying forest habitats with ample fruiting trees. Its distribution in the United States is restricted to Florida Bay, Biscayne Bay, and the Florida Keys, although a few individuals probably nest inland in Monroe and Miami-Dade counties. The diet of the white-crowned pigeons primarily consists of tropical hardwood tree fruits. (FFWCC 2017w)

During the late 1800s and early 1900s, the white-crowned pigeon was threatened by overhunting. However, conservation laws helped the population recover in the United States. Because white-crowned pigeons are restricted to low-lying areas, the main threat to the white-crowned pigeon presently is habitat degradation and deforestation. White-crowned pigeons also face threats to their food supply as tropical hammocks continue to be destroyed in the Keys. Pesticides and other contaminants, collisions with structures or objects, and direct human/ research impacts also are potential threats to the pigeon population. (FFWCC 2017w) White-crowned pigeons have been observed on the Turkey Point site (NRC 2016a, Section 2.4.1.3).

Roseate Spoonbill (*Platalea ajaja*)

This species is state-listed as threatened (FNAI 2017b). The roseate spoonbill is a resident breeder in the coastal areas of Central America, the Caribbean, and the Gulf of Mexico. Mangrove islands and occasionally dredge spoil islands are the preferred nesting habitat for the species. The roseate spoonbill is found along the southern Florida coast from the Florida Keys north to Tampa, with some populations in northeastern Florida (NPS 2017c). The diet of the roseate spoonbill primarily consists of crayfish, shrimp, crabs, and small fish (FFWCC 2017x).

One historical threat to the roseate spoonbill was hunting for their feathers; this practice is now illegal, which has allowed the population to rebound. Another threat to the spoonbill is the availability of adequate food sources and habitat degradation. In the Florida Bay, the increased freshwater flow from the Everglades may affect prey availability for the spoonbill. Other threats include habitat loss and disturbance, pesticides, and illegal shootings. (FFWCC 2017x)

Roseate spoonbills have been observed on the Turkey Point site (NRC 2016a, Section 2.4.1.3).

Black Skimmer (*Rynchops niger*)

This species is state-listed as threatened (FNAI 2017b). The black skimmer inhabits coastal areas in Florida such as estuaries, beaches, and sandbars. Skimmers can be found from the coasts of the northeastern United States, down to Mexico, and over to the Gulf Coast of Florida. The diet of the black skimmer primarily consists of fish. The skimmer has a unique style of feeding that involves literally "skimming" the surface of the water with their lower bill. Skimmers nest on the sand along beaches, sandbars, and islands developed by dredged-up material. Nesting occurs in colonies consisting of one to several hundred pairs of skimmers. (FFWCC 2017y)

The black skimmer faces many threats as the human population increases and spreads to previously undeveloped coasts. Habitat loss due to coastal development is the main threat to the species. People are relocating to the coasts at unprecedented levels, causing increased development and traffic on the beaches, as well as increased predators; all of which are detrimental to skimmer habitat. Predators will feed on skimmer eggs and chicks and include species such as raccoons, crows, opossums, feral hogs, and coyotes. Because skimmers nest on the beach and are colonial they are extremely vulnerable to disturbance by people, pets, and predators. Other threats include recreational activity, beach driving, shoreline hardening, mechanical raking, oil spills, and increased presence of domestic animals, all of which may prevent or disrupt nesting or result in the death or abandonment of eggs and young. Global climate change is an impending threat to the black skimmer. Sea level rise may cause destruction to primary nesting areas, resulting in a decreased population size. (FFWCC 2017y)

Black skimmers nest on sand beaches, small islands, and dredge spoil islands, and have also been found nesting along a road in an agricultural setting. They are not known to occur at Turkey Point, but roads within the CCS could provide suitable nesting habitat. (NRC 2016a, Section 2.4.1.3)

Least Tern (*Sterna antillarum*)

This species is state-listed as threatened (FNAI 2017b). The least tern inhabits areas along the coasts of Florida, including estuaries and bays, as well as areas around rivers in the Great Plains. In Florida, the least tern can be found throughout most coastal areas. Outside of Florida, least terns are found along the U.S. Atlantic Coast, mid-Atlantic states, and down from Mexico to northern Argentina. The least tern's diet primarily consists of fish, but they will also feed on small invertebrates. (FFWCC 2017z)

The least tern faces many threats as the human population increases along the coasts. The main threat to the least tern population is habitat loss. Loss of habitat is often attributed to coastal development. Coastal development causes damage to least tern habitat because of the building on the coasts, human traffic on the beaches, and recreational activities. Increased numbers of predators due to the larger amounts of available food and trash for scavenging are also a threat to the least tern. Predators can cause destruction to breeding colonies while they are nesting by destroying nests and eating chicks and eggs. Also, global climate change is an impending threat to the least tern. Rising sea levels and more frequent strong storms may damage and destroy least tern nests, as well as habitat. Spring tides can also cause flooding of least tern nests. Other threats to the least tern include shoreline hardening, mechanical raking, oil spills, response to oil spill events, and increased presence of domestic animals. (FFWCC 2017z)

Nesting occurs on well-drained sand or gravel substrates with little vegetation. These conditions typically exist on beaches along lagoons, bays, and estuaries. However, least terns have also been observed nesting on dredge spoil islands, construction sites, causeways, and mining areas. Least terns have nested along canals within the Turkey Point site. (NRC 2016a, Section 2.4.1.3)

Annual monitoring for least tern nest success is conducted by the FFWCC on the berms located within the CCS (IWW facility). This survey effort is part of the statewide shorebird monitoring program. The results of the 2016 survey indicate that Turkey Point appears to host the largest ground-nesting colony of least terns on the eastern coast of Florida between Key West and Melbourne, with high rates of nest success. The highest concentrations of nests within the CCS were located on berms containing rocky gravel substrate.

3.7.8.2.3 *Mammals*

Everglades Mink (*Neovison vison evergladensis*)

This species is state-listed as threatened in (FNAI 2017b). The Everglades mink, a disjunct population of the American mink, inhabits southern Florida, particularly the shallow freshwater marshes of the Everglades and Big Cypress Swamp region. Most sightings and specimens have come from either Collier or Dade County, but the Everglades mink presumably inhabits northern and eastern Monroe County as well. The diet of the Everglades mink primarily consists of small mammals, snakes, and insects. (FFWCC 2017aa)

The Everglades mink population faces many threats as the increase of human development continues in Florida. Human disturbance and modifications to the wetlands that might impact minks include drainage, logging, dike construction, canal construction, road construction, reapportioning water for competing interests, the introduction of fire into the forest, and the introduction of pesticides into their habitat. Changes in water levels within the marshes can lead to destruction of habitat and encroachment of exotic vegetation. Canine distemper virus (effects central nervous system, respiratory, and digestive tract) is a virulent disease that is deadly to the Everglades mink. Other threats include the increase of invasive species into their habitat, especially the Burmese python. (FFWCC 2017aa)

Due to the proximity of Turkey Point to known populations of this species, and the abundance of wetland habitat on the site property, this species may occur on the Turkey Point site.

3.7.8.3 Species with Designated Essential Fish Habitat

The Sustainable Fisheries Act of 1996 [16 U.S.C. § 1801 et seq.] amended the Magnuson-Stevens Fishery Conservation and Management Act (MSA) [16 U.S.C. §1801 et seq.] to create a program to protect EFH and to identify habitat areas of particular concern (HAPCs). The South Atlantic Fisheries Management Council and NMFS are responsible for designating EFH for each life stage of federally managed marine fish and shellfish species. During the COL application process for Turkey Point Units 6 and 7, NMFS identified EFH and HAPCs in the vicinity of Turkey Point. Table 3.7-16 provides a summary of species included in the EFH assessment, the applicable fishery management plan, and EFH habitat designations. A brief discussion of EFH and HAPCs follows. (NRC 2016a, Section 2.4.2.3)

Snapper-Grouper Fishery Management Plan

The Snapper-Grouper Fishery Management Plan includes 17 species. Five species belonging to this group have designated EFH near the Turkey Point site. Mangrove habitat is identified as EFH for gray snapper; seagrass and unconsolidated bottom are identified as EFH for both adult and juvenile gray snapper, juvenile mutton snapper, and adult white grunt. EFH for the snapper-grouper group includes coral reef systems, hard-bottom substrates, submerged aquatic vegetation, and artificial reefs and outcroppings from shore to at least 600 feet (2,000 feet for wreckfish [*Polyprion americanus*]), where annual water temperature is sufficient to maintain adults. EFH also includes spawning areas in the water column above adult habitat and additional pelagic environments. With regard to specific life stages of this group, EFH includes areas inshore of the 100-feet contour and includes macroalgae, seagrass beds, salt and brackish marshes, tidal creeks, mangrove fringes, oyster reefs, shell banks, and soft- or hard-bottom substrates. HAPCs for the snapper-grouper species complex include medium- to high-profile hard-bottom areas and all designated nursery areas. (NRC 2016a, Section 2.4.2.3)

Spiny Lobster

Both mangrove and seagrass/unconsolidated bottom habitats are EFH for the spiny lobster. EFH for spiny lobster includes nearshore shelf and oceanic waters, shallow subtidal bottom, seagrass habitat, soft sediment, and coral, hard- bottom, sponge, algal and mangrove communities. Juvenile and adult spiny lobster may be present near the Turkey Point site. (NRC 2016a, Section 2.4.2.3)

Pink Shrimp

The South Atlantic Fisheries Management Council's Shrimp Fishery Management Plan includes five species: brown shrimp (*Farfantepenaeus aztecus*), pink shrimp, rock shrimp (*Sicyonia brevirostris*), royal red shrimp (*Pleoticus robustus*), and white shrimp. Of these, the pink shrimp is considered the most common to Biscayne Bay, is expected to occur near the Turkey Point site, and was specifically identified by NMFS as a species with designated EFH near the Turkey Point site. Juvenile and adult shrimp are omnivorous bottom feeders; they eat polychaetes, amphipods, nematodes, other small crustaceans, and organic debris or detritus. This species is most commonly found on hard sand and shell bottom habitats. Rates of growth for all penaeid shrimp are highly variable and influenced by water salinity and temperature; low temperatures and high salinity inhibit growth. EFH for penaeid shrimp includes inshore estuarine nursery areas, offshore marine habitats, and all interconnecting water bodies. Inshore nursery areas include tidal freshwater, estuarine and marine wetland systems, nearshore mangrove and seagrass habitats, and intertidal and subtidal non-vegetated flats. (NRC 2016a, Section 2.4.2.3)

Habitat Areas of Particular Concern

HAPCs identified by NOAA near the Turkey Point site included mangrove and seagrass habitats described above for the snapper-grouper complex, and Biscayne Bay for spiny lobster. Biscayne

Bay and Biscayne National Park are also EFH-HAPC for coral, coral reefs, and hard-bottom communities. (NRC 2016a, Section 2.4.2.3)

3.7.8.4 Species Protected under the Bald and Golden Eagle Protection Act

Bald eagles are protected under the Bald and Golden Eagle Protection Act. Bald eagles have been known to occur on the Turkey Point site (NRC 2002a, Section 4.6.2). Current and future bald eagle nests located on the Turkey Point site would be subject to all protections under the Bald and Golden Eagle Protection Act.

The Bald and Golden Eagle Protection Act [16 U.S.C. 668-668c], enacted in 1940, prohibits anyone without a permit issued by the Secretary of the Interior from "taking" bald eagles, including their parts, nests, or eggs. The act provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle . . . [or any golden eagle], alive or dead, or any part, nest, or egg thereof." The act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb."

"Disturb" means: "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."

In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death or nest abandonment.

There are currently no Bald and Golden Eagle Protection Act permitting requirements associated with any Turkey Point operations.

3.7.8.5 Species Protected under the Migratory Bird Treaty Act

In addition to the federally and state-listed bird species discussed in Section 3.7.8.1 and Section 3.7.8.2, several bird species that may visit the site are protected under the Migratory Bird Treaty Act (MBTA). The MBTA makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to federal regulations. FPL maintains a Migratory Bird Special Purpose Utility Permit (SPUT) authorized by the USFWS. (USFWS 1999, page 2-11)

Table 3.7-1
Common Species Present in the Turkey Point CCS

Common Name	Scientific Name
Reptiles	
American crocodile	*Crocodylus acutus*
Fish	
Sheepshead minnow	*Cyprinodon variegatus*
Killifish	*Fundulus* sp.
Mosquitofish	*Gambusia* sp.
Mullet	*Mugil* sp.
Sailfin molly	*Poecilia latipinna*
Needlefish	*Strongylura* sp.
Tarpon	*Megalops atlanticus*
Common snook	*Centropomus undecimalis*
Mollusks	
Lightning whelk	*Busycon contrarium*
Ivory cerith	*Cerithium eburneum*
Lister's tree oyster	*Isognomon radiatus*
Flat tree oyster	*Isognomon alatus*
Giant ram's horn	*Marisa cornuarietis*
Eastern melamphus	*Melampus bidentatus*
Florida crown conch	*Melongena corona*
Tellin	*Tellin* sp.
Crustaceans	
Great land crab	*Cardisoma guanhumi*
Fiddler crab	*Uca* sp.
Submerged Aquatic Vegetation	
Mermaid's wineglass (green algae)	*Acetabularia* sp. green algae
Green algae	*Caulerpa* sp.
Widgeon grass	*Ruppia maritima*

(NRC 2016a, Table 2-19)

Table 3.7-2
Benthic Invertebrate Abundance near Turkey Point

Classification	Distance from Shore (feet)			
	250	**500**	**750**	**Total**
Crustaceans	207	50	63	320
Echinoderms	5	3	0	8
Miscellaneous taxa	28	37	20	85
Mollusks	79	64	78	221
Polychaetes	224	64	47	335
Total	**543**	**218**	**208**	**969**

(NRC 2016a, Table 2-20)

Table 3.7-3
Relative Abundance of Aquatic Species Commonly Found in Biscayne Bay for Given Salinity Ranges (Sheet 1 of 3)

Common Name	Scientific Name	Adult	Spawning Adults	Juveniles	Larvae	Eggs
Bay scallop	*Argopectin irradians*	Common	Common	Common	Common	Common
		> 25 ppt	> 25 ppt	> 25 ppt	> 25 ppt	> 25 ppt
American oyster	*Crassostrea virginica*	Common	Common	Common	Common	Common
		0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt
Hard clam	*Mercenaria sp.*	Common	Common	Common	Common	Common
		0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt
Pink shrimp	*Penaeus duorarum*	Not present	Not present	Highly abundant	Highly abundant	Not present
				0.5–> 25 ppt	0.5–> 25 ppt	
Grass shrimp	*Palaemonetes pugio*	Common	Common	Common	Common	Common
		0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt
Blue crab	*Callinectes sapidus*	Abundant to highly abundant	Common to abundant	Abundant to highly abundant	Abundant	Abundant
		0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt
Ladyfish	*Elops saurus*	Common	Not present	Common	Common	Not present
		0.5–> 25 ppt		0.5–> 25 ppt	0.5–> 25 ppt	

Table 3.7-3
Relative Abundance of Aquatic Species Commonly Found in Biscayne Bay for Given Salinity Ranges (Sheet 2 of 3)

Common Name	Scientific Name	Adult	Spawning Adults	Juveniles	Larvae	Eggs
American eel	*Anguilla rostrata*	Common	Not present	Common	Common	Not present
		0.5–> 25 ppt		0.5–> 25 ppt	0.5–> 25 ppt	
Bay anchovy	*Alosa mitchilli*	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant
		0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt
Sheepshead minnow	*Cyprinodon variegatus*	Common	Common	Common	Common	Common
		0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt
Mummichug	*Fundulus heteroclitus*	Not present	Not present	Not present	Not present	Not present
Atlantic silverside	*Menidia menidia*	Abundant	Abundant	Abundant	Abundant	Abundant
		0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt	0.5–> 25 ppt
Gray snapper	*Lutijanus griseus*	Highly abundant	Not present	Highly abundant	Abundant to highly abundant	Not present
		0.5–> 25 ppt		0.5–> 25 ppt	0.5–> 25 ppt	
Pinfish	*Lagodon rhomboids*	Highly abundant	Not present	Highly abundant	Highly abundant	Not present
		0.5–> 25 ppt		0.5–> 25 ppt	0.5–> 25 ppt	
Spotted seatrout	*Cynoscion nebulosus*	Common	Common	Common	Common	Common
		0.5–> 25 ppt	> 25ppt	0.5–> 25 ppt	0.5–> 25 ppt	> 25 ppt

Table 3.7-3
Relative Abundance of Aquatic Species Commonly Found in Biscayne Bay for Given Salinity Ranges (Sheet 3 of 3)

Common Name	Scientific Name	Adult	Spawning Adults	Juveniles	Larvae	Eggs
Spot	*Leiostomus xanthurus*	Common 0.5–> 25 ppt	Not present	Common 0.5–> 25 ppt	Common 0.5–> 25 ppt	Not present
Striped mullet	*Mugil cephalus*	Common 0.5–> 25 ppt	Not present	Common 0.5–> 25 ppt	Common 0.5–> 25 ppt	Not present
Spanish mackerel	*Scomberomorus maculates*	Common 0.5–> 25 ppt	Not present	Common 0.5–> 25 ppt	Common >25 ppt	Not present
Gulf flounder	*Paralichthys albigutta*	Common 0.5–> 25 ppt	Not present	Common 0.5–> 25 ppt	Common 0.5–> 25 ppt	Not present

(NRC 2016a, Table 2-21)

Table 3.7-4
Fish Species Composing 90 Percent of the Total Catch in Card Sound (2008–2009 Sampling Events)

Common Name	Scientific Name	Total Number Collected	Percentage of Total	Catch per Unit Effort
Pinfish	*Lagodon rhomboides*	919	19.64	1.47
Bluestriped grunt	*Haemulon sciurus*	591	12.63	0.94
Silver jenny	*Eucinostomus gula*	577	12.33	0.92
White grunt	*Haemulon plumierii*	544	11.63	0.87
Fringed pipefish	*Anarchopterus criniger*	324	6.92	0.52
Scrawled cowfish	*Acanthostracion quadricornis*	192	4.10	0.31
Gulf toadfish	*Opsanus beta*	172	3.68	0.27
Gray snapper	*Lutjanus griseus*	156	3.33	0.25
Planehead filefish	*Stephanolepis hispida*	152	3.25	0.24
Mojarra	*Eucinostomus spp.*	130	2.78	0.21
Sea bream	*Archosargus rhomboidalis*	104	2.22	0.17
Striped burrfish	*Chilomycterus schoepfii*	82	1.75	0.13
Bandtail puffer	*Sphoeroides spengleri*	81	1.73	0.13
Fringed filefish	*Monocanthus ciliates*	72	1.54	0.11
Hogfish	*Lachnolaimus maximus*	57	1.22	0.09
Trunkfish	*Lactophrys trigonus*	40	0.85	0.06
Grass porgy	*Calamus arctifrons*	39	0.83	0.06

(NRC 2016a, Table 2-22)

Table 3.7-5
Shellfish Species Composing 90 Percent of the Total Catch in Card Sound (2008–2009 Sampling Events)

Common Name	Scientific Name	Total Number Collected	Percentage of Total	Catch per Unit Effort
Pink shrimp	*Farfantepenaeus duorarum*	1,153	55.89	1.84
Penaeid shrimp	*Farfantepenaeus spp.*	354	17.16	0.56
Ornate blue crab	*Callinectes ornatus*	187	9.06	0.30
Caribbean spiny lobster	*Panulirus argus*	172	8.34	0.27

(NRC 2016a, Table 2-23)

Table 3.7-6
Fish Larvae Composing 90 Percent of the Total Collection in Card Sound (2008–2009 Sampling Events)

Common Name	Scientific Name	Total Number Collected	Percentage of Total	Catch per Unit Effort
Gobies	Family *Gobiidae*	921	29.22	0.2307
Herring	Family *Clupeidae*	509	16.15	0.1275
Labrisomid blennies	Family *Labrisomidae*	313	9.93	0.0784
True blennies	Family *Chaenopsidae*	257	8.15	0.0644
Hardhead silverside	*Atherinomorus stipes*	234	7.42	0.0586
Code goby	*Gobiosoma robustum*	203	6.44	0.0509
Spotted dragonet	*Diplogrammus pauciradiatus*	132	4.19	0.0331
Sleepers	Family *Eoeotridae*	117	3.71	0.0293
Gobies	Suborder *Gobioidei*	86	2.73	0.0215
Herring-like fish	Order *Clupeiformes*	71	2.25	0.0178

(NRC 2016a, Table 2-24)

Table 3.7-7
Summary of Benthic Invertebrate Abundances near Card Sound

Classification	Distance from Shore (feet)			
	250	**500**	**750**	**Total**
Crustaceans	234	498	268	1,000
Echinoderms	3	16	9	28
Miscellaneous taxa	31	4	26	61
Mollusks	129	132	179	440
Polychaetes	27	45	88	160
Total	**424**	**695**	**570**	**1,689**

(NRC 2016a, Table 2-25)

Table 3.7-8
Ecologically, Recreationally, and Commercially Important Aquatic Species Likely to Occur at or near Turkey Point (Sheet 1 of 3)

Common Name	Scientific Name	Classification	Designation[a]	Citation[b]
Common bottlenose dolphin	*Tursiops truncatus*	Marine mammal	Eco	b
Common snook	*Centropomus undecimalis*	Game fish	Rec, Eco	c
Tarpon	*Megalops atlanticus*	Game fish	Rec, Eco	c
Spotted seatrout	*Cynoscion nebulosus*	Game fish	Eco, Rec	d
Red drum	*Sciaenops ocellatus*	Game fish	Eco, Com, Rec	e
Red grouper	*Epinephelus morio*	Game fish	Eco, Com, Rec	e
Gray snapper	*Lutjanus griseus*	Forage fish	Eco, Com, Rec	e
Mojarras	*Eucinostomus* spp.	Forage fish	Eco	d
Silver jenny	*Eucinostomus gula*	Forage fish	Eco	d
Grunts	*Haemulon* spp.	Forage fish	Eco, Com, Rec	f
Bluestriped grunt	*Haemulon sciurus*	Forage fish	Eco, Com, Rec	f
Fringed pipefish	*Anarchopterus criniger*	Forage fish	Eco	f
Pinfish	*Lagodon rhomboides*	Forage fish	Eco, Rec	f
Sheepshead minnow	*Cyprinodon variegatus*	Forage fish	Eco	c
Killifishes	*Fundulus* spp.	Forage fish	Eco	c
Mosquitofish	*Gambusia* sp.	Forage fish	Eco	c

Table 3.7-8
Ecologically, Recreationally, and Commercially Important Aquatic Species Likely to Occur at or near Turkey Point (Sheet 2 of 3)

Common Name	Scientific Name	Classification	Designation[(a)]	Citation[(b)]
Sailfin molly	*Poecilia latipinna*	Forage fish	Eco, Com	c
Needlefish	*Strongylura* sp.	Forage fish	Eco	c
Silver perch	*Bairdiella chrysoura*	Forage fish	Eco	c
Pink shrimp	*Farfantepenaeus duorarum*	Crustacean	Eco, Com	b, d, f
Caribbean Spiny lobster	*Panulirus argus*	Crustacean	Eco, Com, Rec	e
Blue crab	*Callinectes sapidus*	Crustacean	Eco, Rec, Com	b
American oyster	*Crassostrea virginica*	Mollusk	Eco, Rec, Com	b, d
Green sea urchin	*Lytechinus variegatus*	Echnonderm	Eco	f
Turtle grass	*Thalassia testudinum*	Seagrass	Eco	g, h
Shoal grass	*Halodule wrightii*	Seagrass	Eco	g, h
Manatee grass	*Syringodium filiforme*	Seagrass	Eco	g, h
Algae	*Batophora* spp.	Macroalgae	Eco	g
Pacific whiteleg shrimp	*Litopenaeus vannamei*	Non-indigenous	Eco, Com	j
Lionfishes	*Pterois* spp.	Non-indigenous	Eco	j
Mayan cichlid	*Cichlasoma urophthalamus*	Non-indigenous	Eco	j
Oscar	*Astronotus ocellatus*	Non-indigenous	Eco	j

Table 3.7-8
Ecologically, Recreationally, and Commercially Important Aquatic Species Likely to Occur at or near Turkey Point (Sheet 3 of 3)

Common Name	Scientific Name	Classification	Designation[a]	Citation[b]
Asiatic clam	*Corbicula fluminea*	Non-indigenous	Eco	k
Zebra mussel	*Dreissena polymorpha*	Non-indigenous	Eco	k

a. Eco = ecologically important; Rec = recreationally important; Com = commercially important.
b. Citation letters indicate the following:
   b. Identified as a species of special relevance and utility for monitoring and reporting the state of Biscayne Bay by Browder et al. (2005).
   c. Documented in ER Rev 6 (NRC 2016a, Table 2-27).
   d. Used by NPS to develop salinity targets for Western Biscayne Bay. (NRC 2016a, Table 2-27)
   e. Representative marine species identified to assess the condition of marine resources in Biscayne National Park. (NRC 2016a, Table 2-27)
   f. Numerically abundant in Card Sound (NRC 2016a, Table 2-27).
   g. Abundant near Turkey Point site (NRC 2016a, Table 2-27).
   h. Common in Biscayne Bay. Identified as species of special relevance and utility for monitoring and reporting the state of Biscayne Bay by Browder et al. (2005).
   i. Non-indigenous crustacean species used in aquaculture (NRC 2016a, Table 2-27).
   j. Non-indigenous fish Species of Concern (NRC 2016a, Table 2-27).
   k. Non-indigenous mollusk species in freshwater systems (NRC 2016a, Table 2-27).

Table 3.7-9
Common Phytoplankton and Zooplankton in Biscayne Bay National Park (Sheet 1 of 2)

Common Name	Scientific Name
Phytoplankton[(a)]	
	Acanthophora spicifera
	Acetabularia calyculus
	Acetabularia crenulata
	Acetabularia schenckii
	Amphiroa compressa
	Anadyomene stellata
	Batophora occidentalis
	Batophora oerstedii
	Caulerpa lanuginosa
	Caulerpa mexicana
	Caulerpa paspaloides
	Caulerpa prolifera
	Caulerpa racemosa
	Caulerpa sertularioides
	Chondria baileyana
	Cladosiphon occidentalis
	Digenea simplex
	Halimeda copiosa
	Halimeda goreaui
	Halimeda incrassata
	Halimeda monile
	Halimeda tuna
	Laurencia gemmifera
	Laurencia intricata
	Laurencia poitei
	Lobophora variegata
	Neogoniolithon spectabile

Table 3.7-9
Common Phytoplankton and Zooplankton in Biscayne Bay National Park (Sheet 2 of 2)

Common Name	Scientific Name
Phytoplankton[a] (continued)	*Neomeris annulata*
	Penicillus capitatus
	Penicillus dumetosus
	Penicillus pyriformis
	Porolithon pachydermum
	Rhipocephalus phoenix
	Sargassum fluitans
	Sargassum natans
	Sargassum pteropleuron
	Spyridia filamentosa
	Stypopodium zonale
	Udotea conglutinata
	Udotea dixonii
	Udotea flabellum
	Ventricaria ventricosa
	Wrangelia penicillata
Zooplankton[b]	
American oyster larvae	*Crassostrea virginica*
Hard clam larvae	*Mercenaria* sp.
Pink shrimp larvae	*Penaeus duorarum*
Grass shrimp larvae	*Palaemonetes pugio*
Blue crab larvae	*Callinectes sapidus*

a. (NPS 2017a)
b. (Browder et al. 2005)

Table 3.7-10
Florida Coastal Fish Consumption Advisories Based on Mercury Levels (Sheet 1 of 5)

Water Body	Species	Women of Childbearing Age and Young Children, Number of Meals	All Other Individuals, Number of Meals
All coastal waters	Almaco jack	One per month	One per month
All coastal waters	Atlantic croaker	Two per week	Two per week
All coastal waters	Atlantic spadefish	One per week	One per week
All coastal waters	Atlantic stingray	One per month	One per week
All coastal waters	Atlantic thread herring	One per week	Two per week
All coastal waters	Atlantic weakfish	One per week	Two per week
All coastal waters	Black drum	One per week	Two per week
All coastal waters	Black grouper	One per month	One per week
All coastal waters	Blackfin tuna	DO NOT EAT	One per month
All coastal waters	Bluefish	One per month	One per week
All coastal waters	Bluntnose sting ray	One per week	Two per week
All coastal waters	Bonefish	One per month	One per week
Florida Bay, Biscayne Bay, and Florida Keys	Crevalle jack	DO NOT EAT	One per month
Remaining coastal waters	Crevalle jack	One per month	One per week
All coastal waters	Cobia	DO NOT EAT	One per month
All coastal waters	Dolphin	One per week	Two per week

Table 3.7-10
Florida Coastal Fish Consumption Advisories Based on Mercury Levels (Sheet 2 of 5)

Water Body	Species	Women of Childbearing Age and Young Children, Number of Meals	All Other Individuals, Number of Meals
All coastal waters	Fantail mullet	Two per week	Two per week
All coastal waters	Florida pompano	One per week	Two per week
All coastal waters	Gafftopsail catfish	One per month	One per week
All coastal waters	Gag	One per month	One per week
Florida Bay, Biscayne Bay, and Florida Keys	Gray snapper	One per month	Two per week
Remaining coastal waters	Gray snapper	One per week	Two per week
All coastal waters	Greater amberjack	One per month	One per week
Florida Bay, Biscayne Bay, and Florida Keys	Great barracuda	DO NOT EAT	One per month
Remaining coastal waters	Great barracuda	One per month	Two per week
All coastal waters	Gulf flounder	One per month	One per week
All coastal waters	Hardhead catfish	One per week	Two per week
All coastal waters	Hogfish	One per week	Two per week
All coastal waters	King mackerel less than 31 inches fork length	DO NOT EAT	One per month
All coastal waters	King mackerel 31 or more inches fork length	DO NOT EAT	DO NOT EAT
All coastal waters	Ladyfish	One per month	One per week

Table 3.7-10
Florida Coastal Fish Consumption Advisories Based on Mercury Levels (Sheet 3 of 5)

Water Body	Species	Women of Childbearing Age and Young Children, Number of Meals	All Other Individuals, Number of Meals
All coastal waters	Lane snapper	One per month	Two per week
All coastal waters	Little tunny	DO NOT EAT	One per month
All coastal waters	Lookdown	One per week	Two per week
All coastal waters	Mutton snapper	One per month	One per week
All coastal waters	Pigfish	One per week	Two per week
All coastal waters	Pinfish	One per week	Two per week
Florida Bay, Biscayne Bay, and Florida Keys	Red drum	One per month	One per week
Remaining coastal waters	Red drum	One per month	Two per week
All coastal waters	Red grouper	One per month	One per week
All coastal waters	Red snapper	One per week	Two per week
All coastal waters	Sand seatrout	One per month	One per week
All coastal waters	Scamp	One per month	One per week
All coastal waters	Shark, all species less than 43 inches	DO NOT EAT	One per month
All coastal waters	Shark, all species 43 inches or more	DO NOT EAT	DO NOT EAT
All coastal waters	Sheepshead	One per month	Two per week

Table 3.7-10
Florida Coastal Fish Consumption Advisories Based on Mercury Levels (Sheet 4 of 5)

Water Body	Species	Women of Childbearing Age and Young Children, Number of Meals	All Other Individuals, Number of Meals
All coastal waters	Silver perch	One per month	One per week
All coastal waters	Skipjack tuna	One per month	Two per week
Florida Bay, Biscayne Bay, and Florida Keys	Snook	One per month	One per month
Remaining coastal waters	Snook	One per month	One per week
All coastal waters	Snowy grouper	One per month	One per month
All coastal waters	Southern flounder	One per week	Two per week
All coastal waters	Spanish mackerel	One per month	One per week
All coastal waters	Spot	One per week	Two per week
Florida Bay, Biscayne Bay, and Florida Keys	Spotted seatrout	One per month	One per month
Remaining coastal waters	Spotted seatrout	One per month	One per week
All coastal waters	Southern kingfish	One per month	Two per week
All coastal waters	Striped mullet	Two per week	Two per week
All coastal waters	Striped mojarra	Two per week	Two per week
All coastal waters	Tarpon	One per week	Two per week
Florida Bay, Biscayne Bay, and Florida Keys	Tripletail	One per month	One per week
Remaining coastal waters	Tripletail	One per month	Two per week

Table 3.7-10
Florida Coastal Fish Consumption Advisories Based on Mercury Levels (Sheet 5 of 5)

Water Body	Species	Women of Childbearing Age and Young Children, Number of Meals	All Other Individuals, Number of Meals
All coastal waters	Vermillion snapper	One per week	Two per week
All coastal waters	Wahoo	One per month	One per week
All coastal waters	White grunt	One per month	One per week
All coastal waters	White mullet	Two per week	Two per week
All coastal waters	Yellow-edge grouper	One per month	Two per week
All coastal waters	Yellowfin tuna	One per month	Two per week
All coastal waters	Yellowtail snapper	One per week	Two per week

(FDH 2017b)

Table 3.7-11
Common Wildlife Species of Southern Florida (Sheet 1 of 17)

Common Name	Scientific Name
Amphibians	
Cuban treefrog	*Osteopilus septentrionalis*
Eastern narrow-mouth toad	*Gastrophryne carolinensis*
Eastern spadefoot toad	*Scaphiophus holbrookii*
Everglades dwarf siren	*Pseudobranchus axanthus*
Florida chorus frog	*Pseudacris nigrata*
Florida cricket frog	*Acris gryllus*
Greater siren	*Siren lacertina*
Green treefrog	*Hyla cinerea*
Greenhouse frog	*Eleuthrodactylus planirostris*
Little grass frog	*Pseudacris ocularis*
Oak toad	*Bufo quercicus*
Peninsula newt	*Notophthalmus viridescens*
Pig frog	*Rana grylio*
Southern leopard frog	*Rana sphenocephala*
Southern toad	*Bufo terrestris*
Squirrel treefrog	*Hyla squirella*
Two-toed amphiuma	*Amphiuma means*
Birds	
Acadian flycatcher	*Empidonax virescens*
American avocet	*Recurvirostra americana*
American bittern	*Botaurus lentiginosus*
American black duck	*Anas rubripes*
American coot	*Fulica americana*
American crow	*Corvus brachyrhynchos*
American golden plover	*Pluvialis dominica*
American goldfinch	*Carduelis tristis*
American kestrel	*Falco sparverius*

Table 3.7-11
Common Wildlife Species of Southern Florida (Sheet 2 of 17)

Common Name	Scientific Name
American oystercatcher	*Haematopus palliatus*
American pipit	*Anthus rubescens*
American redstart	*Setophaga ruticilla*
American robin	*Turdus migratorius*
American white pelican	*Pelecanus erythrorhnchos*
American wigeon	*Anas americana*
American woodcock	*Scolopax minor*
Anhinga	*Anhinga anhinga*
Antillean nighthawk	*Chordeiles gundlachii*
Arctic peregrine falcon	*Falco peregrinus tundrius*
Audubon's shearwater	*Puffinus lherminieri*
Bachman's sparrow	*Aimophila aestivalis*
Bahama mockingbird	*Mimus gundlachii*
Bahama swallow	*Tachycineta cyaneoviridis*
Baird's sandpiper	*Calidris bairdii*
Bald eagle	*Haliaeetus leucocephalus*
Baltimore oriole	*Icterus galbula*
Bananquit	*Coereba flaveola*
Bank swallow	*Riparia riparia*
Barn owl	*Tyto alba*
Barn swallow	*Hirundo rustica*
Barred owl	*Strix varia*
Bar-tailed godwit	*Limosa lapponica*
Bay-breasted warbler	*Dendroica castanea*
Bell's vireo	*Vireo bellii*
Belted kingfisher	*Ceryle alcyon*
Black rail	*Laterallus jamaicensis*
Black scoter	*Melanitta nigra*
Black skimmer	*Rynchops niger*

Table 3.7-11
Common Wildlife Species of Southern Florida (Sheet 3 of 17)

Common Name	Scientific Name
Black tern	*Chlidonias niger*
Black vulture	*Coragyps atratus*
Black-and-white warbler	*Mniotilta varia*
Black-bellied plover	*Pluvialis squatarola*
Black-bellied whistling duck	*Dendrocygna autumnalis*
Black-billed cuckoo	*Coccyzus erythrophthalmus*
Blackburnian warbler	*Debdriuca fusca*
Black-crowned night-heron	*Nycticorax nycticorax*
Black-faced grassquit	*Tiaris bicolor*
Black-headed grosbeak	*Pheucticus melanocephalus*
Black-necked stilt	*Himantopus mexicanus*
Blackpoll warbler	*Dendroica striata*
Black-tailed godwit	*Limosa limosa*
Black-throated blue warbler	*Dendroica caerulescens*
Black-throated gray warbler	*Dendroica nigrescens*
Black-throated green warbler	*Dendroica virens*
Black-whiskered vireo	*Vireo altiloquus*
Blue grosbeak	*Guiraca caerulea*
Blue jay	*Cyanocitta cristata*
Blue-gray gnatcatcher	*Polioptila caerulea*
Blue-headed vireo	*Vireo solitarius*
Blue-winged teal	*Anas discors*
Blue-winged warbler	*Vermivora pinus*
Boat-tailed grackle	*Quiscalus major*
Bobolink	*Dolichonyx oryzivorus*
Bonaparte's gull	*Larus philadelphia*
Brant	*Branta bernicla*
Brewer's blackbird	*Euphagus cyanocephalus*
Bridled tern	*Sterna anaethetus*

Table 3.7-11
Common Wildlife Species of Southern Florida (Sheet 4 of 17)

Common Name	Scientific Name
Broad-winged hawk	*Buteo platypterus*
Bronzed cowbird	*Molothrus aeneus*
Brown booby	*Sula leucogaster*
Brown noddy	*Anous stolidus*
Brown pelican	*Pelecanus occidentalis*
Brown thrasher	*Taxostoma rufum*
Brown-crested flycatcher	*Myiarchus tyrannulus*
Brown-headed cowbird	*Molothrus ater*
Brown-headed nuthatch	*Sitta pusilla*
Budgerigar	*Melopsittacus undulatus*
Buff-breasted sandpiper	*Tryngites subruficollis*
Bufflehead	*Bucephala albeola*
Bullock's oriole	*Icterus bullockii*
Burrowing owl	*Athene cunicularia*
Canada goose	*Branta canadensis*
Canada warbler	*Wilsonia canadensis*
Canvasback	*Aythya valisineria*
Cape may warbler	*Dendroica tigrina*
Cape sable seaside sparrow	*Ammodramus maritimus mirabilis*
Carolina wren	*Thryothorus ludovicianus*
Caspian tern	*Sterna caspia*
Cattle egret	*Bulbulcus ibis*
Cave swallow	*Hirundo fulva*
Cedar waxwing	*Bombycilla cedrorum*
Cerulean warbler	*Dendroica cerulea*
Chestnut-sided warbler	*Dendroica pensylvanica*
Chimney swift	*Chaetura pelagica*
Chipping sparrow	*Spizella passerina*
Chuck-will's-widow	*Caprimulgus carolinensis*

Table 3.7-11
Common Wildlife Species of Southern Florida (Sheet 5 of 17)

Common Name	Scientific Name
Cinnamon teal	*Anas cyanoptera*
Clapper rail	*Rallus longirostris*
Clay-colored sparrow	*Spizella pallida*
Cliff swallow	*Hirundo pyrrhonota*
Common eider	*Somateria mollissima*
Common goldeneye	*Bucephala clangula*
Common grackle	*Quiscalus quiscula*
Common ground dove	*Columbina passerina*
Common moorhen	*Galinula chloropus*
Common myna	*Acridotheres tristis*
Common nighthawk	*Chordeiles minor*
Common tern	*Sterna hirundo*
Common yellowthroat	*Geothlypis trichas*
Connecticut warbler	*Oporornis agilis*
Cooper's hawk	*Accipiter cooperii*
Crested caracara	*Polyborus plancus*
Curlew sandpiper	*Calidris ferruginea*
Dark-eyed junco	*Junco hyemalis*
Dickcissel	*Spiza americana*
Double-crested cormorant	*Phalacrocorax auritus*
Downy woodpecker	*Picoides pubescens*
Dunlin	*Calidris alpina*
Eared grebe	*Podiceps nigricollis*
Eastern bluebird	*Sialia sialis*
Eastern kingbird	*Tyrannus tyrannus*
Eastern meadowlark	*Sturnella magna*
Eastern phoebe	*Sayornis phoebe*
Eastern screech owl	*Otus asio*
Eastern towhee	*Pipilo erythrophthalmus*

Table 3.7-11
Common Wildlife Species of Southern Florida (Sheet 6 of 17)

Common Name	Scientific Name
Eastern wood-pewee	*Contopus virens*
Eurasian collared dove	*Streptopelia decaocto*
Eurasian wigeon	*Anas penelope*
European starling	*Sturnus vulgaris*
Field sparrow	*Spizella pusilla*
Fish crow	*Corvus ossifragus*
Fork-tailed flycatcher	*Tyrannus savana*
Forster's tern	*Sterna forsteri*
Franklin's gull	*Leucophaeus pipixcan*
Fulvous whistling duck	*Dendrocygna bicolor*
Gadwall	*Anas strepera*
Glossy ibis	*Plegadis falcinellus*
Golden eagle	*Aquila chrysaetos*
Golden-winged warbler	*Vermivora chrysoptera*
Grasshopper sparrow	*Ammodramus savannarum*
Gray catbird	*Dumetella carolinensis*
Gray kingbird	*Tyrannus dominicensis*
Gray-cheecked thrush	*Catharus minimus*
Great black-backed gull	*Larus marinus*
Great blue heron	*Ardea herodias*
Great cormorant	*Phalacrocorax carbo*
Great crested flycatcher	*Myiarchus crinitus*
Great egret	*Casmerodius albus*
Great horned owl	*Bubo virginianus*
Great shearwater	*Puffinus gravis*
Greater flamingo	*Phoenicopterus ruber*
Greater scaup	*Aythya marila*
Greater yellowlegs	*Tringa melanoleuca*
Green-backed heron	*Butorides striatus*

Table 3.7-11
Common Wildlife Species of Southern Florida (Sheet 7 of 17)

Common Name	Scientific Name
Green-winged teal	*Anas carolinensis*
Groove-billed ani	*Crotophaga sulcirostris*
Gull-billed tern	*Sterna nilotica*
Hairy woodpecker	*Picoides villosus*
Hermit thrush	*Catharus guttatus*
Herring gull	*Larus argentatus*
Hill myna	*Gracula religiosa*
Hooded merganser	*Lophodytes cucullatus*
Hooded warbler	*Wilsonia citrina*
Horned grebe	*Podiceps auritus*
Horned lark	*Eremophila alpestris*
House sparrow	*Passer domesticus*
House wren	*Troglodytes aedon*
Hudsonian godwit	*Limosa haemastica*
Indigo bunting	*Passerina cyanea*
Ivory-billed woodpecker	*Campephilus principalis*
Kentucky warbler	*Oporornis formosus*
Key West quail-dove	*Geotrygon chrysia*
Killdeer	*Charadrius vociferus*
King rail	*Rallus elegans*
Lapland longspur	*Calcarius lapponicus*
Lark bunting	*Calamospiza melanocorys*
Lark sparrow	*Chondestes grammacus*
Lauging gull	*Larus atricilla*
Laxuli bunting	*Passerina amoena*
Leach's storm-petrel	*Oceanodroma leucorhoa*
Least bittern	*Ixobrychus exilis*
Least flycatcher	*Empidonax minimus*
Least sandpiper	*Calidris minutilla*

Table 3.7-11
Common Wildlife Species of Southern Florida (Sheet 8 of 17)

Common Name	Scientific Name
Least tern	*Sterna antillarum*
LeCont's sparrow	*Ammodramus leconteii*
Lesser black-backed gull	*Larus fuscus*
Lesser nighthawk	*Chordeiles acutipennis*
Lesser scaup	*Aythya affinis*
Lesser yellowlegs	*Tringa flavipes*
Limpkin	*Aramus guarauna*
Lincoln's sparrow	*Melospiza lincolnii*
Little blue heron	*Egretta caerulea*
Loggerhead shrike	*Lanius ludovicianus*
Long-billed curlew	*Numenius americanus*
Long-billed dowitcher	*Limnodromus scolopaceus*
Long-tailed duck	*Clangula hyemalis*
Louisiana waterthrush	*Seiurus motacilla*
Magnificent frigatebird	*Fregata magnificens*
Magnolia warbler	*Dendroica magnolia*
Mallard	*Anas platyrhynchos*
Mangrove cuckoo	*Coccyzus minor*
Marbled godwit	*Limosa fedoa*
Marsh wren	*Cistothorus palustris*
Masked duck	*Nomonyx dominicus*
Merlin	*Falco columbarius*
Mississippi kite	*Ictinia mississippiensis*
Monk parakeet	*Myiopsitta monachus*
Mottled duck	*Anas fulvigula*
Mountain bluebird	*Sialia currucoides*
Mourning dove	*Zenaida macroura*
Mourning warbler	*Oporornis philadelphia*
Nashville warbler	*Vermivora ruficapilla*

Table 3.7-11
Common Wildlife Species of Southern Florida (Sheet 9 of 17)

Common Name	Scientific Name
Nelson's sharp-tailed sparrow	*Ammodramus nelsoni*
Northern bobwhite	*Colinus virginianus*
Northern cardinal	*Cardinalis cardinalis*
Northern flicker	*Colaptes auratus*
Northern gannet	*Morus bassanus*
Northern harrier	*Circus cyaneus*
Northern mockingbird	*Mimus polyglottos*
Northern parula	*Parula americana*
Northern pintail	*Anas acuta*
Northern rough-winged swallow	*Stelgidopteryx serripennis*
Northern shoveler	*Anas clypeata*
Northern waterthrush	*Seiurus noveboracensis*
Orange-crowned warbler	*Vermivora celata*
Orchard oriole	*Icterus spurius*
Osprey	*Pandion haliaetus*
Ovenbird	*Seiurus aurocapillus*
Painted bunting	*Passerina ciris*
Palm warbler	*Dendroica palmarum*
Parasitic jaeger	*Stercorarius parasiticus*
Pectoral sandpiper	*Calidris melanotos*
Peregrine falcon	*Falco peregrinus*
Philadelphia vireo	*Vireo philadelphicus*
Pied-billed grebe	*Podilymbus podiceps*
Pileated woodpecker	*Dryocopus pileatus*
Pine siskin	*Carduelis pinus*
Pine warbler	*Dendroica pinus*
Piping plover	*Charadrius melodus*
Pomarine jaeger	*Stercorarius pomarinus*
Prairie warbler	*Dendroica discolor*

Table 3.7-11
Common Wildlife Species of Southern Florida (Sheet 10 of 17)

Common Name	Scientific Name
Prothonotary warbler	*Protonotaria citrea*
Purple gallinule	*Porphyrula martinica*
Purple martin	*Progne subis*
Red knot	*Calidris canutus*
Red-bellied woodpecker	*Melanerpes carolinus*
Red-breasted merganser	*Mergus serrator*
Red-cockaded woodpecker	*Picoides borealis*
Reddish egret	*Egretta rufescens*
Red-eyed vireo	*Vireo olivaceus*
Redhead	*Aythya americana*
Red-headed woodpecker	*Melanerpes erythrocephalus*
Red-necked grebe	*Podiceps grisegena*
Red-necked phalarope	*Phalaropus lobatus*
Red-shouldered hawk	*Buteo lineatus*
Red-tailed hawk	*Buteo jamaicensis*
Red-winged blackbird	*Agelaius phoeniceus*
Ring-billed gull	*Larus delawarensis*
Ring-necked duck	*Aythya collaris*
Rock dove	*Columba livia*
Roseate spoonbill	*Ajaia ajaja*
Roseate tern	*Sterna dougalli*
Rose-breasted grosbeak	*Pheucticus ludovicianus*
Rose-ringed parakeet	*Psittacula krameri*
Rough-legged hawk	*Buteo lagopus*
Royal tern	*Sterna maxima*
Ruby-crowned kinglet	*Regulus calendula*
Ruby-throated hummingbird	*Archilochus colubris*
Ruddy duck	*Oxyura jamaicensis*
Ruddy turnstone	*Arenaria interpres*

Table 3.7-11
Common Wildlife Species of Southern Florida (Sheet 11 of 17)

Common Name	Scientific Name
Ruff	*Philomachus pugnax*
Rufous hummingbird	*Selasphorus rufus*
Rusty blackbird	*Euphagus carolinus*
Saltmarsh sharp-tailed sparrow	*Ammodramus caudacutus*
Sanderling	*Calidris alba*
Sandhill crane	*Grus canadensis*
Sandwich tern	*Sterna sandvicencis*
Savannah sparrow	*Passerculus sandwichensis*
Say's phoebe	*Sayornis saya*
Scarlet ibis	*Eudocimus ruber*
Scarlet tanater	*Piranga olivacea*
Scissor-tailed flycatcher	*Tyrannus forficatus*
Seaside sparrow	*Ammodramus maritimus*
Sedge wren	*Cistothorus platensis*
Semipalmated plover	*Charadrius semipalmatus*
Semipalmated sandpiper	*Calidris pusilla*
Sharp-shinned hawk	*Accipiter striatus*
Sharp-tailed sandpiper	*Calidris acuminata*
Shiny cowbird	*Molothrus bonariensis*
Short-billed dowitcher	*Limnodromus griseus*
Short-eared owl	*Asio flammeus*
Short-tailed hawk	*Buteo brachyurus*
Smooth-billed ani	*Crotophaga ani*
Snail kite	*Rostrhamus sociabilis*
Snow goose	*Chen caerulescens*
Snowy egret	*Egretta thula*
Snowy plover	*Charadrius alexandrinus*
Solitary sandpiper	*Tringa solitaria*
Song sparrow	*Melospiza melodia*

Table 3.7-11
Common Wildlife Species of Southern Florida (Sheet 12 of 17)

Common Name	Scientific Name
Sooty shearwater	*Puffinus griseus*
Sooty tern	*Sterna anaethetus*
Sora	*Porzana carolina*
Spot-breasted oriole	*Icterus pectoralis*
Spotted sandpiper	*Actitis macularia*
Stilt sandpiper	*Micropalama himantopus*
Summer tanager	*Piranga rubra*
Surf scoter	*Melanitta perspicillata*
Swainson's hawk	*Buteo swainsoni*
Swainson's thrush	*Catharus ustulatus*
Swainson's warbler	*Limnothlypis swainsonii*
Swallow-tailed kite	*Elanoides forficatus*
Swamp sparrow	*Melospiza georgiana*
Tennessee warbler	*Vermivora peregrina*
Thick-billed vireo	*Vireo crassirostris*
Tree swallow	*Tachycineta bicolor*
Tricolored heron	*Egretta tricolor*
Tropical kingbird	*Tyrannus melancholicus*
Tufted titmouse	*Parus bicolor*
Turkey vulture	*Cathartes aura*
Upland sandpiper	*Bartramia longicauda*
Veery	*Catharus fuscescens*
Vermilion flycatcher	*Pyrocephalus rubinus*
Vesper sparrow	*Pooecetes gramineus*
Virginia rail	*Rallus limicola*
Western kingbird	*Tyrannus verticalis*
Western sandpiper	*Calidris mauri*
Western spindalis	*Spindalis zena*
Western tanager	*Piranga ludoviciana*

Table 3.7-11
Common Wildlife Species of Southern Florida (Sheet 13 of 17)

Common Name	Scientific Name
Whimbrel	*Numenius phaeopus*
Whip-poor-will	*Caprimulgus vociferus*
White ibis	*Eudocimus albus*
White-cheeked pintail	*Anas bahamensis*
White-crowned pigeon	*Columba Leucocephala*
White-crowned sparrow	*Zonotrichia leucophrys*
White-eyed vireo	*Vireo griseus*
White-faced ibis	*Plegadis chihi*
White-rumped sandpiper	*Calidris fuscicollis*
White-tailed kite	*Elanus caeruleus*
White-throated sparrow	*Zonotrichia albicollis*
White-winged dove	*Zenaida asiatica*
White-winged scoter	*Melanitta fusca*
Wild turkey	*Meleagris gallopavo*
Willet	*Catoptrophorus semipalmatus*
Willow flycatcher	*Empidonax traillii*
Wilson's phalarope	*Phalaropus tricolor*
Wilson's plover	*Charadrius wilsonia*
Wilson's snipe	*Gallinago delicata*
Wilson's storm-petrel	*Oceanites oceanicus*
Wilson's warbler	*Wilsonia pusilla*
Wood duck	*Aix sponsa*
Wood stork	*Mycteria americana*
Wood thrush	*Hylocichla mustelina*
Worm-eating warbler	*Helmitheros vermivorus*
Yellow rail	*Coturnicops noveboracensis*
Yellow warbler	*Dendroica petechia*
Yellow-bellied flycatcher	*Empidonax flaviventris*
Yellow-bellied sapsucker	*Sphyrapicus varius*

Table 3.7-11
Common Wildlife Species of Southern Florida (Sheet 14 of 17)

Common Name	Scientific Name
Yellow-billed cuckoo	*Coccyzus americanus*
Yellow-breasted chat	*Icteria virens*
Yellow-crowned night-heron	*Nyctanassa violacea*
Yellow-faced grassquit	*Tiaris olivaceus*
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*
Yellow-rumped warbler	*Dendroica coronata*
Yellow-throadted vireo	*Vireo flavifrons*
Yellow-throated warbler	*Dendroica dominica*
Zenaida dove	*Zenaida aurita*
Mammals	
Atlantic bottlenosed dolphin	*Tursiops truncatus*
Black bear	*Ursus americanus*
Bobcat	*Lynx rufus*
Brazilian free-tailed bat	*Tadarida brasiliensis*
Coati	*Nasua narica*
Cotton mouse	*Peromyscus gossypinus*
Cotton rat	*Sigmodon hispidus*
Domestic cat	*Felis domesticus*
Domestic dog	*Canis familiaris*
Domestic pig	*Sus scrofa*
Eastern cottontail	*Sylvilagus floridana*
Eastern mole	*Scalopus aquaticus*
Eastern spotted skunk	*Spilogale putorius*
Evening bat	*Nycticeius humeralis*
Everglades mink	*Mustela vison*
Florida bonneted bat (formerly Florida mastiff bat)	*Eumops floridanus* *(formerly Eumops glaucinus floridanus)*
Florida panther	*Felis concolor coryi*
Fox squirrel	*Sciurus niger*

Table 3.7-11
Common Wildlife Species of Southern Florida (Sheet 15 of 17)

Common Name	Scientific Name
Gray squirrel	*Sciurus carolinensis*
Grey fox	*Urocyon cineroargenteus*
House mouse	*Mus musculus*
Least shrew	*Cryptotis parva*
Long-tailed weasel	*Mustela frenata*
Marsh rabbit	*Sylvilagus palustris*
Nine-banded armadillo	*Dasypus novemcinctus*
Northern yellow bat (also known as Florida yellow bat)	*Lasiurus intermedius*
Norway rat	*Rattus norvegicus*
Opossum	*Didelphis marsupialis*
Pilot whale	*Globicephala macrorhyncha*
Raccoon	*Procyon lotor*
Red fox	*Vulpes vulpes*
Rice rat	*Oryzomys palustris*
River otter	*Lutra canadensis*
Roof rat	*Rattus rattus*
Roundtail muskrat	*Neofiber alleni*
Seminole bat	*Lasiurus seminolus*
Short-tailed shrew	*Blarina brevicauda*
Southern flying squirrel	*Glaucomys volans*
Striped skunk	*Mephitis mephitis*
West Indian manatee	*Trichechus manatus*
White-tailed deer	*Odocoileus virginianus*
Reptiles	
American alligator	*Alligator mississippiensis*
American crocodile	*Crocodylus acutus*
Atlantic hawksbill	*Eretmochelys imbricata*
Atlantic leatherback	*Dermochelys coriacea*

Table 3.7-11
Common Wildlife Species of Southern Florida (Sheet 16 of 17)

Common Name	Scientific Name
Atlantic ridley	*Lepidochelys kempii*
Boa constrictor	*Constrictor constrictor*
Brahminy blind snake	*Ramphotyphlops braminus*
Brown anole	*Anolis sagrei*
Brown water snake	*Nerodia taxispilota*
Burmese python	*Python molurus bivittatus*
Caiman	*Caiman crocodilus*
Common iguana	*Iguana iguana*
Corn snake	*Elaphae guttata*
Diamondback terrapin	*Malaclemys terrapin*
Dusky pygmy rattlesnake	*Sistrurus miliarius*
Eastern coachwhip	*Masticophis flagellum*
Eastern coral snake	*Micrurus fulvius*
Eastern diamondback	*Crotalus adamanteus*
Eastern garter snake	*Thamnophis sirtalis*
Eastern glass lizard	*Ophisaurus ventralis*
Eastern hognose snake[2]	*Heterodon platyrhinos*
Eastern indigo snake	*Drymarchon corais*
Eastern mud snake	*Farancia abacura*
Eastern racer	*Coluber constrictor*
Everglades rat snake	*Elaphae obsoleta rossalleni*
Florida box turtle	*Terrapene carolina*
Florida brown snake	*Storeia dekayi*
Florida chicken turtle	*Deirochelys reticularia*
Florida cottonmouth	*Agkistrodon piscivorous*
Florida green water snake	*Nerodia floridana*
Florida kingsnake	*Lempropeltis getulus*
Florida mud turtle	*Kinosternon subrubrum*
Florida redbelly turtle	*Pseudemys nelsoni*

Table 3.7-11
Common Wildlife Species of Southern Florida (Sheet 17 of 17)

Common Name	Scientific Name
Florida reef gecko	*Sphaerodactylus notatus*
Florida scarlet snake	*Cemophora coccinea*
Florida snapping turtle	*Chelydra serpentina*
Florida softshell	*Apalone ferox*
Florida water snake	*Nerodia fasciata*
Gopher tortoise	*Gopherus ployphemus*
Green anole	*Anolis caroliniensis*
Green turtle	*Chelonia mydas*
Ground skink	*Scincella lateralis*
Indopacific gecko	*Hemidactylus garnotii*
Island glass lizard	*Ophisaurus compressus*
Knight anole	*Anolis equestris*
Loggerhead	*Caretta caretta*
Mangrove salt marsh snake	*Nerodia clarkii*
Peninsula cooter	*Pseudemys floridana*
Peninsula ribbon snake	*Thamnophis sauritus*
Rough green snake	*Opheodrys aestivus*
Scarlet kingsnake	*Lempropeltis triangulum*
South Florida swamp snake	*Seminatrix pygaea*
Southeastern five-lined skink	*Eumeces inexpectatus*
Southern ringneck snake	*Diadophis punctatus*
Stinkpot	*Sternotherus ordoratus*
Striped crayfish snake	*Regina alleni*
Striped mud turtle	*Kinosternon baurii*
Tokay gecko	*Gekko gecko*
Tropical house gecko	*Hemidactylus mabouia*
Yellow rat snake	*Elaphae obsoleta quadrivitatta*

(NPS 2017d)

Table 3.7-12
Federally Listed Species in Miami-Dade County, Florida (Sheet 1 of 3)

Common Name	Scientific Name	Federal Status
Plants and Lichens		
Crenulate lead-plant	*Amorpha herbacea var. crenulata*[(a)(b)]	E
Blodgett's wild-mercury (Blodgett's silverbush)	*Argythamnia blodgettii*[(a)(b)]	T
Florida brickell-bush	*Brickellia mosieri*[(a)(b)]	E
Hairy deltoid spurge	*Chamaesyce deltoidea* ssp. *adhaerens*[(a)]	E
Deltoid spurge	*Chamaesyce deltoidea* ssp. *deltoidea*[(a)(b)]	E
Pinelands spurge (pinelands sandmat)	*Chamaesyce deltoidea* ssp. *pinetorum*[(a)(b)]	T
Wedge spurge	*Chamaesyce deltoidea* ssp. *serpyllum*[(a)]	E
Garber's spurge	*Chamaesyce garberi*[(a)(b)]	T
Cape sable thoroughwort	*Chromolaena frustrata [Eupatorium frustratum]*[(b)]	E
Florida semaphore cactus	*Consolea [Opuntia] corallicola*[(b)]	E
Okeechobee gourd	*Cucurbita okeechobeensis ssp. Okeechobeensis*[(b)]	E
Florida prairie clover	*Dalea carthagenensis var. floridana*[(a)(b)]	E
Few-flowered fingergrass	*Digitaria pauciflora*[(a)(b)]	T
Small's milkpea	*Galactia smallii*[(a)(b)]	E
Johnson's seagrass	*Halophila johnsonii*[(a)]	T
Beach Jacquemontia	*Jacquemontia reclinata*[(a)(b)]	E
Sand Flax	*Linum arenicola*[(a)(b)]	E
Carter's small-flowered flax	*Linum carteri var. carteri*[(a)(b)]	E
Tiny polygala	*Polygala smallii*[(a)(b)]	E
Florida bristle fern (Florida filmy fern)	*Trichomanes punctatum* ssp. *floridanum*[(a)(b)]	E
Everglades bully	*Sideroxylon reclinatum* ssp. *austrofloridense*[(a)(b)]	T

Table 3.7-12
Federally Listed Species in Miami-Dade County, Florida (Sheet 2 of 3)

Common Name	Scientific Name	Federal Status
Invertebrates		
Miami tiger beetle	*Cicindelidia floridana*[a]	E
Florida leafwing	*Anaea troglodyta floridalis*[a][b]	E
Miami blue butterfly	*Cyclargus thomasi bethunebakeri*[a][b]	E
Schaus' swallowtail	*Papilio aristodemus ponceanus*[a][b]	E
Bartram's scrub-hairstreak	*Strymon acis bartrami*[a][b]	E
Stock island tree snail	*Orthalicus reses reses*[a][b]	T
Fish		
Shortnose sturgeon	*Acipenser brevirostrum*[c]	E
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	E
Nassau grouper	*Epinephelus striatus*[c]	T
Smalltooth sawfish	*Pristis pectinata*[c]	E
Reptiles		
American alligator	*Alligator mississippiensis*[a][b]	SAT
American crocodile	*Crocodylus acutus*[a][b]	T
Loggerhead sea turtle	*Caretta caretta*[a][b]	T
Green sea turtle	*Chelonia mydas*[a]	T
Leatherback sea turtle	*Dermochelys coriacea*[a][b]	E
Eastern indigo snake	*Drymarchon couperi*[a][b]	T
Hawksbill sea turtle	*Eretmochelys imbricata*[a][b]	E
Gopher tortoise	*Gopherus polyphemus*[a][b]	C
Kemp's Ridley sea turtle	*Lepidochlys kempii*[c]	E

Table 3.7-12
Federally Listed Species in Miami-Dade County, Florida (Sheet 3 of 3)

Common Name	Scientific Name	Federal Status
Birds		
Cape sable seaside sparrow	*Ammodramus maritimus mirabilis*[(a)(b)]	E
Red knot	*Caladris rufa*[(b)]	T
Piping plover	*Charadrius melodus*[(a)(b)]	T
Wood stork	*Mycteria americana*[(a)(b)]	T
Snail kite	*Rostrhamus sociabilis*[(a)(b)]	E
Audubon's crested caracara	*Polyborus plancus audubonii*[(b)]	T
Kirtland's warbler	*Setophaga kirtlandii*[(b)]	E
Bachman's warbler	*Vermivora bachmani*[(b)]	E
Mammals		
Florida bonneted bat	*Eumops floridanus*[(a)(b)]	E
Florida panther	*Puma concolor coryi*[(a)(b)]	E
Florida [West Indian] manatee	*Trichechus manatus*[(a)(b)]	T

a. (USFWS 2017b)
b. (FNAI 2017b)
c. (NOAA 2017a)

Federal status designations are as follows:
E = Listed as endangered species at the federal level by the USFWS
T = Listed as threatened species at the federal level by the USFWS
C = Candidate species
SAT = Treated as threatened due to similarity of appearance

Table 3.7-13
American Crocodile Monitoring Results at the Turkey Point Site, 2000−2016

Year	Nests Identified	Hatchlings Captured and Tagged	Citation
2000	17	298	(a)
2001	14	227	(a)
2002	17	291	(a)
2003	17	295	(a)
2004	18	134	(a)
2005	24	282	(a)
2006	24	340	(a)
2007	21	305	(a)
2008	28	510	(a)
2009	24	548	(a)
2010	16	196	(b)
2011	15	268	(b)
2012	18	229	(b)
2013	25	429	(b)
2014	25	409	(b)
2015	9	119	(b)
2016	8	127	(b)

a. (NRC 2016a, Table 2.29)
b. Source is not a public document.

Table 3.7-14
State-Listed Species in Miami-Dade County (Sheet 1 of 5)

Common Name	Scientific Name	State Status
Plants and Lichens		
Golden leather fern	*Acrostichum aureum*	T
Fragrant maidenhair fern	*Adiantum melanoleucum*	E
Brittle maidenhair fern	*Adiantum tenerum*	E
Meadow jointvetch	*Aeschynomene pratensis*	E
Bracted colic-root	*Aletris bracteata*	E
Everglades leaf lace	*Alvaradoa amorphoides*	E
Wright's anemia	*Anemia wrightii*	E
Sea lavender	*Argusia gnaphalodes*	E
Marsh's Dutchman's pipe	*Aristolochia pentandra*	E
American toothed spleenwort	*Asplenium dentatum*	E
American bird's nest fern	*Asplenium serratum*	E
Modest spleenwort	*Asplenium verecundum*	E
Rockland orchid	*Basiphyllaea corallicola*	E
Costa rican ladies'-tresses	*Beloglottis costaricensis*	E
Smooth strongbark	*Bourreria cassinifolia*	E
Locustberry	*Byrsonima lucida*	T
Myrtle-of-the-river	*Calyptranthes zuzygium*	E
Powdery catopsis	*Catopsis berteroniana*	E
Many-flowered catopsis	*Catopsis floribunda*	E
Porter's broad-leaved spurge	*Chamaesyce porteriana*	E
Cuban snake-bark	*Colubrina cubensis var. floridana*	E
Christmas berry	*Crossopetalum ilicifolium*	T
Rhacoma	*Crossopetalum rhacoma*	T
Florida tree fern	*Ctenitis sloanei*	E
Tall neottia	*Cyclopogon elatus*	E
Cowhorn orchid	*Cyrtopodium punctatum*	E

Table 3.7-14
State-Listed Species in Miami-Dade County (Sheet 2 of 5)

Common Name	Scientific Name	State Status
Milkbark	*Drypetes diversifolia*	E
Spurred neottia	*Eltroplectris calcarata*	E
Dollar orchid	*Encyclia boothiana var. erythronioides*	E
Clamshell orchid	*Encyclia cochleata var. triandra*	E
Epidendrum nocturnum	*Night-scented Orchid*	E
Ernodea cokeri	*Coker's Beach Creeper*	E
Eugenia confusa	*Tropical Ironwood*	E
Eugenia rhombea	*Red Stopper*	E
Eupatorium villosum	*Villose Fennel*	E
Rockland painted-leaf	*Euphorbia pinetorum*	E
Two-keeled helmet orchid	*Galeandra bicarinata*	E
Coastal vervain	*Glandularia maritima*	E
Sheathing govenia	*Govenia floridana*	E
Lignum-vitae	*Guaiacum sanctum*	E
Fakahatchee guzmania	*Guzmania monostachia*	E
Simpson's prickly apple	*Harrisia simpsonii*	E
Manchineel	*Hippomane mancinella*	E
White ironwood	*Hypelate trifoliata*	E
Krug's holly	*Ilex krugiana*	T
Wild potato morning glory	*Ipomoea microdactyla*	E
Rocklands morning glory	*Ipomoea tenuissima*	E
Pineland jacquemontia	*Jacquemontia curtissii*	T
Skyblue clustervine	*Jacquemontia pentanthos*	E
Small-headed lantana	*Lantana canescens*	E
Florida lantana	*Lantana depressa var. depressa*	E
Atlantic coast Florida lantana	*Lantana depressa var. floridana*	E
Ghost plant	*Leiphaimos parasitica*	E

Table 3.7-14
State-Listed Species in Miami-Dade County (Sheet 3 of 5)

Common Name	Scientific Name	State Status
Gulf licaria	*Licaria triandra*	E
Small's flax	*Linum carteri var. smallii*	E
Holly vine fern	*Lomariopsis kunzeana*	E
Climbing vine fern	*Microgramma heterophylla*	E
Wedgelet fern	*Odontosoria clavata*	E
Burrowing four-o'clock	*Okenia hypogaea*	E
Florida dancinglady orchid	*Oncidium floridanum*	E
Hand fern	*Ophioglossum palmatum*	E
White passionflower	*Passiflora multiflora*	E
Everglades Key passion-flower	*Passiflora sexflora*	E
Mangrove mallow	*Pavonia paludicola*	E
Blunt-leaved peperomia	*Peperomia obtusifolia*	E
Mahogany mistletoe	*Phoradendron rubrum*	E
Bitter bush	*Picramnia pentandra*	E
Ghost orchid	*Polyrrhiza lindenii*	E
Small-flowered prescotia	*Prescotia oligantha*	E
West Indian cherry	*Prunus myrtifolia*	T
Florida cherry-palm	*Pseudophoenix sargentii*	E
Mangrove berry	*Psidium longipes*	T
Bahama wild coffee	*Psychotria ligustrifolia*	E
Bahama brake	*Pteris bahamensis*	T
Giant orchid	*Pteroglossaspis ecristata*	T
Florida royal palm	*Roystonea elata*	E
Bahama sachsia	*Sachsia polycephala*	T
Fahkahatchee ladies'-tresses	*Sacoila lanceolata var. paludicola*	T
Yellowwood	*Schaefferia frutescens*	E
Ray fern	*Schizaea pennula*	E

Table 3.7-14
State-Listed Species in Miami-Dade County (Sheet 4 of 5)

Common Name	Scientific Name	State Status
Havana skullcap	*Scutellaria havanensis*	E
Eaton's spike moss	*Selaginella eatonii*	E
Green ladies'-tresses	*Spiranthes polyantha*	E
Southern ladies'-tresses	*Spiranthes torta*	E
Pineland pencil flower	*Stylosanthes calcicola*	E
West Indies mahogany	*Swietenia mahagoni*	T
Least halberd fern	*Tectaria fimbriata*	E
Rockland hoary-pea	*Tephrosia angustissima var. corallicola*	E
Coastal hoary-pea	*Tephrosia angustissima var. curtissii*	E
Creeping maiden fern	*Thelypteris reptans*	E
Stiff-leaved maiden fern	*Thelypteris sclerophylla*	E
Toothed maiden fern	*Thelypteris serrata*	E
Florida thatch palm	*Thrinax radiata*	E
Banded wild-pine	*Tillandsia flexuosa*	T
Pineland noseburn	*Tragia saxicola*	T
Lamarck's trema	*Trema lamarckianum*	E
Kraus' bristle fern	*Trichomanes krausii*	E
Florida gama grass	*Tripsacum floridanum*	T
Young-palm orchid	*Tropidia polystachya*	E
Worm-vine orchid	*Vanilla barbellata*	E
Leafy vanilla	*Vanilla phaeantha*	E
Mucha-gente	*Xylosma buxifolia*	E
Biscayne prickly ash	*Zanthoxylum coriaceum*	E
Redmargin zephyrlily	*Zephyranthes simpsonii*	T
Reptiles		
Pine snake	*Pituophis melanoleucus*	ST
Rim rock crowned snake	*Tantilla oolitica*	ST

Table 3.7-14
State-Listed Species in Miami-Dade County (Sheet 5 of 5)

Common Name	Scientific Name	State Status
Birds		
Florida burrowing owl	*Athene cunicularia floridana*	ST
Little blue heron	*Egretta caerulea*	ST
Reddish egret	*Egretta rufescens*	ST
Tricolored heron	*Egretta tricolor*	ST
Southeastern American kestrel	*Falco sparverius paulus*	ST
Florida sandhill crane	*Grus canadensis pratensis*	ST
American oystercatcher	*Haematopus palliatus*	ST
White-crowned pigeon	*Patagioenas leucocephala*	ST
Roseate spoonbill	*Platalea ajaja*	ST
Black skimmer	*Rynchops niger*	ST
Least tern	*Sternula antillarum*	ST
Mammals		
Southern Mink, southern Florida pop.	*Neovison vison pop. 1*	ST

(FNAI 2017b)

E = Endangered: species of plants native to Florida that are in imminent danger of extinction within the state
T = Threatened: species native to the state that are in rapid decline in the number of plants within the state, but which have not so decreased in number as to cause them to be Endangered
ST = State population listed as Threatened by the FFWCC

Table 3.7-15
State-Listed Plants and Lichens and Associated Habitat in Miami-Dade County (Sheet 1 of 7)

Scientific Name	Common Name	State Status	Habitat
Acrostichum aureum	Golden leather fern	T	Brackish and freshwater marshes
Adiantum melanoleucum	Fragrant maidenhair fern	E	Sides of limestone sinks
Adiantum tenerum	Brittle maidenhair fern	E	Moist limestone in rockland hammocks
Aeschynomene pratensis	Meadow jointvetch	E	Marl prairie; cypress domes; swales
Aletris bracteata	Bracted colic-root	E	Marl prairie; pine rockland
Alvaradoa amorphoides	Everglades leaf lace	E	Pine rocklands and transition zones with rockland hammocks
Anemia wrightii	Wright's anemia	E	Limestone pinnacles; walls of solution holes; pine rockland; rockland hammocks
Argusia gnaphalodes	Sea lavender	E	Beach dunes; coastal thickets
Aristolochia pentandra	Marsh's Dutchman's pipe	E	Rockland hammock
Asplenium dentatum	American toothed spleenwort	E	Tropical hardwood hammocks; limestone outcrops; walls of limesinks
Asplenium serratum	American bird's nest fern	E	Cypress swamps; tropical rockland hammocks
Asplenium verecundum	Modest spleenwort	E	Rockland hammock; limestone outcrops, grottoes, and sinkholes
Basiphyllaea corallicola	Rockland orchid	E	Pine rocklands and rockland hammock
Beloglottis costaricensis	Costa Rican ladies'-tresses	E	Rockland hammock
Bourreria cassinifolia	Smooth strongbark	E	Pine rocklands
Byrsonima lucida	Locustberry	T	Pine rocklands and rockland hammock
Calyptranthes zuzygium	Myrtle-of-the-river	E	Rockland hammocks; coastal berm

Table 3.7-15
State-Listed Plants and Lichens and Associated Habitat in Miami-Dade County (Sheet 2 of 7)

Scientific Name	Common Name	State Status	Habitat
Catopsis berteroniana	Powdery catopsis	E	Tropical hammocks; cypress swamps
Catopsis floribunda	Many-flowered catopsis	E	Tropical hammocks; cypress swamps
Chamaesyce porteriana	Porter's broad-leaved spurge	E	Pine rocklands, rockland hammock, coastal rock barrens, marl prairie
Colubrina cubensis var. floridana	Cuban snake-bark	E	Rockland hammocks and pine rocklands
Crossopetalum ilicifolium	Christmas berry	T	Marl prairie, pine rockland, rockland hammock
Crossopetalum rhacoma	Rhacoma	T	Coastal berm, coastal strand, pine rockland, rockland hammock
Ctenitis sloanei	Florida tree fern	E	Rockland hammocks and strand swamp
Cyclopogon elatus	Tall neottia	E	Rockland hammocks
Cyrtopodium punctatum	Cowhorn orchid	E	Cypress swamps, coastal hammocks, occasionally pinerocks and marl prairies
Drypetes diversifolia	Milkbark	E	Rockland hammocks
Eltroplectris calcarata	Spurred neottia	E	Mesic hammock, rockland hammock
Encyclia boothiana var. erythronioides	Dollar orchid	E	Disturbed upland, rockland hammock, tidal swamp
Encyclia cochleata var. triandra	Clamshell orchid	E	Trunks and branches of pond apple, cypress, live oak, and buttonwood trees in swamps and hammocks
Epidendrum nocturnum	Night-scented orchid	E	Tree trunks, branches, and stumps in hammocks, swamps, and sloughs
Ernodea cokeri	Coker's beach creeper	E	Pine rocklands

Table 3.7-15
State-Listed Plants and Lichens and Associated Habitat in Miami-Dade County (Sheet 3 of 7)

Scientific Name	Common Name	State Status	Habitat
Eugenia confusa	Tropical ironwood	E	Rockland hammocks
Eugenia rhombea	Red stopper	E	Rockland hammocks
Eupatorium villosum	Villose fennel	E	Pine rocklands, rockland hammocks
Euphorbia pinetorum	Rockland painted-leaf	E	Pine rocklands
Galeandra bicarinata	Two-keeled helmet orchid	E	Hammocks
Glandularia maritima	Coastal vervain	E	Back dunes, dune swales, coastal hammocks; disturbed, sandy areas
Govenia floridana	Sheathing govenia	E	Rockland hammocks
Guaiacum sanctum	Lignum-vitae	E	Rockland hammocks
Guzmania monostachia	Fakahatchee guzmania	E	Swamps and wet hammocks
Harrisia simpsonii	Simpson's prickly apple	E	Scrubby flatwoods and xeric hammocks on the Atlantic Coastal Ridge
Hippomane mancinella	Manchineel	E	Coastal berms and hammocks in brackish areas just inland of the mangrove zone
Hypelate trifoliata	White ironwood	E	Rockland hammocks
Ilex krugiana	Krug's holly	T	Pine rockland, rockland hammock
Ipomoea microdactyla	Wild potato morning glory	E	Pine rocklands
Ipomoea tenuissima	Rocklands morning glory	E	Pine rocklands
Jacquemontia curtissii	Pineland jacquemontia	T	Disturbed upland, marl prairie, mesic flatwoods, pine rockland

Table 3.7-15
State-Listed Plants and Lichens and Associated Habitat in Miami-Dade County (Sheet 4 of 7)

Scientific Name	Common Name	State Status	Habitat
Jacquemontia pentanthos	Skyblue clustervine	E	Bayhead, coastal rock barren, disturbed upland, marl prairie, pine rockland, rockland hammock
Lantana canescens	Small-headed lantana	E	Transition zones between rockland hammock and pine rockland
Lantana depressa var. depressa	Florida lantana	E	Pine rocklands
Lantana depressa var. floridana	Atlantic coast Florida lantana	E	Stabilized dunes of the Atlantic Coast barrier islands and relictual dunes of central Florida
Leiphaimos parasitica	Ghost plant	E	Rockland hammocks, sinkholes
Licaria triandra	Gulf licaria	E	Rockland hammocks
Linum carteri var. smallii	Small's flax	E	Pine rocklands, pine flatwoods, adjacent disturbed areas
Lomariopsis kunzeana	Holly vine fern	E	Rockland hammocks, sinkholes
Microgramma heterophylla	Climbing vine fern	E	Rockland hammocks
Odontosoria clavata	Wedgelet fern	E	Pine rocklands, sinkholes, limestone ledges, rocky glades
Okenia hypogaea	Burrowing four-o'clock	E	Beach dune, disturbed upland
Oncidium floridanum	Florida dancing lady orchid	E	Rockland hammocks, cypress swamps
Ophioglossum palmatum	Hand fern	E	"Boots," or old leaf bases, of cabbage palms in maritime hammocks and wet hammocks
Passiflora multiflora	White passionflower	E	Tropical hammocks
Passiflora sexflora	Everglades Key passion flower	E	Tropical hammocks
Pavonia paludicola	Mangrove mallow	E	Disturbed wetland, tidal marsh, tidal swamp

Table 3.7-15
State-Listed Plants and Lichens and Associated Habitat in Miami-Dade County (Sheet 5 of 7)

Scientific Name	Common Name	State Status	Habitat
Peperomia obtusifolia	Blunt-leaved peperomia	E	Rockland hammocks, hydric hammocks, strand swamps
Phoradendron rubrum	Mahogany mistletoe	E	Rockland hammock
Picramnia pentandra	Bitter bush	E	Rockland hammocks
Polyrrhiza lindenii	Ghost orchid	E	Dense, wet subtropical to tropical forests and hammocks
Prescotia oligantha	Small-flowered prescotia	E	Rockland hammock
Prunus myrtifolia	West Indian cherry	T	Rockland hammock
Pseudophoenix sargentii	Florida cherry-palm	E	Coastal berm, rockland hammock
Psidium longipes	Mangrove berry	T	Pine rockland, rockland hammocks
Psychotria ligustrifolia	Bahama wild coffee	E	Rockland hammock
Pteris bahamensis	Bahama brake	T	Disturbed upland, marl prairie, pine rockland, rockland hammock
Pteroglossaspis ecristata	Giant orchid	T	Sandhill, scrub, pine flatwoods, pine rocklands
Roystonea elata	Florida royal palm	E	Tropical hardwood hammocks, rockland hammocks, strand swamp and disturbed wetlands
Sachsia polycephala	Bahama sachsia	T	Disturbed upland, pine rockland
Sacoila lanceolata var. paludicola	Fahkahatchee ladies'-tresses	T	Swamps and hydric hammocks
Schaefferia frutescens	Yellowwood	E	Rockland hammock
Schizaea pennula	Ray fern	E	Bayhead, floodplain forest, mesic flatwoods, rockland hammock
Scutellaria havanensis	Havana skullcap	E	Disturbed upland, pine rockland
Selaginella eatonii	Eaton's spike moss	E	Rockland hammocks and pine rocklands

Table 3.7-15
State-Listed Plants and Lichens and Associated Habitat in Miami-Dade County (Sheet 6 of 7)

Scientific Name	Common Name	State Status	Habitat
Spiranthes polyantha	Green ladies’-tresses	E	Rock outcrops in mesic hammock, rockland hammock, maritime hammock
Spiranthes torta	Southern ladies’-tresses	E	Pine rockland, marl prairie, edges of rockland hammock
Stylosanthes calcicola	Pineland pencil flower	E	Pine rocklands and marl prairies, especially the transition zones between these two communities
Swietenia mahagoni	West Indies mahogany	T	Between pine rockland and marl prairie communities
Tectaria fimbriata	Least halberd fern	E	Solution holes in limestone in rockland hammocks
Tephrosia angustissima var. corallicola	Rockland hoary-pea	E	Pine rocklands
Tephrosia angustissima var. curtissii	Coastal hoary-pea	E	Scrub and sandy areas
Thelypteris reptans	Creeping maiden fern	E	Limestone grottoes and sinkholes
Thelypteris sclerophylla	Stiff-leaved maiden fern	E	Rockland hammock and sinkholes
Thelypteris serrata	Toothed maiden fern	E	Cypress swamps, sloughs, floodplains
Thrinax radiata	Florida thatch palm	E	Coastal berm, rockland hammock, pine rockland
Tillandsia flexuosa	Banded wild pine	T	17 habitats: coastal berm, coastal grassland, coastal rock barren, disturbed upland, dome swamp, freshwater tidal swamp, maritime hammock, marl prairie, pine rockland, rockland hammock, sandhill, scrub, shell mound, strand swamp, tidal marsh, tidal swamp, xeric hammock
Tragia saxicola	Pineland noseburn	T	Disturbed upland, pine rockland
Trema lamarckianum	Lamarck’s trema	E	Disturbed upland, pine rockland, marl prairie, rockland hammock

Table 3.7-15
State-Listed Plants and Lichens and Associated Habitat in Miami-Dade County (Sheet 7 of 7)

Scientific Name	Common Name	State Status	Habitat
Trichomanes krausii	Kraus' bristle fern	E	Buttressed roots and tree bases in rockland hammocks
Tripsacum floridanum	Florida gama grass	T	Pine rockland, marl prairie
Tropidia polystachya	Young-palm orchid	E	Rockland hammock
Vanilla barbellata	Worm-vine orchid	E	Mangroves, coastal hammocks, rocky pinelands, island hammocks in the Everglades
Vanilla phaeantha	Leafy vanilla	E	Island hammocks in the Everglades
Xylosma buxifolia	Mucha-gente	E	Pine rockland[a]
Zanthoxylum coriaceum	Biscayne prickly ash	E	Tropical coastal hammocks
Zephyranthes simpsonii	Redmargin zephyrlily	T	Disturbed upland, disturbed wetland, mesic flatwoods, swale, wet flatwoods

(NRC 2016a, Table 2-14)

a. (Sadle 2010)

E = Endangered: species of plants native to Florida that are in imminent danger of extinction within the state
T = Threatened: species native to the state that are in rapid decline in the number of plants within the state, but which have not so decreased in number as to cause them to be Endangered

Table 3.7-16
Designated Essential Fish Habitat Likely to Occur near the Turkey Point Site

Common Name	Scientific Name	Applicable Fishery Management Plan	Mangrove	Seagrass and Unconsolidated Bottom
Gray snapper	*Lutjanus griseus*	Snapper-Grouper	X	X
Dog snapper	*L. jocu*	Snapper-Grouper	X	
Mutton snapper	*L. analis*	Snapper-Grouper		X
Bluestriped grunt	*Haemulon sciurus*	Snapper-Grouper	X	
White grunt	*H. plumieri*	Snapper-Grouper		X
Spiny lobster	*Panulirus argus*	Spiny Lobster	X	X
Pink shrimp	*Farfantepenaeus duorarum*	Shrimp Fishery	X	X

(NRC 2016a, Table 2-31)

Note: Biscayne Bay and Biscayne National Park are also EFH-HAPC for coral, coral reefs, and hard-bottom communities

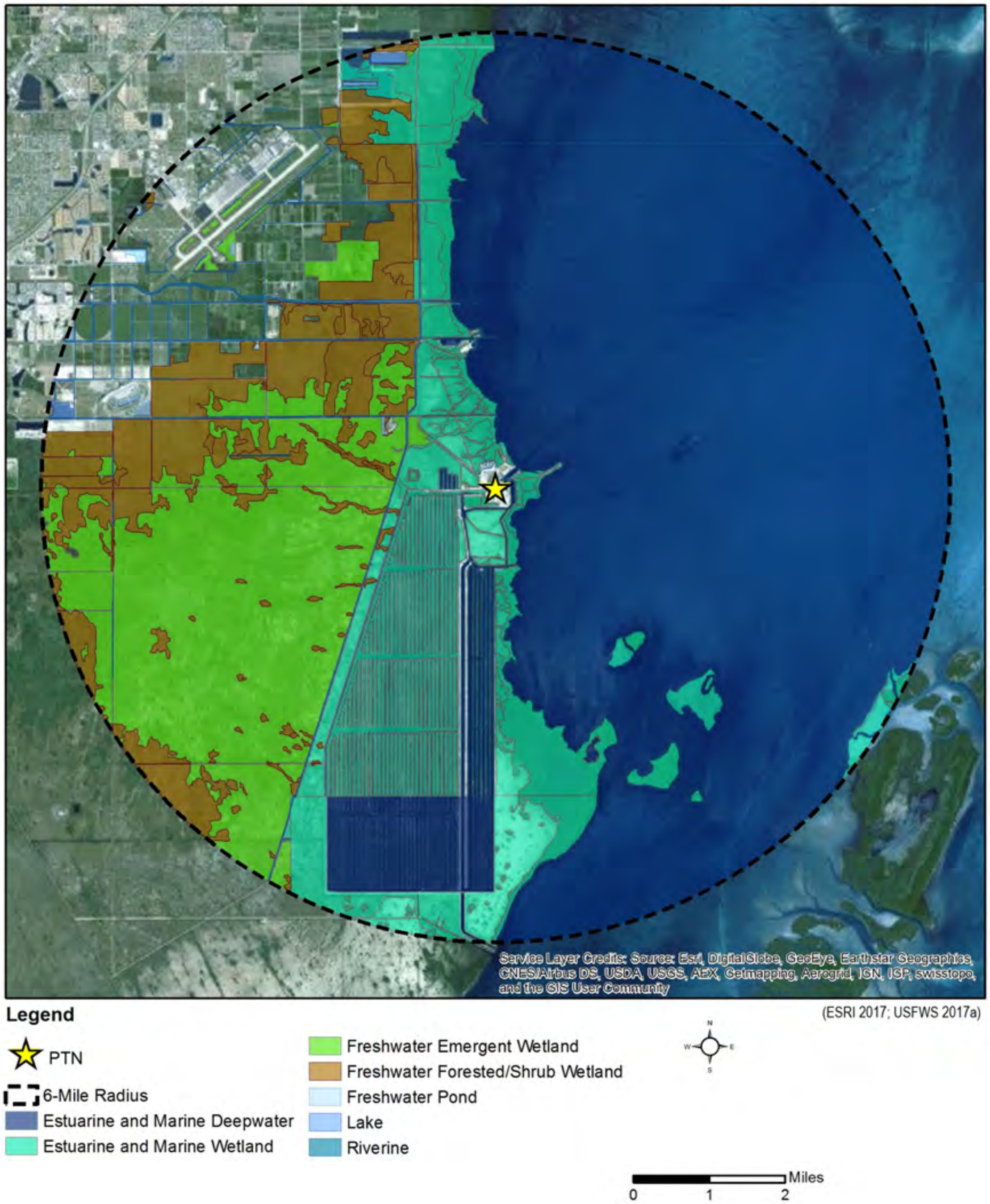

Figure 3.7-1
NWI Wetlands, 6-Mile Radius of PTN

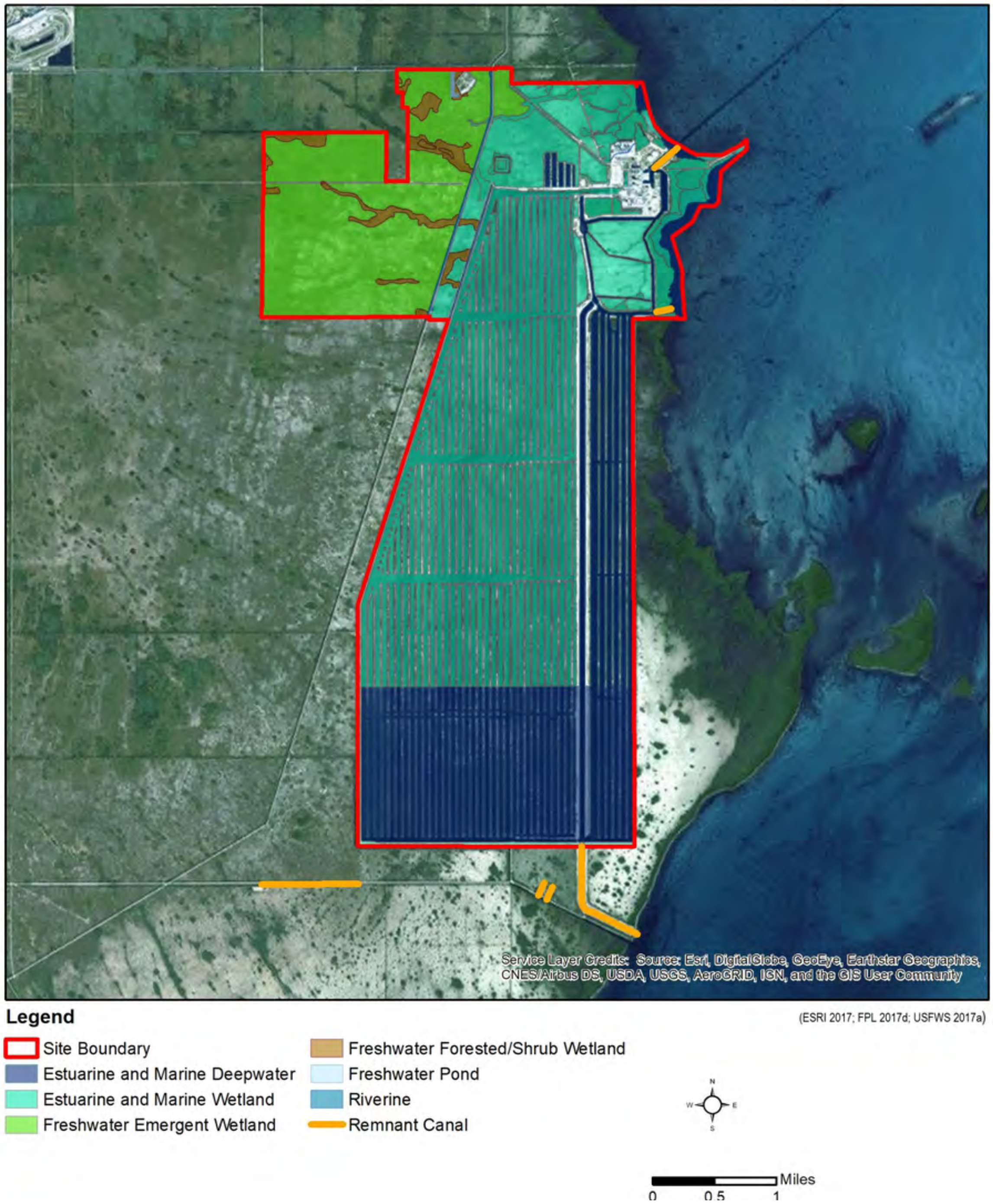

Figure 3.7-2
NWI Wetlands, Turkey Point Property

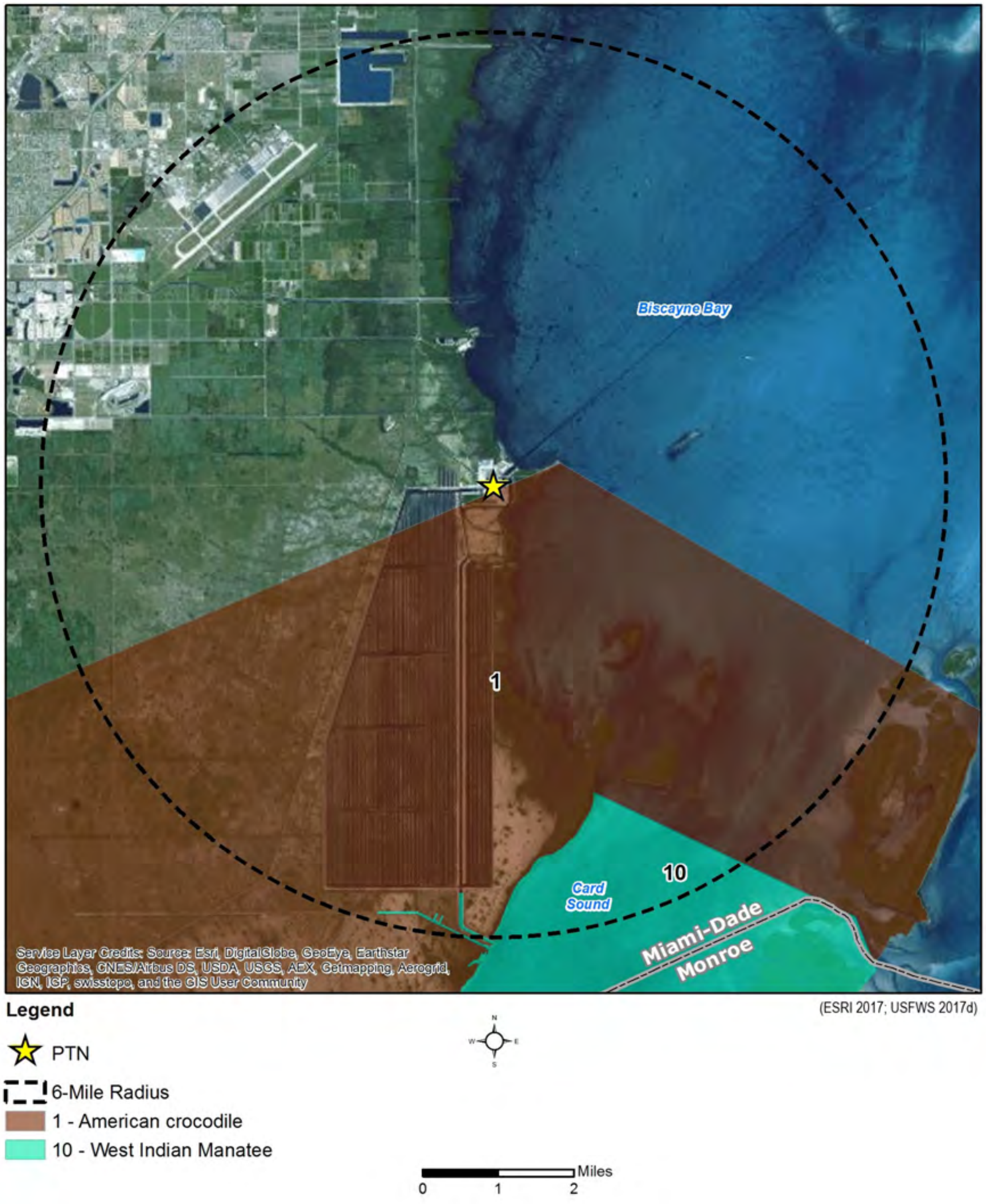

Figure 3.7-3
Critical Habitat, 6-Mile Radius of PTN

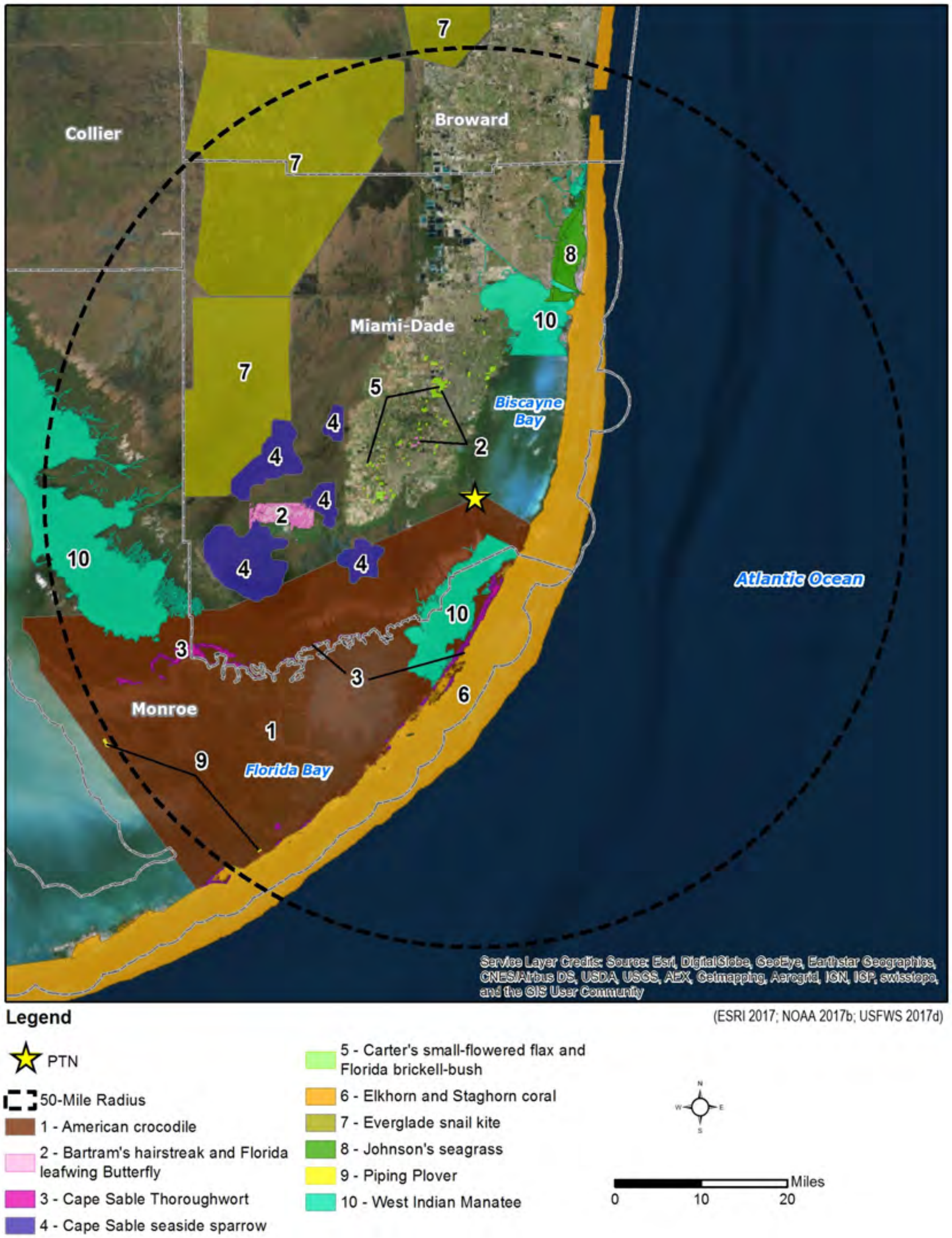

Figure 3.7-4
Critical Habitat, 50-Mile Radius of PTN

3.8 Historic and Cultural Resources

Cultural resources include prehistoric era and historic era archaeological sites and objects, architectural properties and districts, and traditional cultural properties, which are defined as significant objects or places important to Native American tribes for maintaining their culture (NPS 1998). Of particular concern are those cultural resources that may be considered eligible for listing on the NRHP. Any cultural resources listed on or eligible for the NRHP are considered historic properties under the National Historic Preservation Act (NHPA) [16 USC 470].

Prior to taking any action to implement an undertaking, Section 106 of the NHPA requires the NRC as a federal agency to do the following:

- Take into account the effects of an undertaking (including issuance of a license) on historic properties, including any district, site, building, structure, or object included in or eligible for inclusion in the NRHP.
- Afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on such undertaking.

To provide early consultation for the Section 106 process, FPL contacted the Florida Division of Historic Resources (DHR) for informal consultation concerning PTN SLR and potential effects on cultural resources within the approximately 9,460-acre facility and on historic properties within a 6-mile radius of PTN (Attachment C). Native American groups recognized as potential stakeholders were also consulted by FPL with the opportunity for comment (Attachment C).

Previous cultural resources investigation reports, archaeological site forms, and historic structure records on file with the DHR are summarized below:

- Florida Master Site File (FMSF) GIS application, which was accessed multiple times for cultural resources site data from May 17, 2017, through June 19, 2017 (FMFS 2017).
- USGS Map Locator webpage, which was accessed on May 30, 2017 (USGS 2017f).
- "Exploring Florida Maps" webpage produced by the Florida Center for Instructional Technology, which was accessed from May 17, 2017, through June 18, 2017 (FCIT 2017).

All of these data sets were used to inform an archaeological sensitivity analysis of the FPL Turkey Point property and to identify all known NRHP-listed sites within a 6-mile radius of PTN. The approximately 9,460-acre FPL Turkey Point property consists primarily of forest, grassland, wetlands, and developed areas. The land within a 6-mile radius is primarily hypersaline mudflats, dwarf mangrove wetlands, open water, and developed areas.

Although construction of the existing Turkey Point facility itself may have impacted any archaeological resources that may have been located within its footprint, some of the surrounding area remains largely undisturbed. No archaeological sites have been recorded in the 9,640-acre Turkey Point property, but the entire facility has not been subjected to archaeological survey. Janus Research, Inc. (JRI) conducted a cultural resources survey and prepared a cultural resource report for part of the 9,640 acres. This investigation included background research, pedestrian survey, and shovel testing to assess the likelihood for archaeological deposits throughout the property. The background research determined the general area to have low potential for archaeological research and no potential for historic standing structures. (JRI 2009)

A literature review conducted for previously recorded archaeological sites included the Turkey Point area of potential effect (APE) and an area within a 6-mile radius. The purpose of the literature review was to help develop an understanding of the local context by conducting an inventory of all previously recorded archaeological sites on the 9,640-acre Turkey Point property and within a 6-mile radius of PTN. No archaeological sites have been recorded on the Turkey Point site, and the facility is located within an area of low Prehistoric and Historic Period site density.

The results of the review show that there are 95 archaeological and architectural resources that have been previously recorded within a 6-mile radius of PTN. There are 93 archaeological and architectural resources found within a 6-mile radius of PTN that have not been evaluated for NRHP listing or are considered not NRHP eligible (Table 3.8-1). Two cultural resource sites have been determined to be NRHP eligible (Table 3.8-2). There are no NRHP-listed resources within a 6-mile radius of PTN. Of the 95 cultural resources, five are bridges associated with early canals, 27 are standing structures associated with the Homestead Air Force Base, and 63 are located offshore and include shipwrecks, an airplane crash site, and underwater marine cultural features and artifacts. No traditional cultural properties have been suggested to date by research or by potentially interested parties for any property within a 6-mile radius of PTN.

Past tribal consultation was conducted as part of the 2016 EIS for the COL associated with Units 6 and 7, the NRC consulted with the Muscogee (Creek) Nation of Florida, the Seminole Tribe of Florida, the Poarch Band of Creek Indians, and the Seminole Nation Oklahoma. The letters sent on June 24, 2010 provided the recipients the opportunity to identify concerns and provide advice on the evaluation of historic properties (NRC 2016a). The NRC conducted follow-up calls on July 29, 2010. The Muscogee (Creek) Nation of Florida, the Poarch Band of Creek Indians, and the Seminole Nation Oklahoma did not express interest in the project. The Seminole Tribe of Florida was consulted regarding to the transmission line project.

3.8.1 Land Use History

The land use history for Turkey Point and the surrounding region was developed as part of a Phase 1A literature review and archaeological sensitivity assessment of the FPL Turkey Point property and is summarized here. Section 3.8.2 provides a more detailed discussion of historical land use as part of the cultural history. Early maps provide information on how the area was used in the past. An 1874 map from the General Land Office does not show any cultural features within the vicinity of the Turkey Point site (Figure 3.8-1). The 1949 and 1950 USGS topographical maps (the maps from both years are identical) show two canals which run west to east in the center of Sections 17 and 21, but no other cultural features within the APE (Figure 3.8-2). The USGS map from 1956 similarly only shows the two canals (Figure 3.8-3). The USGS map from 1982 depicts the power plant, substation, and the CCS (Figure 3.8-4). The 1988 USGS map has greater detail of PTN with over 20 structures, additional roads, bridges, electrical transmission lines, and storage facilities (Figure 3.1-2).

The FPL Turkey Point property and the surrounding region hold evidence of both prehistoric and historic occupation by Native Americans and Euro-Americans. Archaeological records suggest that the FPL Turkey Point property and the surrounding area were potentially occupied by Native American populations for the Paleoindian Period (prior to 7500 BC), the Archaic Period (ca. 7500 BC to 500 BC), and the Formative Period (ca. 500 BC to AD 1513).

The HUD tribal directory assessment tool was developed by the Office of Environment and Energy to identify tribes that have an interest in locations nationwide and provides tribal contact information to assist with initiating Section 106 consultation under the NHPA. Six federally recognized tribes (Miccosukee Tribe of Indians, Poarch Band of Creeks, Seminole Tribe of Florida, the Choctaw Nation of Oklahoma, the Muscogee (Creek) Nation, and the Seminole Nation of Oklahoma) have interest in cultural resources identified in Miami-Dade County, Florida (HUD 2017) (FDOT 2017a). The six tribes were consulted for this undertaking in keeping with Section 106 of the NHPA.

3.8.2 Cultural History

3.8.2.1 Paleoindian Period (Prior to 7500 BC)

The prevailing view of Paleoindian culture is that of a nomadic hunting and gathering existence, in which now-extinct Pleistocene megafauna were exploited. Settlement patterns were restricted by availability of fresh water and access to high-quality stone from which the specialized Paleoindian tool assemblages were made. Most sites of this time period are found near karst sinkholes or spring caverns. The majority of Paleoindian sites in Florida consist of surface finds.

The most widely recognized Paleoindian tool in Florida is the Suwannee point, typically found along the springs and rivers of northern Florida. Other points, including Simpson and Clovis points, are found in lesser numbers. Some of these, and other Paleoindian lanceolate points, were hafted by attaching them to an ivory shaft that was, in turn, attached to a wooden spear shaft. Other tools include bifacial and "hump-backed" unifacial scrapers, blade tools, and retouched flakes. (JRI 2009)

3.8.2.2 Archaic (7500 to 500 BC)

The Archaic Period began in Florida around 7500 BC and is divided into the Early Archaic (7500–5000 BC), the Middle Archaic (5000–3000 BC), and the Late Archaic (3000–500 BC). The Late Archaic is further subdivided into the Preceramic Late Archaic (3000–2000 BC) and the Orange Period (2000–500 BC).

Early Archaic peoples transitioned from the nomadic Paleoindian subsistence pattern to a more sedentary coastal- and riverine-based subsistence strategies. Sites with Early Archaic components are typically located near natural springs and the extensive perched water sources of northern Florida. Early Archaic points are found in smaller numbers at upland sites in northern Florida where there is a lack of Paleoindian materials. (JRI 2009)

The Middle Archaic period is characterized by increasing population and a gradual subsistence shift toward shellfish, fish, and other freshwater and coastal wetlands food resources. Middle Archaic sites general consist of small special-use camps, large base camps, and quarries which are found in a variety of locations, including the freshwater shell middens along the St. Johns River and the Atlantic Lagoon and throughout the forests of the interior of northern Florida. The Middle Archaic artifact assemblage is characterized by stemmed, broad-blade projectile points including the Newnan, Alachua, Levy, Marion, and Putnam projectile points. (JRI 2009)

The subsistence strategy in the Late Archaic suggests more dependence on wetland and marine food resource. By the Late Archaic Period, a regionalization of cultures is apparent in the archaeological record and is associated with adaptations to specific environmental zones.

By about 2000 BC, pottery appears in the archaeological record, marking the beginning of the Orange Period. The earliest ceramics in Florida were tempered with plant fibers, while surface decoration is found around 1650 BC, providing a tool for differentiating sites dating to the second half of the Late Archaic. (JRI 2009)

3.8.2.3 Formative Period (500 BC to AD 1513)

In the Formative Period significant changes occurred in pottery and technology throughout Florida. Specifically, pottery changed with the replacement of fiber-tempered pottery with sand-tempered, limestone-tempered, and chalky-paste ceramics. Basally-notched, corner-notched, and stemmed projectile point styles occur contemporaneously with the new ceramic types. The earliest known major occupations of southern Florida date to this period. (JRI 2009)

The regional diversity that marked this period has been primarily attributed to local adaptation to varied ecological conditions within the state. Traditionally, this diversity has been described archaeologically in terms of cultural periods based on variations in ceramic types. The ceramic tradition for southern Florida, characterized by sand-tempered bowls with incurvate rims, is known as the Glades or Everglades cultural tradition.

3.8.2.4 European Contact and Colonial Period (ca. 1513–1821)

Juan Ponce de Leon is credited as the first European to the area with his voyage in 1513 along the eastern coast of the peninsula (JRI 2009). Over the next 50 years, the Spanish government and private individuals financed expeditions in hopes of establishing a colony in Florida. Jesuit missions were established in the Central Peninsular Gulf Coast and Glades archaeological regions, including the mission of Carlos at Charlotte Harbor, the mission of Tocobaga at Tampa Bay, and a mission at a Tequesta village at the mouth of the Miami River. By 1572, native groups in Florida were still resistant to Christian conversion, and Jesuit authorities decided to abandon their missionary efforts in Florida. The failure of the missions may have been due to the seasonal movement of native groups associated with resource exploitation. (JRI 2009)

The Franciscan mission effort began in the 1570s and was focused in northern areas of Florida. Consequently, the region of the Turkey Point site was relatively disregarded as the Spanish concentrated their efforts in the northern half of the peninsula. By the beginning of the 18th century, the Native American population of southern Florida had declined considerably as a result of disease, slave raids and intertribal warfare. Many survivors integrated into the Seminoles, descendants of Creek Indians who moved into Florida during the early 18th century to escape the political and population pressures of the expanding American colonies to the north. (JRI 2009)

By the end of the 18th century, the Seminoles had become the dominant Native American group in the state. Groups of fugitive African-American slaves had also settled among the Seminoles by the early 19th century. Armed conflict with pioneers, homesteaders, and eventually the U.S. Army resulted in the removal of many Seminoles from Florida. This action forced the withdrawal of the remaining Seminole population to the harsh environments of the Everglades and Big Cypress Swamp by the late 19th century. (JRI 2009)

3.8.2.5 Territorial and Statehood Period (1821–1860)

The United States acquired Florida from Spain in 1821. The population of the territory was centered in the north around Pensacola, St. Augustine, and Tallahassee. As more European-American settlers moved into the region, conflicts arose with the Seminole over available land. Pressure was brought to bear upon the government to remove the Seminoles from northern Florida and relocate them farther south. The Treaty of Moultrie Creek (1823) restricted the Seminole people to approximately 4 million acres of land in the middle of the state, running south from Micanopy to just north of the Peace River. The treaty was unpopular with the Seminoles, as they were reluctant to move from their established homes to an area that they felt could not be cultivated. Equally unpopular were the later treaties of Paynes Landing (1832) and Fort Gibson (1833), which called for Seminole emigration to the western territories. The three treaties helped foster Seminole resentment of settlers and outbreaks of hostility that culminated in the Second Seminole War in 1835. (JRI 2009)

The Second Seminole War was initially centered near the Withlacoochee region. In 1838, U.S. troops moved south to pursue the retreating Seminoles into the Lake Okeechobee and Everglades regions. Colonel Zachary Taylor was sent to the area between the Kissimmee River and Peace Creek. Colonel Persifor Smith and his volunteers were dispatched to the Caloosahatchee River, and U.S. Navy Lt. Levi N. Powell was assigned the task of penetrating the Everglades. Powell's detachment had several skirmishes with Seminole people near Jupiter Inlet. Powell established a depot on the Miami River and erected Fort Dallas in the approximate location of present-day downtown Miami. For 3 months, Fort Dallas was a base of operations as Powell led his men into the Everglades in search of the Seminoles. The Armed Occupation Act of 1842 offered settlers 160 acres of land at no cost, provided they built a house, cleared 5 acres, planted crops, and resided on the land for 5 years. Any head of a family or single man over 18 years of age and able to bear arms was eligible to receive a homestead. This act, plus the end of the Second Seminole War, created a small wave of immigration by Anglo-American pioneers to central Florida. (JRI 2009)

3.8.2.6 Civil War and Post-Civil War Period (1860–1898)

The Civil War disrupted most development in Florida, but in general the state did not have regular battles. Florida contributed 15,000 troops and supplies to the Confederate Army. Florida cattlemen became an important supplier of beef to the Confederate Army, and Florida supplied salt for tanning and meat preservation. Union forces established control of the Florida coastline in 1863. Florida suffered economic devastation due to the Civil War, including railroad lines being destroyed or falling into disrepair, and the cotton and agricultural industries declined. (JRI 2009)

The post-Reconstruction era resulted in economic growth, prosperity, and population expansion for Florida. Transportation routes, primarily through the railroad's expansion along both coasts, encouraged the state's overall development. Agricultural products were easily shipped to out-of-state markets and building materials were shipped into the state. The development encouraged the beginning of Florida's tourist industry.

3.8.2.7 Spanish-American War/Turn of the Century Period (1898–1917)

The Spanish-American War began in 1898, and with Florida the closest state to Cuba, American troops were stationed and deployed from coastal cities. Harbors in Tampa, Pensacola, and Key West were improved as ships were launched with troops and supplies. The war was short in duration, but evidence of the conflict remained in the form of improved harbors, expanded railroads, and military installations. (JRI 2009)

Between 1900 and 1910, the state population increased from 528,542 residents to 752,619. Rapid and widespread growth included thousands of miles of railroad tracks and growth of the citrus industry. Manufacturing, industry, fertilizer production, boat building, and lumber and timber products were large industries. (JRI 2009)

3.8.2.8 World War I to Modern Era (post-1917)

In 1917, wartime activity resulted in several training facilities which were set up in the state. Protecting the coastlines was a priority at that time. Although the conflict only lasted until November of 1918, the economy was boosted with shipbuilding, additional industrialization, and increased agricultural production and tourism. (JRI 2009)

After World War I, Florida experienced unprecedented growth. Bank deposits increased, real estate companies opened in many cities, and state and county road systems expanded quickly. Earlier land reclamation projects had created thousands of new acres of land to be developed. Real estate activity increased steadily after the war's end driving up property values. Prices on lots were inflated to appear more enticing to out-of-state buyers. Every city and town in Florida had new subdivisions platted and lots were selling and reselling for quick profits. Southeastern Florida, including cities such as Miami and Palm Beach, experienced the most activity, although the boom affected most communities in central and southern Florida (JRI 2009).

The boom period began to decline in August 1925, when the Florida East Coast Railway placed an embargo on freight shipments to southern Florida. Ports and rail terminals were overflowing with unused building materials. In addition, northern newspapers began to suggest fraudulent land deals were occurring in Florida. In 1926 and 1928, two hurricanes hit southeastern Florida, killing people and destroying thousands of buildings. The collapse of the real estate market and the subsequent hurricane damage effectively ended the boom. Further damaging Florida's economy was a Mediterranean fruit fly infestation in 1929 that devastated citrus groves throughout the state. When the stock market collapsed in 1929, Florida was already suffering from an economic depression. (JRI 2009)

As a result of hard economic times, President Franklin D. Roosevelt initiated several national relief programs. Important New Deal-era programs in Florida were the Works Progress Administration and the Civilian Conservation Corps. The Works Progress Administration provided jobs for professional workers and laborers. Their work included the construction and improvement of many roads, public buildings, parks, and airports in Florida. The Civilian Conservation Corps improved and preserved forests, parks, and agricultural lands. (JRI 2009)

From the end of the Great Depression through the post-war era, Florida's history was inextricably bound with World War II and its aftermath. It became one of the nation's major training grounds for the various military branches, including the Army, Navy, and Air Force. Tourism declined as tourist and civilian facilities were placed into wartime service. (JRI 2009)

At the conclusion of World War II, Florida's economy was close to fully recovered. Tourism rebounded and became the major source of the state's economy. Former military personnel found the local climate amenable and remained in Florida permanently after the war. These new residents greatly increased the population during the late 1940s and 1950s. In 1947, immediately after the war, Everglades National Park was established, thereby increasing tourism to the area. (JRI 2009)

3.8.3 Onsite Cultural Resources

Onsite cultural resources are those located within the 9,640-acre FPL Turkey Point property. That property includes the entirety of the archaeological APE, which is also the onsite portion of the aboveground APE. No ground-disturbing activities are associated with the SLR; therefore, the SLR is considered an administrative action that does not have the potential to adversely affect historic resources. No NRHP-eligible cultural resources have been identified in the 9,640-acre FPL Turkey Point property (Figure 3.8-5). Analysis of the documents from the FMSF indicated no previously recorded cultural resource sites—including archaeological resources, standing structures, human burials, historic bridges, or other resources that could be potentially eligible for inclusion to the NRHP—are within the 9,640-acre FPL Turkey Point property.

3.8.4 Offsite Cultural Resources

Offsite cultural resources are those outside the 9,640-acre FPL Turkey Point property boundary but within a 6-mile radius of PTN. There are 95 archaeological and architectural offsite resources within a 6-mile radius of Turkey Point (FMSF 2017). Lists of known archaeological sites and historic properties within a 6-mile radius of PTN are presented in Table 3.8-1. There are no NRHP-listed resources within a 6-mile radius of PTN (Table 3.8-1; Table 3.8-2; Figure 3.8-5). Of the 93 resources within a 6-mile radius of PTN, 28 are ineligible and 65 have not been evaluated for NRHP listing (Table 3.8-1). Additionally, the Jones Family Historic District (8DA13873) is an NRHP-listed resource (NRHP Reference No. 13000846) on Totten and Porgy Keys that is slightly beyond the 6-mile radius from PTN. The district includes domestic and farming features and artifacts, including the remains of standing structures that are significant due to providing a unique example of exploration and settlement of the Florida Keys, as well as settlement and agriculture in the harsh maritime environment. (FMSF 2017)

Two sites have been determined eligible for listing in the NRHP by the Florida state historic preservation office (SHPO), but have not been nominated or listed (Table 3.8-2). The first is the K-9 Cemetery (DA12863), which is associated with the Homestead ARB and is 5.9 miles from PTN. The second is the SW 117th Avenue/North Canal Bridge (DA11918), which is 3.6 miles from PTN. Based on a desktop evaluation, PTN is not visible from the two sites determined to be NRHP eligible. The NRHP Jones Family Historic District is slightly outside the 6-mile radius from PTN and the portion on Totten Key is separated from PTN by only open water. The remains of the home and other features on Totten Key have been subjected to the harsh environment and are no longer standing. Visibility over open water is limited by the curvature of the earth and is approximately 3 miles from standing height. As such, it is unlikely that PTN is visible from the Jones Family Historic District. Additionally, as no refurbishment activities are part of the SLR, there is no potential for the undertaking to adversely affect the viewshed of the NRHP eligible resources.

3.8.5 Cultural Resource Surveys

There is no documentation of a cultural resources survey of the 9,460-acre property prior to the 1972 operation of PTN (FMSF 2017). A county-wide survey (FMSF Survey 340) in 1978 through 1980 included part of the Turkey Point site but did not involve intensive testing (Carr et al. 1980). Similarly, the 1978 Dade County Historic Survey (FMSF Survey 602/733) included part of the Turkey Point site but did not involve intensive pedestrian survey of the Turkey Point site (Carr 1981). Additionally, the Phase II Dade County Historic Survey (FMSF Survey 2127) did not involve an intensive pedestrian survey of the Turkey Point site but included a windshield survey by an architectural/historical surveyor (Rodriguez 1989).

In 1995 and 1996, a cultural resources survey (FMSF Survey 5103) including controlled surface collection, remote sensing, and test excavation was conducted within part of the Turkey Point site for a mitigation bank associated with USACE permitting (Lewis and Davis 1996). The survey was conducted in Sections 20, 21, 25, 26, 27, 28, 29, 32, 33, 34, 35, and 36 of Township 58 South, Range 39 East; Sections 5, 6, 7, 8, 18, 19, 27, 28, 30, 31, 32, and 33 of Township 58 South, Range 40 East; Sections 1 and 2 of Township 59 South, Range 39 East; and Section 6 of Township 59 South, Range 40 East. This survey includes the portion of the Turkey Point site that is west and south of the cooling canals. No cultural resources were identified during this survey.

In 2004 JRI conducted an investigation (FMSF Survey 10826) for a Florida Gas Transmission Company project to construct a pipeline with compression and ancillary facilities. The project included ground disturbance within the Turkey Point site as well as off site. Citing a 2004 Florida SHPO/DHR determination of no adverse effect on historic properties relating to the FPL Turkey Point expansion, JRI recommended that no further cultural resource investigations were required for the pipeline and associated facilities project and the SHPO concurred. (JRI 2004)

JRI conducted a cultural resource assessment (FMSF Survey 18168) in 2008 and 2009 for the FPL Turkey Point Units 6 and 7 site and associated non-linear facilities (JRI 2009). The survey area included the area around the Nuclear Administration Building, Training Building, parking area, the radial collector wells and delivery pipelines to the site, the FPL reclaimed water treatment facility and delivery pipelines to the site, the FPL-owned fill source, the equipment barge unloading area, the heavy haul road on plaint property, and the spoils areas on plant property. JRI surveyed approximately 1,400 acres with pedestrian surveys and shovel test pits. The survey did not result in identifying any cultural resources.

In 2013 JRI conducted a survey (FMSF Survey 19970) of the revised location of the reclaimed water treatment facility and onsite reclaimed water pipeline alternate locations, which are within the Turkey Point site. JRI conducted detailed background research that resulted in assessing the project area as low probability for the presence of cultural resources. JRI conducted a pedestrian survey with judgmentally placed shovel test pits that confirmed the low probability assessment, and no cultural resources were identified. (JRI 2013)

3.8.6 Procedures and Integrated Cultural Resources Management Plan

FPL has administrative controls in place for management of cultural resources ahead of future ground-disturbing activities at the plant, although no license renewal-related ground-disturbing activities have been identified. These controls consist of the following:

- The 2016 conditions of certification of Turkey Point Units 3, 4, and 5, as well as previous conditions of certification for PTN, describe the procedure for historical and archaeological finds (IV U:9). The procedure states, "If historical or archaeological artifacts are discovered at any time within the project site, the Licensee shall notify the DEP Southeast District office and the Bureau of Historic Preservation, Division of Historical Resources," and gives contact information.

- The *Environmental Control Program for Turkey Point Plant, Units 3 & 4 Construction Activities* states, "If the construction site is suspected of being on a historical, archaeological site, or artifacts are found at the site, contact the Florida Department of State, Division of Historical Resources (§ 267.031, Fla. Stat.) to determine if the site is subject to regulations of Section 106 of the National Historic Preservation Act (NHPA), 36 C.F.R. § 67.2, requires federal agencies to protect historic properties."

These administrative controls ensure that existing, or potentially existing, cultural resources are adequately protected and assist FPL in meeting state and federal expectations.

Table 3.8-1
Archaeological Sites within a 6-Mile Radius of PTN (Sheet 1 of 6)

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[(a)]
DA12618	SW 117th Avenue / Canal C-103 Bridge	Miami-Dade	Homestead	Ineligible
DA14366	SW 127th Avenue / Canal C-103 Bridge	Miami-Dade	Homestead	Ineligible
DA12835	Building 246 Guard House	Miami-Dade	Homestead	Ineligible
DA12836	Building 260 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12837	Building 261 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12838	Building 262 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12839	Building 263 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12840	Building 264 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12841	Building 265 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12842	Building 269 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12843	Building 270 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12844	Building 271 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12845	Building 272 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12846	Building 273 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12847	Building 274 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12848	Building 277 Magazine Igloo	Miami-Dade	Homestead	Ineligible

Table 3.8-1
Archaeological Sites within a 6-Mile Radius of PTN (Sheet 2 of 6)

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[(a)]
DA12849	Building 278 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12850	Building 279 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12851	Building 280 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12852	Building 281 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12853	Building 282 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12854	Building 285 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12855	Building 286 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12856	Building 287 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12857	Building 288 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12859	Building 701 SAC Alert Crew Quarters	Miami-Dade	Homestead	Ineligible
DA12861	Building 4055 Hush House	Miami-Dade	Homestead	Ineligible
DA12862	Building 4064 Hush House	Miami-Dade	Homestead	Ineligible
DA12617	SW 107th Avenue/Canal C102 Bridge	Miami-Dade	Perrine	Not Evaluated
DA11941	Channel Ballast, BISC-5	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11942	University Dock, BISC-6	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11943	Black Wreck, "Marty's Lost Site". . .	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11944	Jordan's Ballast, Sorelaw's Ballast, . . .	Miami-Dade	Arsenicker Keys	Not Evaluated

Table 3.8-1
Archaeological Sites within a 6-Mile Radius of PTN (Sheet 3 of 6)

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[(a)]
DA11945	Cement Barge Wreck, BISC-11	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11947	Cement Barge Wreck, BISC-11	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11948	BISC-20, HMS Fowey, Legare Anchorage	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11949	Sands Cut Ballast Piles, BISC-024	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11950	BISC-25, Reef Ballast, Reef Ballast Scat	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11951	BISC-26, Machinery Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11952	BISC-28, Elkhorn Reef Ballast	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11953	BISC-29, Reef Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11954	BISC-30, Morgans Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11955	BISC-31, Stairs Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11956	BISC-32, Ball Buoy Wreck (Anomaly #12. . .)	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11957	BISC-33, Outline Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11958	BISC-35, Pillar Dollar Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11960	BISC-51, Legare Barrels	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11961	BISC-52, South Pacific Reef Ballast Scat	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11962	BISC-53, Bottle Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11963	BISC-55, Biscayne Channel Barge	Miami-Dade	Arsenicker Keys	Not Evaluated

Table 3.8-1
Archaeological Sites within a 6-Mile Radius of PTN (Sheet 4 of 6)

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[(a)]
DA11964	BISC-56, Bug Light Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11965	BISC-57, Bell Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11966	BISC-58, Brick Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11967	BISC-59, Boxcar Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11968	BISC-59, Captain Ed's Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11969	BISC-61, Second Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11970	BISC-62, Cannon Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11971	BISC-63, Fowey Rock Barrels	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11972	BISC-64, I-Beam Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11973	BISC-66, Ballast Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11974	BISC-68, Anchor (Alias: Old Anchor Reef)	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11975	BISC-70, Safety Valve Barge	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11976	BISC-73, Ore Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11977	BISC-74, Aladdin Lamp Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11978	BISC-75, Ring Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11979	BISC-76, Admiralty Anchor, Alice's. . .	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11980	BISC-77, Reef Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated

Table 3.8-1
Archaeological Sites within a 6-Mile Radius of PTN (Sheet 5 of 6)

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[(a)]
DA11981	BISC-78, Old Rhodes Ballast, Chris'. . .	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11982	BISC-79, Triumph Reef South Ballast	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11983	BISC-80, Triumph Reef Metal Scatter	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11984	BISC-114, Boca Chita North Pontoon	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11985	BISC-86, Anchor Fluke	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11986	BISC-87, Steel Frames	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11987	BISC-88, Stock Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11988	BISC-89, Sunken Bell Buoy	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11989	BISC-90, Tannehill Cannon	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11995	BISC-100, Pacific Reef Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11996	BISC-101, Debbet Site Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA12619	SW 328th Street / Canal C-107 Bridge	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14302	BISC-99, Grapnel Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14303	BISC-115, Coral Chain Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14304	BISC-116, Patch Reef Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14305	BISC-118, Lionfish Killer Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14307	BISC-120, Shrimp Boat	Miami-Dade	Arsenicker Keys	Not Evaluated

Table 3.8-1
Archaeological Sites within a 6-Mile Radius of PTN (Sheet 6 of 6)

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[a]
DA14308	BISC-121, Corsair Wreckage	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14309	BISC-122, Anchor Holding Fast	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14310	BISC-123, Rocky Reef Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14311	BISC-124, The Wall Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14312	BISC-125, Straits of Florida Debris	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14315	BISC-130, Reef Tower Ballast	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14317	BISC-132, Boiler	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14318	BISC-133, Olive Jar Survey Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14319	BISC-134, Wreck Scatter	Miami-Dade	Arsenicker Keys	Not Evaluated

(FMSF 2017)

a. NRHP status is based on FMSF files.

Table 3.8-2
NRHP-Eligible Archaeological Sites within a 6-Mile Radius of PTN

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status*	Distance from PTN
DA12863	K-9 Cemetery	Miami-Dade	Homestead	Eligible	5.9 miles
DA11918	SW 117th Avenue/North Canal Bridge	Miami-Dade	Homestead	Eligible	3.6 miles

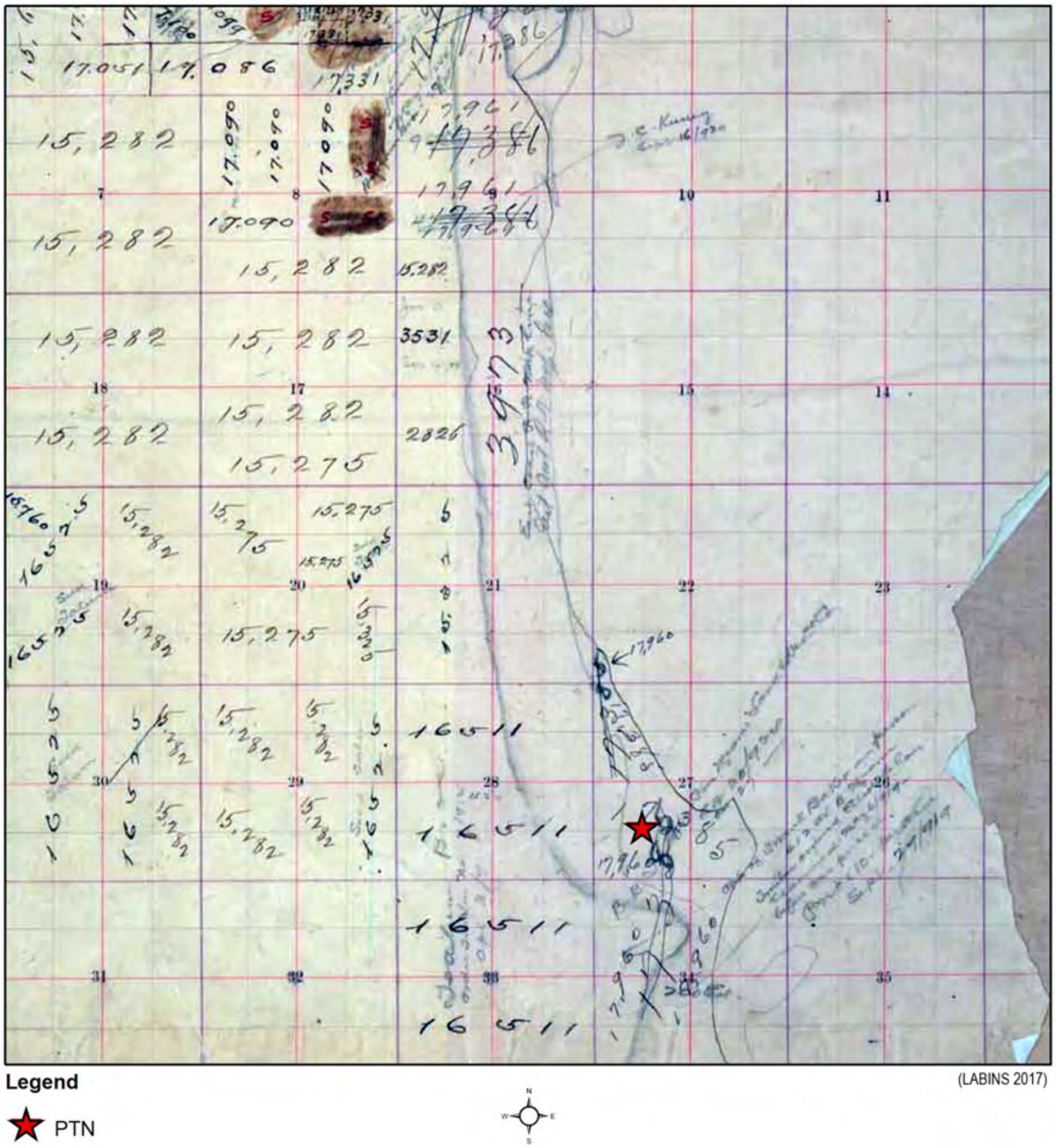

Figure 3.8-1
1874 General Land Office Historic Florida Topographic Drawing

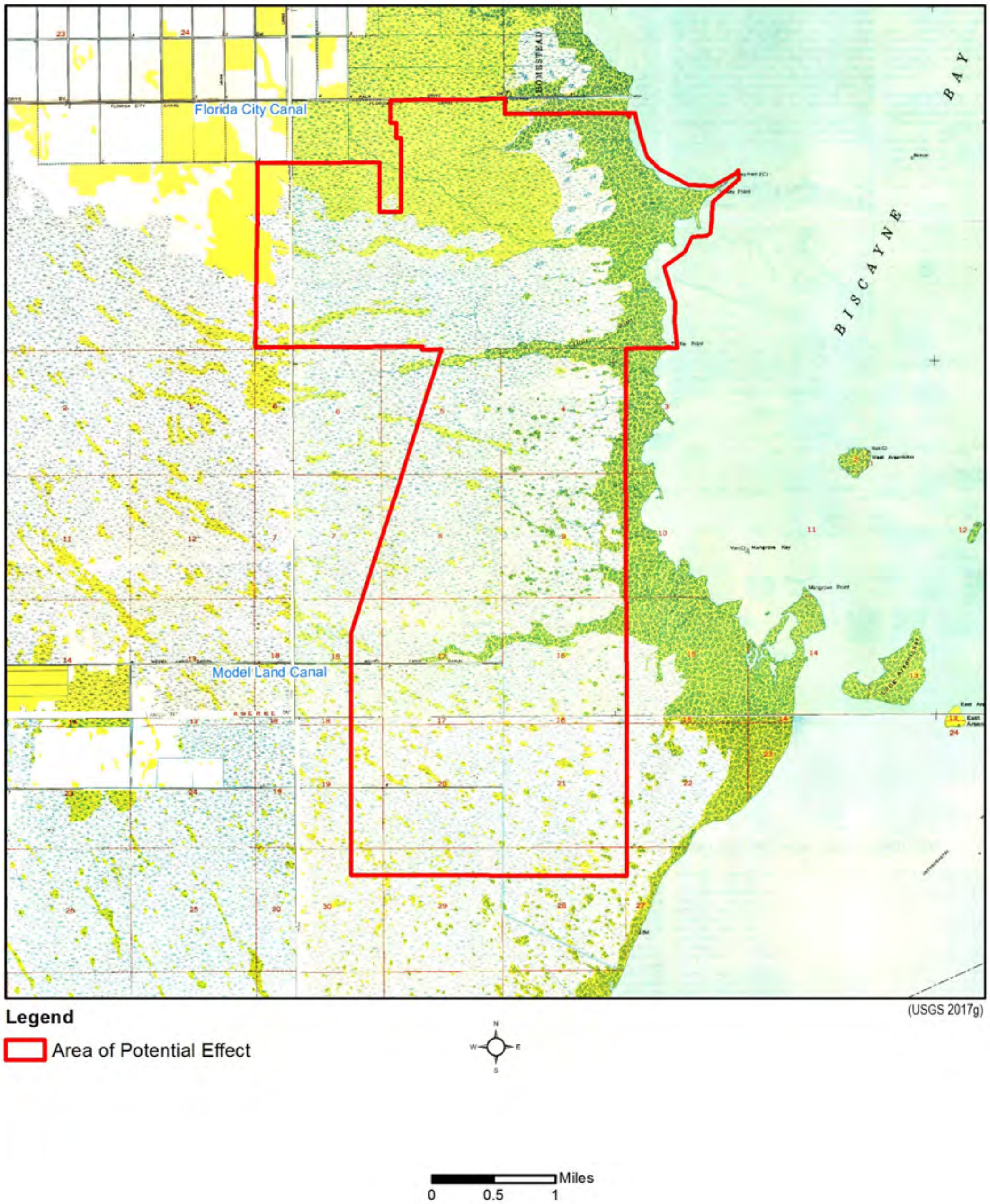

Figure 3.8-2
1949 and 1950 Historic Topographic Map

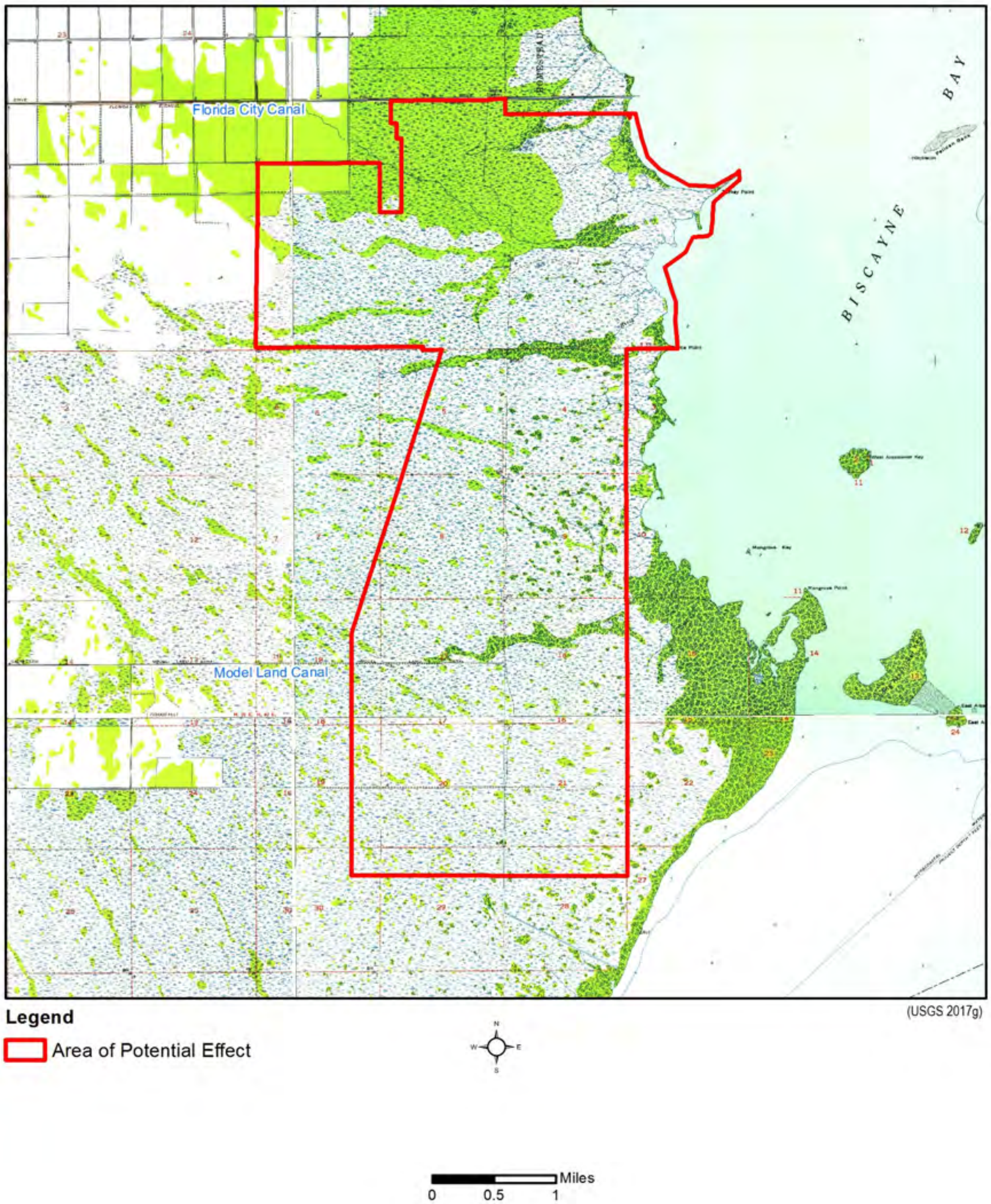

Figure 3.8-3
1956 Historic Topographic Map

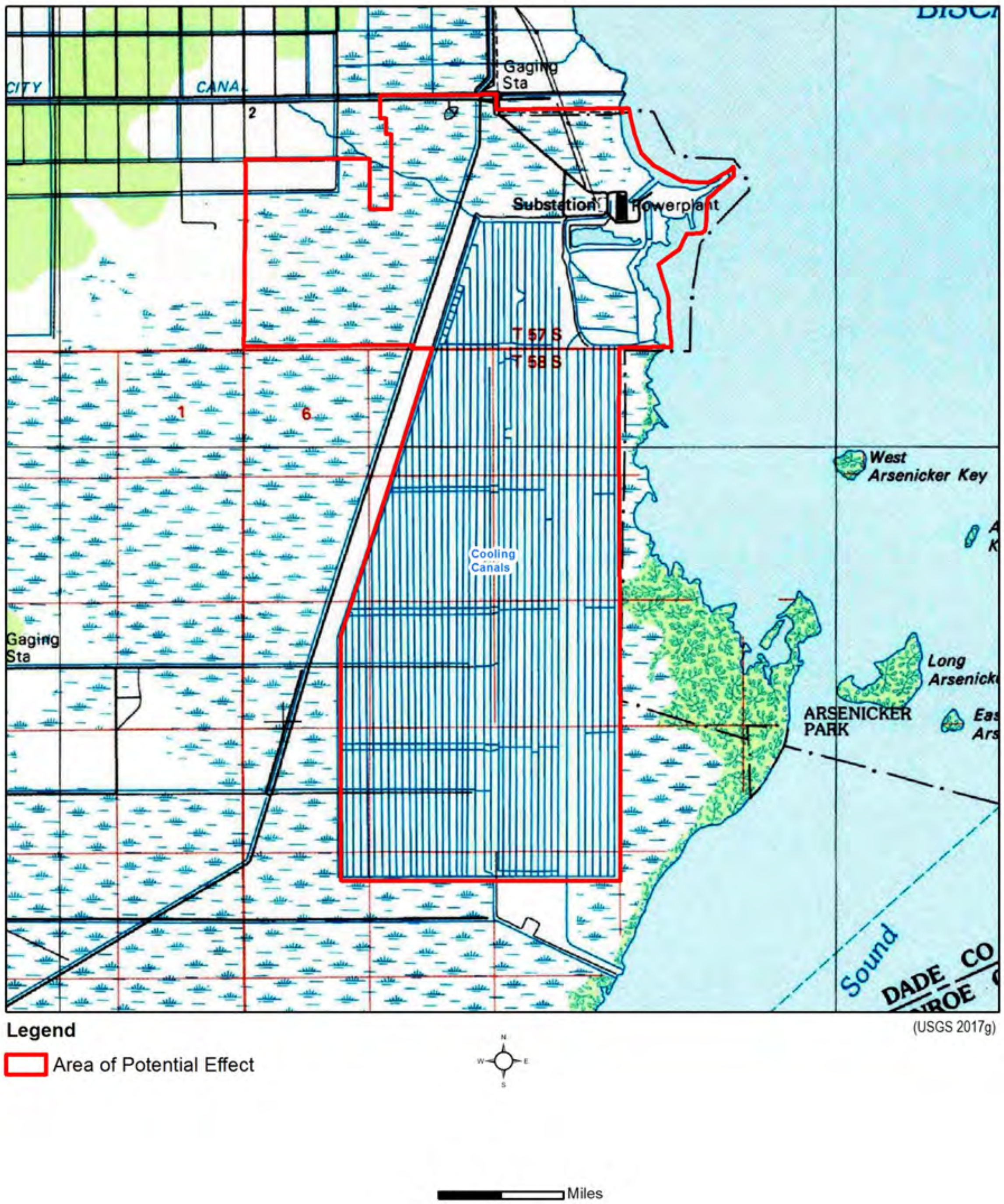

Figure 3.8-4
1982 Homestead, Florida

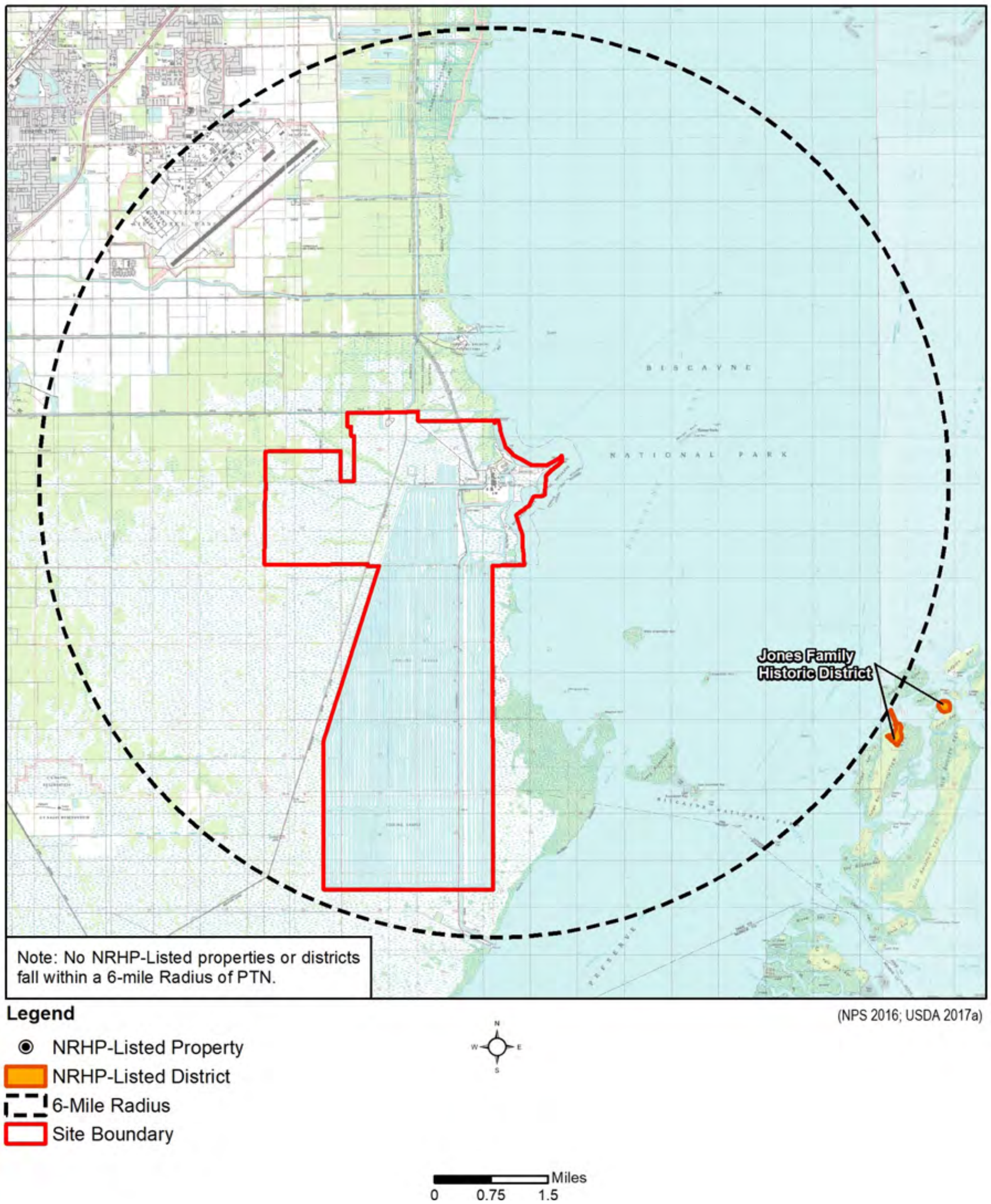

Figure 3.8-5
NRHP-Listed Sites, 6-Mile Radius of PTN

3.9 Socioeconomics

Socioeconomic descriptions are focused on Miami-Dade County in Florida because, as described in Section 2.5, approximately 85 percent of the permanent PTN workforce lives in this county, with the largest percentage of staff living in the city of Miami and the city of Homestead. In addition, Turkey Point is an FPL asset on which property taxes are paid to Miami-Dade County.

The PTN units are on 18-month refueling cycles and, during the most recent refueling event, employed an additional 1,200 workers for a period of 25 to 35 days (Section 2.5). The local communities and cities of Homestead, Florida City, Goulds, and Miami are located within a 50-mile radius of the plant and offer numerous motel, campground, and food service options along US-1 and I-95.

3.9.1 Employment and Income

As discussed in Section 2.5, Miami-Dade County is where a majority of PTN workers reside (specifically the city of Miami and city of Homestead), and this is the area most influenced economically by PTN operations. As discussed in Section 3.11.1, the population of Miami-Dade County is expected to increase during the SLR period. Low-income populations and poverty thresholds for Miami-Dade County are described in Section 3.11.2.

The estimated total employed population in Miami-Dade County in 2015 was 1,681,253 persons, which is approximately 14.9 percent of the total number of employed population in the state of Florida (11,287,608 persons). The leading reported occupational sector for Miami-Dade County was health care and social assistance, with approximately 10.5 percent (176,548 persons) employed. This was followed by the retail trade sector with approximately 10.3 percent (173,888 persons) employed, and the government and government enterprises sector with approximately 8.7 percent (145,797 persons) employed. The annual payroll in Miami-Dade County was approximately $116.5 billion in 2015, as compared to $900.6 billion for the state of Florida. The average annual wage per job in Miami-Dade County was $52,491 in 2015, which was higher than the state of Florida average wage ($47,686). In 2015, the per capita personal income was $43,278 in Miami-Dade County, lower than the state of Florida per capita personal income ($44,429). (BEA 2017) The state of Florida average annual unemployment rate decreased from 5.4 percent in 2015 to 4.9 percent in 2016. During this same study period, Miami-Dade County reported a higher average annual unemployment rate than the state of Florida, but overall the County average annual unemployment rate decreased from 5.9 percent in 2015 to 5.4 percent in 2016. (BLS 2017)

The top three major private sector employers in Miami-Dade County include Baptist Health South Florida, University of Miami, and American Airlines. FPL is the fourth largest employer in Miami-Dade County. (TBC 2017) As of 2016, the Miami-Dade County quarterly labor market report identified there were over 26 consecutive quarters of expansion, and the county has averaged 6,700 additional jobs per quarter. (MDC 2017c)

Activities at Turkey Point stimulate Florida's labor income and employment. Along with the workforce at PTN (Section 2.5), in Miami-Dade County, an additional 1,930 jobs are supported by operations at Turkey Point (over 2,600, including employment at the site). Operations at Turkey Point also support nearly 1,020 jobs in Monroe and Broward counties. Turkey Point supports 8,000 jobs across Florida (including those at the plant and staff supporting operation in the Juno Beach headquarter offices). The annual payroll, plus fringe benefits, for the direct FPL jobs is approximately $150 million. (NEI 2017b).

3.9.2 Housing

Between 2010 and 2015, the total population for Miami-Dade County grew by approximately 7.9 percent (Table 3.11-2). As seen in Table 3.9-1, total available housing within the county grew by 16.1 percent between 2000 and 2010, but only 0.9 percent between 2010 and 2015. The vacancy rate was 15.7 percent in 2015, an increase of 3.3 percent from 2010, which exceeds population growth during the same time period. This would indicate that enough housing was available to keep up with the increase in population.

The median home values in Miami-Dade County increased significantly (approximately 117.4 percent) from 2000 to 2010, but were estimated to decrease between 2010 and 2015 by approximately 24.6 percent (USCB 2017d). This decrease is attributed to a housing bubble that peaked in 2007, causing housing values to decrease until 2011. Since then, the values have increased but have not reached the 2007 level (Brannigan 2014). The median rent for the county increased 55.2 percent between 2000 and 2010, and 10.8 percent between 2010 and 2015 (USCB 2017d).

3.9.3 Water Supply and Wastewater

As described in Section 3.6.3.2, Turkey Point gets its potable water from the Miami-Dade public water supply system. The nuclear units' domestic wastewater is routed to an onsite sewage treatment plant and disposed via underground injection well.

3.9.3.1 Water Supply

The SFWMD is a regional governmental agency that manages the water resources in the southern half of the state, covering 16 counties from Orlando to the Florida Keys and serving a population of 8.1 million residents. The district is responsible for making sure there is enough water to serve the needs of agriculture, the Everglades, and a rapidly growing urban community. Miami-Dade County falls within the district's governance area. (SFWMD 2017c; MDWASD 2017)

There are five major public water-supply systems in Miami-Dade County: the MDWASD, Florida City, Homestead, North Miami, and North Miami Beach systems (NRC 2016a, Section 2.5.2.6). Miami-Dade County's sole source for drinking water is groundwater from wells (MDWASD 2017). The major water-supply sources for all the existing water-treatment systems in Miami-Dade County are the Biscayne Aquifer and the Floridan Aquifer (NRC 2016a, Section 2.5.2.6).

The MDWASD provides drinking water to approximately two million customers in Miami-Dade County and is the main water supplier in the county (MDWASD 2017; NRC 2016a, Section 2.5.2.6). Within the MDWASD service area there are 15 wholesale customers, and include agreements with the water systems serving the cities of Homestead, North Miami, and North Miami Beach. The MDWASD water service area contains a number of water treatment and storage facilities and interconnected water delivery systems. For the most part, MDWASD functions as a single service area, with three subareas: the Hialeah-Preston area (serving the northern part of Miami-Dade County), the Alexander Orr, Jr. area (serving the central and portions of the southern part of Miami-Dade County), and the South Dade area (serving the southern part of Miami-Dade County). (MDWASD 2017)

As described in Table 3.9-2, in 2014 the MDWASD service area population was estimated at 2,243,879. The MDWASD waste treatment facilities reported installed capacity was 72.85 percent of the MDWASD installed well field capacity. This would indicate that the MDWASD water supply and treatment systems have sufficient installed capacity to produce more potable water than is currently required. The MDWASD reports that future water treatment facilities installed capacity will be at 71.40 percent of the MDWASD installed well field capacity (supply capacity total 724.44 MGD) and treatment capacity total 517.19 MGD), indicating that there will be sufficient potable water available for future needs. (MDWASD 2017)

In addition to MDWASD, there are four other water suppliers within Miami-Dade County that provide water to parts of unincorporated Miami-Dade County and within their respective municipal boundaries. Two such water suppliers in the South Dade area are Homestead and Florida City. The Homestead public water system has a current service area population of 65,000 and treatment facilities installed capacity is 99.47 percent of the installed wellfield capacity. Pursuant to the terms of a CA between the city of Homestead and the SFWMD (dated December 7, 2009), the city of Homestead was required to reduce its withdrawal from the Biscayne Aquifer by approximately 3 MGD to meet the conditions of the city's water use permit. To meet the demands of its retail customers, in 2010 the Homestead water system entered in a 20-year water wholesale agreement with MDWASD to purchase up to 3 MGD of water. In addition, MDWASD provides some water service within portions of the municipal boundary of the city of Homestead, and Homestead sells water to Florida City water system to service a small portion of the Florida city service area. Florida City has a current service area population of more than 9,700, and the Florida City water treatment facility utilizes 100 percent of its available wellfield water withdrawal capacity. (MDWASD 2017)

In the North Dade area, the city of North Miami water system and the city of North Miami Beach water system provide water to portions of unincorporated and incorporated parts of Miami-Dade County. As of 2014, the city of North Miami water system reportedly served a population of 91,000, and the North Miami water treatment facilities installed capacity is 62.17 percent of its installed wellfield capacity. North Miami currently purchases approximately 37 percent of their water needs from MDWASD. The city of North Miami Beach water system distributes potable water service to more than 163,962 people and has a 30-year wholesale agreement with MDWASD to purchase water on an as-needed basis. As of 2014, the city of North Miami Beach treatment facilities installed capacity was 80.06 percent of the installed wellfield capacity. (MDWASD 2017)

The 2014 MDWASD 20-year *Water Supply Facilities Work Plan (2014–2033)* reported that the county's projected finished water demands are now significantly lower than anticipated when the first 20-year water use permit application was submitted to the SFWMD in 2007. The updated water demand projections have resulted in a 71 MGD decrease by the year 2030. This demand reduction has eliminated the anticipated supply shortages that were the basis for an ambitious schedule of several costly alternative water supply projects, which are no longer requested or needed. As such, reuse projects to address water supply have been eliminated. However, MDWASD will be implementing a total of 117.5 MGD of reuse to address the ocean outfall legislation, which includes 27.6 MGD of Floridan Aquifer recharge and up to 90 MGD of reuse water to FPL for Turkey Point Unit 5 and proposed Units 6 and 7. (MDWASD 2017)

The decrease in water demands has been a result of the successful implementation of the county's water conservation plan and new population projections based on the 2010 census. Through 2013, a total of 11.2 MGD have been saved through the implementation of the water conservation plan BMPs. Additionally, Miami-Dade County has enacted water use efficiency legislation including permanent landscape irrigation restrictions, landscape ordinances, and the installation of high-efficiency plumbing fixtures in new construction. In 2033, MDWASD will serve potable water to approximately 85 percent of the total county population. (MDWASD 2017)

3.9.3.2 Wastewater

Wastewater treatment in the SFWMD is accomplished through regional wastewater treatment facilities, smaller "package plants," and septic tanks. The city of Homestead and the MDWASD are providers of public wastewater treatment in Miami-Dade County. In 2008, amendments to Section 403.086, Florida statutes, were passed, commonly referred to as the ocean outfall legislation, requiring the elimination of the use of six ocean outfalls in southeastern Florida as primary means for disposal of treated domestic wastewater and the reuse of a least 60 percent of the outfall flows by 2025. Currently, primary means of water reuse in the region can include public access irrigation (e.g., golf courses, parks, and schools). By 2030, cooling water for power plants or groundwater recharge could also be a significant means for wastewater reuse. (SFWMD 2017c)

The city of Homestead operates and maintains the Homestead WWTP, which has an FDEP-permitted capacity of 6 MGD. The annual average daily flow from the Homestead WWTP was 5.30 MGD in 2010 (88.33 percent utilization), indicating adequate capacity is available. Excess wastewater flows are pumped to the Miami-Dade South District WWTP operated by the MDWASD. All the Homestead treated water is discharged to a series of rapid infiltration trenches that recharge the Biscayne Aquifer. The Homestead WWTP reused 100 percent of the wastewater treated at the facility in 2010. Homestead has evaluated various alternative water supply projects to meet future growth demands. The city determined that in the future it could provide reclaimed water from its WWTP to the city-owned electric generating plant for cooling water purposes, which would then ultimately be reused to recharge the Biscayne Aquifer. (SFWMD 2017c)

The MDWASD collects and treats most of the wastewater generated in Miami-Dade County. The MDWASD wastewater service area is divided into three regional districts: the North District, Central District, and South District WWTPs. The current MDWASD districts are located in the eastern portion of Miami-Dade County. MDWASD is also considering a new West District Water Reclamation Plant. MDWASD currently uses two ocean outfalls and 21 deep injection wells to dispose of treated wastewater. Each facility reuses a small amount of treated wastewater, mostly for processes at the facilities. (SFWMD 2017c)

Two factors are driving the commitment to increase water reuse in Miami-Dade County. First, the MDWASD water use permit stipulates that 170 MGD of water reuse must be in place before volumes over its base condition water use are withdrawn from specific subarea wellfields. The intent of the requirement is to comply with restricted allocation area criteria and implement projects that recharge the aquifer. Secondly, the 2008 ocean outfall amendments mandate significant reuse. Because all the MDWASD's WWTPs are interconnected, the three plants are considered one system and may meet the reuse requirement on a system-wide basis. MDWASD will be required to beneficially reuse 117.5 MGD of treated wastewater by 2025. (SFWMD 2017c)

Regarding sufficient WWTP capacity by MDWASD to support service area customers, in 2010 the Central District WWTP facility had an FDEP-permitted capacity of 143 MGD, and an annual average flow of 101 MGD (70.63 percent utilization); the North District WTTP facility had an FDEP-permitted capacity of 112.50 MGD, and an annual average daily flow of 87.15 MGD (77.47 percent utilization); the South District WTTP facility had an FDEP-permitted capacity of 112.50 MGD, and an annual average daily flow of 93.18 MGD (82.83 percent utilization). This would indicate that adequate capacity remains within the wastewater system to support service area population. (SFWMD 2017c)

The MDWASD has proposed the addition of a West District water reclamation plant, which would include wastewater treatment with storage facilities to meet needs for peak wet weather conditions. Various alternatives, including plant capacity associated with reclaimed water opportunities, are being developed in conjunction with system-wide wastewater transmission and treatment facilities. MDWASD tentatively scheduled this plant to come online by 2026. (SFWMD 2017c)

3.9.4 Community Services and Education

Miami-Dade County has one public school district, which is the fourth largest public school district in the country (TBC 2017). Based on the 2014–2015 school year, there were 555 public schools in the county with approximately 356,964 students and 20,836 teachers (full-time equivalent). The Miami-Dade County student/teacher ratio was 17.13. The Miami-Dade public school system supports all age groups (preschool through Grade 12). Located nearest Turkey Point, the city of Homestead has 45 public schools that fall within the Miami-Dade school system, and the city of Miami has 295 public schools. In addition, there are 346 private schools in Miami-Dade County with approximately 66,639 students and 5,274 teachers (full-time equivalent). (NCES 2017) Miami-Dade County colleges, universities and vocational programs offer a comprehensive array of programs for students, from business and healthcare to information technology and construction trades (TBC 2017). There are 120 colleges or universities reported for the Turkey Point region with an additional 262,375 students (NCES 2017).

The Miami-Dade County Police Department serves the entire county, including all the municipalities (NRC 2016a, Section 2.5.2.6). Miami-Dade County reported a total of 2,674 officers in 2014, which results in an estimated officer/population ratio of one officer per 1,000 people. Located closest to Turkey Point, the city of Homestead reported a total of 109 officers, which results in an estimate of 1.7 officers per 1,000 people. The city of Miami reported a total of 1,148 officers with an estimated 2.7 officers per 1,000 people. (FBI 2017)

The Florida Hospital Association has 37 hospitals registered in the Miami-Dade service area, with 9,812 total licenses beds (FHA 2017). Homestead Hospital is the closest public medical facility to Turkey Point and has approximately 300 physicians on staff. Homestead Hospital is a modern, full-service 142-bed facility, opened in May 2007. (HH 2017)

Registered with the U.S. Fire Administration, Miami-Dade County has 98 fire stations and a staff of 3,485 active career firefighters. The various county departments serve a 2015 estimated population of 2,693,117 (Table 3.11-2) with an overall ratio of 1.3 firefighters per 1,000 residents. Near the plant, the Homestead ARB has one station with 54 active career firefighters. Also located in the city of Homestead, the Everglades National Park visitor protection unit has two stations and 15 active firefighters available on call. The city of Miami Fire-Rescue department has 14 stations and 699 active career firefighters. (USFA 2017)

3.9.5 Local Government Revenues

Florida does not have a state-level property tax. Private property owners pay property taxes to the county and a local school district and may also pay taxes to special taxing units. Property values are set by the county property appraisers, and some exemptions may apply. The tax rate (millage) is set by each taxing unit. County and school district governments may levy taxes up to 10 mills each (1 percent). (NRC 2016a, Section 2.5) For fiscal year (FY) 2015–2016, the overall millage rate for Miami-Dade County was 9.7585 mills for property with a taxable value of $150,000 in unincorporated Miami-Dade County. For residents of municipalities, all the county millage rates would apply, except the individual municipal millage rate would be used in place of the unincorporated municipal services area rate. Also, some municipalities are not in the Fire Rescue District or library system, and their residents pay for those services through the municipal millage rates. In both FY 2014–2015 and FY 2015–2016, Miami-Dade County levied less than half of the property taxes for the majority of properties located in municipalities. (MDC 2017d)

As shown in Table 3.9-3, Miami-Dade County operating property tax revenues (actual) for 2016 were $1,585,671,000. These taxes funded four separate taxing jurisdictions: general county, debt service, fire protection, and the libraries. Two of the largest programs receiving Miami-Dade County funding were public health and the protection of people and property. (MDC 2017d; MDC 2017e).

Miami-Dade Public School District is a taxing entity separate from Miami-Dade County. The Florida Education Finance Program is the primary mechanism for funding the operating costs of Florida school districts. Funding comes from local, state, and federal government sources. Local funding is from property taxes on properties located within the school district. State funding is by legislative appropriation and the major source of revenue is the state sales tax. Federal funding is coordinated by the Florida Department of Education. Under the Florida Education Finance Program, funding is based on the number of full-time equivalent students and considers variations in several factors when determining funding for each district: local property tax bases, education program costs, costs of living, and costs for equivalent educational programs due to the student population's density and distribution. (NRC 2016a, Section 2.5)

The Miami-Dade School Board is authorized by state law to levy property taxes for district school operations, capital improvements, and debt service. Property taxes consist of *ad valorem* taxes on real and personal property within the district. For FY 2015-2016, the overall millage rate for Miami-Dade County Public School District was 7.612 mills. Total levied taxes on the 2015 tax roll were $1,995,314,000 for 2015–2016. (MDCPS 2017)

Under Florida law, both real property (land and permanent buildings) and tangible personal property (primarily business equipment) are subject to property tax. FPL pays taxes on real and tangible personal property to Miami-Dade County and the Miami-Dade School District. In 2016, remitted taxes were $37,882,946 on PTN, $2,018,405 on fossil Units 1 and 2, and $6,565,399 on gas Unit 5, for a total property tax payment of $46,466,750 (Table 3.9-3). Miami-Dade County would have received 53.4 percent of the tax payment, while the Miami-Dade County School District received 41.7 percent. The remaining 4.9 percent was assigned to special districts, which included the Florida Inland Navigation District, the SFWMD, the Everglades Construction Project, the Children's Trust Authority, and the Library District. (MDC 2017d; NRC 2016a, Section 2.5)

As reported in Table 3.9-3, there was an increase in FPL's property tax payment between 2012–2013 and 2013–2014. This payment increase coincides with the Units 3 and 4 EPU going into service and the lien date, which took place January 1. When an investment is made in one year, it will not be taxable until the next year. As such, the EPU was the dominant contributor to the rise in property tax payment by FPL. There were no adjustments to the tax payments by reassessments and other actions. FPL does not anticipate any future changes in tax laws, rates, assessed property value, or any other adjustments.

The estimated total economic impact (direct and secondary) to Miami-Dade County, Monroe and Broward counties, and the rest of Florida from FPL operating Turkey Point is nearly $1.7 billion in output and $930 million in gross state product every year. These operations also contribute $479 million in after-tax income to residents of Florida. The nuclear operations and their secondary effects also account for over 8,000 jobs in Florida.

At FPL and Turkey Point, community involvement is a priority as well as a way of life. FPL employees and their families donate thousands of volunteer hours each year to make a difference in their communities. In 2016, employee volunteers contributed more than 85,000 hours in their local community through company-sponsored projects and their own personal volunteer time. Additionally, more than 200 community organizers have employees volunteering on their boards. (NEI 2017b)

3.9.6 Transportation

The Turkey Point site transportation network includes U.S. and interstate highways, multilane divided state highways, and local streets. Miami-Dade County operates public transportation services including rail and bus service. The county also includes air transportation infrastructure including airports, heliports, and a seaplane base; a seaport for commercial freight and passenger service; and an intermodal transportation hub for air, rail, and ship. (NRC 2016a, Section 2.5.2.3)

The primary road network in the vicinity and region are shown in Figure 3.1-3 and Figure 3.1-4. As discussed in Section 3.1.1, the 50-mile region has a highly developed roadway network associated with the populated areas along the coastline. Major roads and highways in the region include US-1, running north and south through Florida City, Homestead, and the city of Miami, where it intersects with I-95. Locally, road access to Turkey Point is via East Palm Drive (SW 344 Street), which is a two-lane road for approximately one-half of its length from the plant to Florida City. East Palm Drive intersects US-1 in Florida City, approximately 9 miles from Turkey Point. FDOT provides average annual daily traffic (AADT) volumes for state roads, including SW 344 Street/East Palm Drive. The 2015 AADT reported two-way traffic volume for the SW 344 Street/Palm Drive traffic FDOT monitoring site closest to Turkey Point was 7,800. The 2016 AADT reported two-way traffic volume for the SW 344 Street/Palm Drive FDOT monitoring site closest to Turkey Point was 10,000. (FDOT 2017b)

The U.S. Transportation Research Board has developed a commonly used indicator called level of service (LOS) to measure how well a highway accommodates traffic flow. LOS is a qualitative assessment of traffic flow and how much delay the average vehicle might encounter during peak hours. LOS categories are defined in the *Highway Capacity Manual* (HCM) (TRB 2010) and listed in Table 3.9-4.

As of 2000, both Palm Drive and US-1 are four-lane roads in the area of the intersection and carry a LOS classification of "B" (FPL 2000b, Section 2.11.2). No additional recent information was available with respect to an LOS classification assignment under current conditions on East Palm Drive (SW 344 Street), where the street becomes a two-lane road. To provide a current evaluation of LOS for East Palm Drive (SW 344 Street), the known AADT traffic volumes were compared to the estimated capacity of a two-lane highway, as presented in the HCM. The HCM notes that the capacity of a two-lane highway under base conditions is 1,700 passenger cars per hour (pc/h) in one direction, with a limit of 3,200 pc/h for the total of the two directions. Because of the interactions between directional flows, when a capacity of 1,700 pc/h is reached in one direction, the maximum opposing flow would be limited to 1,500 pc/h. (TRB 2010) Based on 2015 AADT recorded volumes, East Palm Drive (SW 344 Street) would have an estimated 2015 flow rate of 325 pc/h on average. Based on 2016 AADT recorded volumes, East Palm Drive (SW 344 Street) would have an estimated 2016 flow rate of 447 pc/h on average. Although there was a rise in the AADT count between 2015 and 2016 on East Palm Drive (SW 344 Street), the base condition capacities for a two-lane road are not exceeded, and there should be ample traffic capacity on East Palm Drive (SW 344 Street) in the road area associated with the plant.

In 2008, FPL performed a traffic study analysis of peak hour capacity on Turkey Point area roads in the ER for the potential construction and operation of proposed Units 6 and 7 at Turkey Point. Included in the study was analysis of SW 344 Street west of SW 137th Avenue/Tallahassee Road. At that point in time, peak hour trips were well within the established capacity for the road. During a subsequent site visit, the NRC review team confirmed low use of the roads in the vicinity of Turkey Point through interviews conducted with local and Miami-Dade County authorities and through independent verification on site. The review team concluded that should the proposed project move forward, the traffic on roads surrounding the proposed site would noticeably increase during construction, but with proposed mitigation measures, would not destabilize traffic in the affected area. (NRC 2016a, Section 2.5.2.3)

3.9.7 Recreational Facilities

As depicted in Figure 3.1-5, there are number of recreational areas that fall within the vicinity of PTN. The vicinity partially includes Biscayne National Park and Biscayne Bay Aquatic Preserve. The natural attractions of Biscayne Bay drew an estimated 54 percent of Miami-Dade County residents over a 12-month period. The Biscayne Bay Aquatic Preserve management plan also estimates there were 10,288,484 visitors to Miami-Dade County in 2004, with 6,832,112 visitors who used Biscayne Bay water for recreation. (FDEP 2017f) The NPS reported that half a million visitors accessed Biscayne National Park (NPS 2017e). The Homestead-Miami Speedway is located approximately 5 miles west-northwest of PTN and has a capability of seating 55,000 guests in the grandstand for facility events. (HMS 2017)

Local parks that fall within the vicinity include the Homestead Bayfront Park and the Homestead Sport Complex. The Homestead Bayfront Park is a paid-entry Miami-Dade County public facility with a restaurant, boat docking, and marina services (MDC 2017f). Owned by the city of Homestead, the most recent use for the Homestead Sports Complex was to temporarily provide housing for the Homestead Police Department. The facility is also included as a venue for the Homestead Little League. (MH 2017; HLL 2017)

Table 3.9-1
Housing Statistics for Miami-Dade County, 2000–2015

Name	2000	2010	2000–2010 % Change	2015 Estimate[(a)]	2010–2015 % Change
Total housing units	852,278	989,447	16.1	998,833	0.9
Occupied units	776,774	867,362	11.7	842,153	-2.9
Vacant units	75,504	122,085	61.7	156,680	28.3
Vacancy rate (%)	8.9	12.3	3.5	15.7	3.3
Median house value ($)	124,000	269,600[(b)]	117.4	203,300	-24.6
Median rent ($/month)	647	1,004[(b)]	55.2	$1,112	10.8

(USCB 2017d)

a. American Community Survey 2011–2015 5-year estimate.
b. American Community Survey 2006–2010 5-year estimate.

Table 3.9-2
Public Water Supply Systems, Miami-Dade County

Public Water Supply System	2014 Population Served	Existing Well Field Installed Capacity[(a)]	Existing Water Treatment Facility Installed Capacity[(a)]	Capacity Utilization (%)
MDWASD	2,243,879	682.44	497.19	72.85
City of North Miami	91,000	14.96	9.3	62.17
City of North Miami Beach	163,962	39.97	32	80.06
City of Homestead	65,000	16.99	16.9	99.47
Florida City	9,700	4	4	100.00

(MDWASD 2017)

a. Measured in MGD.

Table 3.9-3
Turkey Point Property Tax Payments 2012–2016

	2012	2013	2014	2015	2016
FPL total property tax paid (real and tangible personal property)	$15,651,284	$38,323,568	$48,493,514	$48,081,261	$46,466,750
Fossil Units 1-2	$1,339,433	$941,380	$583,403	$2,063,697	$2,018,405
Gas Unit 5	$7,658,639	$7,769,143	$7,315,900	$7,021,587	$6,565,399
Nuclear Units 3-4	$6,653,212	$29,613,045	$40,594,211	$38,995,977	$37,882,946
Miami-Dade County operating property tax revenues (actual)	$1,297,333,000	$1,264,643,000	$1,351,331,000	$1,468,496,000	$1,585,671,000
Miami-Dade County school property tax (levied)	$1,525,140,000	$1,584,376,000	$1,647,236,000	$1,872,320,000	$1,995,314,000
Percent payment assigned to county	51.8	51.6	52.0	52.3	53.4
Percent payment assigned to school district	42.6	43.2	42.8	42.7	41.7
Percent payment assigned to special districts	5.6	5.2	5.1	4.9	4.9

(MDC 2017c; MDC 2017d; MDCPS 2017)

Table 3.9-4
Level of Service Definitions

Level of Service	Conditions
A	Free flow of the traffic stream; users are mostly unaffected by the presence of other vehicles.
B	Free flow of the traffic stream, although the presence of other vehicles becomes noticeable. Drivers have slightly less freedom to maneuver.
C	The influence of the traffic density on operations becomes marked and queues may be expected to form. The ability to maneuver with the traffic stream is clearly affected by other vehicles.
D	The ability to maneuver is severely restricted due to traffic congestion. Travel speed is reduced by the increasing volume. Only minor disruptions can be absorbed without extensive queues forming and the service deteriorating.
E	Operations at or near capacity, an unstable level. The densities vary, depending on the free-flow speed. Vehicles are operating with the minimum spacing (or gaps) for maintaining uniform flow. Disruptions cannot be dissipated readily, often causing queues to form and service to deteriorate to LOS F.
F	Forced or breakdown of flow. It occurs either when vehicles arrive at a rate greater than the rate at which they are discharged or when the forecast demand exceeds the computed capacity. Queues form behind these breakdowns. Operations within queues are highly unstable, with vehicles experiencing brief periods of movement followed by stoppages.

(TRB 2010)

3.10 Human Health

This section describes site conditions likely to contribute to the occurrence of pathogenic thermophillic microbiological organisms, methodology and procedures designed to meet the regulatory requirements and standards for limiting potential induced current hazards arising from energized in-scope transmission lines, and a description of the plant's radiological health environment and preventative measures necessary to reduce potential exposure levels to plant workers and visitors during plant operations.

3.10.1 Microbiological Hazards

The NRC considered health impacts from thermophilic organisms posed to both the public and plant workers, because ideal conditions for thermophilic bacteria can result from nuclear facility operations and discharges. The NRC designated public health impacts resulting from thermophilic organisms a Category 2 issue requiring plant specific analysis. Information considered is whether the discharges, and the fresh water and flow conditions of the receiving waters, exhibit characteristics conducive to the survival of thermophilic organisms in public waters. Microbiological hazards to plant workers are designated a Category 1 issue by the NRC because they are expected to be controlled through the industrial hygiene practices. (NRC 2002a, Section 4.1; NRC 2013a, Summary and Section 3.9)

The GEIS discussion of microbiological hazards focuses on the thermophilic microorganisms *Legionella* spp. (which can be a hazard in cooling towers) and the pathogenic amoeba, *Naegleria fowleri* (which can be a hazard in cooling water discharges) (NRC 2013a, Section 3.9.3). *Naegleria fowleri* and *Legionella* spp. are freshwater organisms (CDC 2017a; CDC 2017b).

PTN discharges to the cooling canals of the IWW facility and does not have cooling towers. The IWW facility receives heated effluent from the plant and is permitted for discharges to the underlying groundwater only with no discharges to surface water. The cooling canals are owner-controlled and closed to the public. Thus, the receiving waters for PTN's thermal discharge are not public waters, and there is no discharge from the cooling canals to surrounding surface waters, public or not. However, FPL employees and contractors work in the cooling canals (aquatic weed removal, berm and canal maintenance, and environmental monitoring). As mentioned above, both *Naegleria fowleri* and *Legionella* spp. are freshwater organisms. As discussed in Section 3.6.1.4.5, the annual average salinity in the cooling canals gradually increased from approximately 34 PSU in the early 1970s to approximately 70 PSU in 2013.

In the 2016 CO between FPL and the FDEP, FPL entered into an agreement to achieve a CCS average annual salinity of at or below 34 PSU ("threshold") at the completion of the fourth year of freshening activities, which are authorized by the Turkey Point site certification modification (FDEP 2016b). The anticipated average annual salinity level for the proposed SLR term would be 34 PSU. In comparison, fresh water's PSU is nearly 0.0, while ocean water averages 35 PSU (NOAA 2017c).

The *Legionella* spp. infection is considered a respiratory disease (CDC 2017a; NRC 2013a) and the route of exposure would be inhalation or aspiration. No pathway for inhalation exposure from aerosol production (such as spray nozzles or cooling towers) exists within the canal system. *Naegleria fowleri* infection requires the waterborne organism to enter through the nasal passages (CDC 2017b; NRC 2013a). Restrictions against swimming and fishing in the cooling canals preclude both direct contact and ingestion routes. Work within the cooling canals would subject to the PTN occupational safety program, which includes hazards assessments, work procedures, and personal protective equipment.

3.10.2 Electric Shock Hazards

PTN in-scope transmission lines connect to a shared switchyard (which also services Turkey Point Units 1, 2, and 5). Due to the shared status of the switchyard, it was not feasible to characterize any of the lines from the switchyard as being specifically dedicated for use by PTN. FPL analyzed all eight lines to confirm compliance with NESC clearance standards for limiting electrical shock hazards. (FPL 2000b, Section 4.13) The NESC standard for "steady-state" current of 5-milliamperes (mA) continued to be the standard during NRC's analysis for the 2013 GEIS (NRC 2013a, Section 4.9.1.1.5), and the NESC's 5-year review cycle for the 2017 edition of standards did not revise the standard, NESC 234 G.3 (NESC 2016; Idaho Power 2017). Therefore, the initial license renewal analysis is adopted for the SLR and is summarized below.

The NESC standards limit transmission line “steady-state” current due to electrostatic effects to 5-mA root mean square (rms). This electrostatic effect limit must be considered for the largest anticipated vehicle or piece of equipment that might be placed under the line and subjected to a potential short-circuit to ground. (FPL 2000b, Section 4.13.1) The Turkey Point analysis considered the lines from the plant’s main transformers to the switchyard. It took into account the FDOT limits on vehicle size and utilized a hypothetical 53-foot long by 13.5-foot high by 8.5-foot wide semi tractor-trailer. It determined the minimum vertical roadbed clearance is 38.1 feet when ambient temperatures are 120°F. (FPL 2000b, Section 4.13.2; NRC 2002a, Section 4.2.1)

The Electric Power Research Institute (EPRI) guidance methodology was utilized to perform the calculation of maximum short-circuit current. Worst-case parameters (voltage, current, conductor position) were input to the EZEMF computer program to determine the maximum electrical field strength 1 meter above the road. The position of the tractor trailer was perpendicular to the phase conductors and the maximum short-circuit current was calculated assuming the maximum electric field value was applied to the entire length of the truck. The resulting value of this calculation was 2.00 kV per meter (kV/m). The resulting maximum steady-state short circuit current was 1.60 mA rms. The lines connecting the plant to the switchyard are in compliance with the NESC requirements. Similar calculations were conducted for the lines leaving the switchyard, and they too were determined to be below the allowable 5 mA rms. (FPL 2000b, Section 4.13.2)

In addition, Turkey Point has a procedure which addresses Occupational Safety and Health Administration (OSHA) requirements related to personal protective equipment, equipment use, and checklists to be considered when working in high voltage grounding areas.

3.10.3 Radiological Hazards

The radiological environmental monitoring program (REMP) for PTN is conducted by the Florida Department of Health (DOH) Bureau of Radiation Control per an agreement between FPL and the DOH and at a frequency described within the ODCM. This program carefully monitors and documents radiological impacts to the members of the public and site employees by measuring radiation and radioactive materials with the highest potential exposure pathways and confirming measurable concentrations of radioactive effluent releases do not exceed expected concentrations within the environment. This ensures the plant conforms to 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operation" (PTN 2015b). The DOH monitors potential exposure pathways by collecting samples of air, water, aquatic biota, and milk and food products, and by measuring direct radiation exposure using thermoluminescent dosimetry at various sampling locations for each media within a 5-mile radius of the plant. Control samples are collected from areas not subject to the influence of PTN or any other nuclear facility, while indicator samples are obtained from areas where environmental radiation levels could increase as a result of station operations. FPL utilizes an inter-laboratory comparison program, thus ensuring precise and accurate sample measurements. Any laboratory may provide samples for the inter-laboratory comparison program provided the sample preparation radioisotopes are traceable to the National Institute of Standards and Technology (PTN 2017a).

Annual radiological environmental operating reports for PTN contain the results of the monitoring program performed for the previous year for documentation to the NRC. The results for years 2011–2016 were considered for this review. Each year's measurements (attained by the Florida DOH) verified the dose commitment to members of the public resulting from operations at PTN were well within the "as low as reasonably achievable" (ALARA) criteria established by 10 CFR Part 50, Appendix I, and no adverse trends in the radiological environment were identified. (PTN 2012b; PTN 2013b; PTN 2014c; PTN 2015b; PTN 2016b; PTN 2017b)

The annual radiological environmental operating report for year 2016 (PTN 2017b) reported the following:

- No abnormal air particulate and radioiodine releases occurred, and the previous years were reported to be similar.
- Tritium was found at 2 of 24 indicator locations and 1 of 12 control locations. The results were well below the required reporting level.
- No nuclides attributable to station operation were found in food or sediment samples.
- Cesium-137 was detected in broad leaf vegetation at indicator locations. Concentrations were well below the reporting level and are likely attributable to other historic source incidents within the area.

- Florida DOH does not show adverse trends in levels of radioactive materials in unrestricted locations.
- Results have remained relatively constant with no adverse trends over time.

3.10.3.1 Liquid and Gaseous Effluent Releases

A description of the PTN radwaste system is presented in Section 2.2.6. Normal liquid and gaseous release pathways are continuously monitored to ensure that potential doses to the general public would remain within the allowable limits of 10 CFR Part 20 and 10 CFR Part 50, Appendix I. The controls for limiting the release of radiological liquid and gaseous effluents are described in Section 1.3.3 of the 2017 updated final safety analysis report (UFSAR). Offsite dose calculation methods and assumptions for a LOCA are documented within Appendix 14F with revisions captured in Section 14.3.5 in the 2017 UFSAR update. Controls are based on (1) concentrations of radioactive materials in liquid and gaseous effluents and projected dose or (2) dose commitment to a hypothetical member of the public, with consideration of background levels and other source inputs (FPL 2017b).

Nuclear power plants are required to submit an annual report to the NRC that lists the types and quantities of radioactive effluents released into the environment, per regulation 10 CFR 50.36(a). Based on review of PTN annual radioactive effluent release reports for the years 2011–2016 (PTN 2012a; PTN 2013a; PTN 2014b; PTN 2015a; PTN 2016a; PTN 2017a), doses to members of the public were a fraction of the limits and were in accordance with radiation protection standards identified within 10 CFR Part 50 (Appendix I), 10 CFR Part 20, and 40 CFR Part 190.

Calculations for dose estimates to members of the public are based on radioactive gaseous and liquid effluent release data and atmospheric and aquatic transport models. The liquid waste treatment system is shared by both units at the site, and generally all liquid releases are allocated on a 50/50 basis to each unit respectively. In addition, both units share the gaseous releases from the shared gaseous waste treatment system on a 50/50 basis. (PTN 2017a)

Liquid effluent releases in 2016 resulted from the following sources (PTN 2017a):

- Effluent from liquid radwaste system (PTN chemistry laboratories, containment sumps, floor drains, showers and other miscellaneous sources flow to waste and monitoring hold up tanks. In addition, laundry wastes are segregated into one of two monitor tanks.)
- PTN steam generator blowdown
- Storm drains

Gaseous release effluent concentrations in 2016 detected in onsite air samples were reported to have occurred from the following sources (PTN 2017a):

- Gas decay tanks
- Containment purges
- Refueling water storage tank via vent line
- PTN equipment hatch during outages
- Releases incidental to plant operations

Both liquid and gaseous radioactive effluent releases are monitored with an alarm system that results in automatic termination of radioactive releases (PTN 2017a).

The annual radioactive effluent release report for year 2016 contains detailed information for each type of radioactive discharge and the resultant dose calculations (PTN 2017a).

The following summarizes the calculated dose to a member of the public in an unrestricted area from radioactive gaseous and liquid effluents released during year 2016 (PTN 2017a):

- The total body dose to an offsite public member from radioactive effluents is 4.12E-01 millirem (mrem), which is 1.65E-00 percent of the 25 mrem dose limit specified within 10 CFR Part 190.
- The maximum organ dose to an offsite public member from radioactive effluents is 6.99E-05 mrem, which is 2.80E-04 percent of the 25-mrem dose limit specified within 10 CFR Part 190.
- The maximum air dose from gamma radiation in gaseous effluents is 1.22E-06 mrem dose, which is 1.22E-05 percent of the 10-mrem dose criterion within 10 CFR Part 190.
- The maximum air dose from beta radiation in gaseous effluents is 2.42E-06 mrem dose, which is 1.21E-05 percent of the 20 mrem dose criterion declared within 10 CFR Part 190.

All dose calculations to the public were a fraction of the limits and maintained ALARA. (PTN 2017a, Section 8.0-Table A-5)

As discussed in Section 2.3, no license renewal-related refurbishment activities have been identified. There could be no changes to effluent releases and doses from those described attributed to refurbishment.

3.11 Environmental Justice

This section characterizes the population and demographic makeup, including the identification of minority and low-income individuals, within a 50-mile radius of PTN.

3.11.1 Regional Population

The GEIS presents a population characterization method based on two factors: *sparseness* and *proximity* (NRC 1996b, Section C.1.4). *Sparseness* measures population density and city size within 20 miles of a site and categorizes the demographic information as follows.

Demographic Categories Based on Sparseness

		Category
Most sparse	1.	Less than 40 persons per square mile and no community with 25,000 or more persons within 20 miles.
	2.	40 to 60 persons per square mile and no community with 25,000 or more persons within 20 miles.
	3.	60 to 120 persons per square mile or less than 60 persons per square mile with at least one community with 25,000 or more persons within 20 miles.
Least sparse	4.	Greater than or equal to 120 persons per square mile within 20 miles.

(NRC 1996b, Section C.1.4)

Proximity measures population density and city size within 50 miles and categorizes the demographic information as follows.

Demographic Categories Based on Proximity

		Category
Not close proximity	1.	No city with 100,000 or more persons and less than 50 persons per square mile within 50 miles.
	2.	No city with 100,000 or more persons and between 50 and 190 persons per square mile within 50 miles.
	3.	One or more cities with 100,000 or more persons and less than 190 persons per square mile within 50 miles.
Close proximity	4.	Greater than or equal to 190 persons per square mile within 50 miles.

(NRC 1996b, Section C.1.4)

The GEIS then uses the following matrix to rank the population in the vicinity of the plant as low, medium, or high.

GEIS Sparseness and Proximity Matrix

		Proximity			
		1	**2**	**3**	**4**
Sparseness	**1**			1.3	1.4
	2		2.2	2.3	2.4
	3	3.1	3.2	3.3	3.4
	4	4.1	4.2	4.3	4.4

Low Population Area

Medium Population Area

High Population Area

(NRC 1996b, Figure C.1)

The 2010 census population and TIGER/Line data from the U.S. Census Bureau (USCB) were used to determine demographic characteristics in the vicinity of the site. The data were processed at the state, county, and census block levels using ArcGIS (USCB 2017b; USCB 2017e; USCB 2017f). Census data include people living in group quarters, such as institutionalized and non-institutionalized populations. Examples of institutional populations living in group quarters are correctional institutions (i.e., prisons, jails, and detention centers); nursing homes; mental (psychiatric) hospitals; hospitals or wards for the chronically ill; and juvenile institutions. Examples of non-institutional populations living in group quarters are group homes; college dormitories; military quarters; soup kitchens; shelters for abused women (shelters against domestic violence or family crisis centers); and shelters for children who are runaways, neglected, or without conventional housing.

The 2010 census data indicate that approximately 702,557 people live within a 20-mile radius of the PTN site, which equates to a population density of 559 persons per square mile (USCB 2017f). Based on the GEIS sparseness index, the site is classified as Category 4 with greater than or equal to 120 persons per square mile within 20 miles.

The 2010 census data indicate that approximately 3,472,804 people live within a 50-mile radius of the site, which equates to a population density of 442 persons per square mile (USCB 2017f). Seven communities within a 50-mile radius have a population greater than 100,000 residents (Table 3.11-1). Based on the GEIS proximity index, the site is classified as Category 4, greater than or equal to 190 persons per square mile within 50 miles.

As illustrated in the GEIS sparseness and proximity matrix, the combination of sparseness Category 4 and proximity Category 4 results in the conclusion that the PTN site is located in a high population area.

Miami-Dade County had a 2015 population of 2,693,117 (Table 3.11-2). According to the USCB, the land area of Miami-Dade County is 1,897.72 square miles. The resulting population density of Miami-Dade County is 1,419.1 persons per square mile (USCB 2017b).

The area within a 50-mile radius of PTN partially includes four counties within the state of Florida (Table 3.11-2). According to the 2010 census, the permanent population (not including transient populations) of the entire four counties was approximately 4,639,133 (Table 3.11-2). By 2053, the end of the SLR period, the permanent population (not including transient populations) of the entire four counties is projected to be approximately 6,792,623. For the 2010–2053 projection period, an annual growth rate of approximately 0.89 percent is anticipated for the permanent population in the four counties partially within a 50-mile radius of PTN (FOEDR 2017).

As shown in Table 3.11-2, the total population (including transient populations) of the four counties that are totally or partially included within a 50-mile radius is projected to be approximately 6,890,445 in 2053. The total population (including transient populations) within a 50-mile radius is projected to be 4,916,069 in 2053. (FOEDR 2017; USCB 2017e; USCB 2017f; VFL 2017).

The latest permanent population projections for Florida were obtained from the Office of Economic and Demographic Research, a research arm of the Florida Legislature (FOEDR 2017). County-level permanent population values for the counties within a 50-mile radius of PTN are shown in Table 3.11-2. Transient data for the state of Florida were obtained from the Visit Florida website (VFL 2017).

PTN is located in Miami-Dade County. As shown in Table 3.11-2, the population of Miami-Dade County, Florida, as reported in the 2010 census was 2,496,457. Based on Florida's projected data set (Table 3.11-3), Miami-Dade County's projected permanent population for 2053 is expected to be 3,828,962 (FOEDR 2017). Estimated projected populations and average annual growth rates for Miami-Dade County are shown in Table 3.11-3.

Cities, towns, villages, and census designated places with centers falling within a 50-mile radius are listed in Table 3.11-1. The town nearest to PTN with a census-reported population is Homestead ARB. As shown in Table 3.11-1, its 2010 population was reported at 964 residents.

There are two towns that are wholly or partially located within the site's 6-mile vicinity for which the USCB provides population data. These are Homestead and Homestead ARB with estimated 2015 populations of 64,676 and 1,141 residents, respectively. Seven communities within a 50-mile radius have a population greater than 100,000: Fort Lauderdale (approximately 49 miles), Hialeah (approximately 29 miles), Hollywood (approximately 41 miles), Miami (approximately 25 miles), Miami Gardens (approximately 35 miles), Miramar (approximately 39 miles), and Pembroke Pines (approximately 40 miles). These cities, located in the state of

Florida, have a 2015 population of 173,570; 234,714; 146,791; 424,632; 112,021; 131,384; and 162,243 residents, respectively. A total of 33 additional communities within a 50-mile radius have a population greater than 25,000. (Table 3.11-1)

3.11.2 Minority and Low-Income Populations

3.11.2.1 Background

The NRC performs environmental justice analyses utilizing a 50-mile radius around the plant as the environmental impact area. LIC-203 Revision 3 (NRC 2013c) defines a geographic area for comparison as a 50-mile radius (also referred to as "the region" in this discussion) centered on the nuclear plant. An alternative approach is also addressed that uses an individual state that encompasses the 50-mile radius individually for comparative analysis as the "geographic area." Both approaches were used to assess the minority and low-income population criteria for PTN.

LIC-203 guidance suggests using the most recent USCB decennial census data. However, low-income data are collected separately from the decennial census and are available in 5-year averages. The 2015 low-income and minority census population data and TIGER/Line data for Florida were obtained from the USCB website and processed using ArcGIS software (USCB 2017g). Census population data were used to identify the minority and low-income populations within a 50-mile radius of PTN. Environmental justice evaluations for minority and low-income populations are based on the use of USCB block groups for minority and low-income populations.

3.11.2.2 Minority Populations

NRC procedural guidance defines a minority population as Black or African American, American Indian or Alaska Native, Asian, Native Hawaiian/other Pacific Islander, some other race, two or more races, the aggregate of all minority races, Hispanic or Latino ethnicity, and the aggregate of all minority races and Hispanic ethnicity (NRC 2013c, pages D-4 and D-5). The guidance indicates that a minority population is considered present if either of the following conditions exists:

(1) The minority population in the census block group exceeds 50 percent; or

(2) The minority population percentage is more than 20 percentage points greater in the census block group than the minority percentage of the geographic area chosen for the comparative analysis.

To establish minimum thresholds for each minority category, the minority population total for the state was divided by the total population. This process was repeated with a 50-mile radius total minority population and 50-mile radius total population. As described in the second criterion, 20 percent was added to the minority percentage values for each geographic area. The lower of the two NRC conditions for a minority population was selected as defining a minority area (i.e., census block group minority population exceeds 50 percent, or minority population is more than 20 percent greater than the minority population of the geographic area). Any census block group with a percentage exceeding this value was considered a minority population. Minority percentages and the corresponding criteria for Florida and the region are shown in Table 3.11-4.

A minority category of "Aggregate of All Races" is created when the populations of all the 2015 U.S. census minority categories are summed. As shown in Table 3.11-4, the 2015 "Aggregate and Hispanic" category, when compared to the total population, indicates 78.5 percent of the population in the region are minorities. The "Aggregate and Hispanic" population percentage for Florida is 43.9 percent. Using the Condition 2 approach defined above, where the region is used as the geographic area, any census block group with a combined "Aggregate and Hispanic" population equal to or greater than 98.5 percent (78.5 percent plus 20 percent) would be considered a minority population. Because 98.5 percent exceeds the 50 percent noted for Condition 1, defined above, the lower criterion (50 percent) was used for the threshold. Similarly, the state was evaluated and a series of criteria for each minority and low-income category were defined. When the state is used as the geographic area, any census block group with an "Aggregate and Hispanic" population exceeding 50 percent in Florida would be considered a minority population.

Because Hispanic is not considered a race by the USCB, Hispanics are already represented in the census-defined race categories. However, because Hispanics can be represented in any race category, some white Hispanics not otherwise considered minorities become classified as a minority when categorized in the "Aggregate and Hispanic" category.

The number of census block groups contributing to the minority population count was evaluated using the criteria shown in Table 3.11-4 and summarized in Table 3.11-5. The results of the evaluation are census block groups flagged as having a minority population(s). The resulting maps (Figures 3.11-1, 3.11-2, 3.11-3, 3.11-4, 3.11-5, 3.11-6, 3.11-7, 3.11-8, 3.11-9, 3.11-10, 3.11-11, 3.11-12, 3.11-13, 3.11-14, 3.11-15, and 3.11-16) depict the location of minority population census block groups flagged accordingly for each race or aggregate category. Because no block group met the criteria for the "Native Hawaiian/Other Pacific Islander" race category, no figures illustrating that race category were produced.

The percentage of census block groups exceeding the "Aggregate of All Races" minority population criterion was 20.2 percent when a 50-mile radius was used and 22.4 percent when the individual state was used as the geographic area (Table 3.11-5). For the "Aggregate and Hispanic" category, 81.2 percent of the census block groups contained a minority population when the region was used, and 81.2 percent of the block groups contained minority populations when the individual state was used (Table 3.11-5). The percent of identified minority block groups were significantly reduced when races were analyzed individually.

The identified minority population closest to the PTN center point is located adjacent to the site: Block Group 120860114013. This census block group contained a total of 5,116 people, with 2,199 Black or African American, 367 Asian, 71 Other Race, 142 Two or More Races, and

2095 Hispanic or Latino individuals. Using either the individual state criteria or the regional criteria, the block group was flagged as containing the following minority populations: Black or African American, an Aggregate of All Races, and an Aggregate of All Races and Hispanic population. (USCB 2017e; USCB 2017g) There are seven block groups within a 6-mile radius that meet the criteria for a minority population. There are 1,847 identified minority population block groups located in, partially within, or adjacent to cities, municipalities, or USCB-defined urban areas (USCB 2017c; USCB 2017g). This leaves two block groups that do not fall within or are not immediately adjacent to cities, municipalities, or USCB-defined urban areas (USCB 2017c; USCB 2017g).

As discussed in Section 3.1.3, the Seminole Tribe of Florida, Hollywood Reservation and the Miccosukee Tribe are located in the PTN region. The Seminole Tribe of Florida, Hollywood Reservation location was identified in the analysis as a minority population.

3.11.2.3 Low-Income Populations

NRC guidance defines *low-income* using USCB statistical poverty thresholds for individuals or families (NRC 2013c, pages D-5 and D-6). As addressed above with minority populations, two alternative geographic areas (Florida State individually and the region) were used as the geographic areas for comparison in this analysis. The guidance indicates that a low-income population is considered present if either of the two following conditions exists:

(1) The low-income population in the census block group exceeds 50 percent.

(2) The percentage of households below the poverty level in a block group is significantly greater (typically at least 20 percentage points) than the low-income population percentage of the geographic area chosen for the comparative analysis (i.e., individual state and region's combined average).

To establish minimum thresholds for the individual low-income category, the population with an income below the poverty level for the state was divided by the total population for whom poverty status is determined in the state. To establish minimum thresholds for the family low-income category, the family population count with an income below the poverty level for the state was divided by the total family population count in the state. This process was repeated for the regional population with an income below the poverty level and regional total population for whom poverty status is determined. As described in Condition 2, above, 20 percent was added to the low-income values for individuals and families and each geographic area. None of the geographic areas described in the first condition exceeded 50 percent.

As shown in Table 3.11-6, when the 2011–2015 census data category "income in the past 12 months below poverty level" (individual) is compared to "total population for whom poverty status is determined," 18.6 percent of the population in the region has an individual income below poverty level. In the state of Florida, the percentage of individuals with an income below poverty level is 16.5 percent.

As shown in Table 3.11-6, Florida has an estimated 1,100,556 families living below poverty level. When the 2011–2015 census data family category "income in the past 12 months below poverty level" is compared to "total family count," 18.6 percent of the families within the region have an income below poverty level. In the state of Florida, the percentages of the family population with an income below poverty level is 15.1 percent.

As an example, when Florida is used as the geographic area, any census block group within the region with a low-income population equal to or greater than 36.5 percent of the total block group, the population would be considered a "low-income population" (individual) (Table 3.11-6). Using the appropriate criteria for the individual state (Florida), 283 of the total 2,154 census block groups (13.1 percent) have low-income individual population percentages that meet or exceed the threshold criteria noted in Table 3.11-5. These census block groups are illustrated in Figure 3.11-18 (USCB 2017c; USCB 2017g).

When the region is used as the geographic area, any census block group within a 50-mile radius with populations of low-income individuals equal to or greater than 38.6 percent of the total block group population would be considered a "low-income population." Using this criterion, 241 of the 2,154 census block groups (11.2 percent) were identified as low-income populations within a 50-mile radius of the PTN site, as shown in Figure 3.11-17. (USCB 2017g)

Using the family individual state and regional criteria, provided in Table 3.11-5, 307 and 232 census block groups, respectively, were identified as having low-income families in each criteria. These census block groups are illustrated in Figure 3.11-19 and Figure 3.11-20. (USCB 2017e; USCB 2017g) The closest low-income block group that meets the guidance criteria for individuals or families is located approximately 2.0 miles northwest of the PTN center point. It is Block Group 120860107042. (USCB 2017g)

3.11.3 Subsistence Populations and Migrant Workers

Migrant labor, or migrant worker, is defined by the USDA as "a farm worker whose employment required travel that prevented the migrant worker from returning to his/her permanent place of residence the same day." In 2012, Miami-Dade County reported that 1,318 out of 2,954 total farms employed farm labor. The 2012 Census of Agriculture reported that 106 of the Miami-Dade County farms employed migrant farm workers. For Miami-Dade County, an estimated total of 9,045 farm laborers were hired, of which 3,850 were estimated to work fewer than 150 days per year. (USDA 2017b)

Subsistence refers to the use of natural resources as food for consumption and for ceremonial and traditional cultural purposes, usually by low-income or minority populations. Specific examples of subsistence uses include gathering plants for direct consumption (rather than produced for sale from farming operations) for use as medicine or in ritual practices. Fishing or hunting activities associated with direct consumption or use in ceremonies, rather than for sport, are other examples. Determining the presence of subsistence use can be difficult, as data at the county or block group level are aggregated and not usually structured to identify such uses on or near the site, where any potential impacts arising from the continued operation of PTN would arise.

Local government officials, staff of social welfare agencies, and the Miccosukee Indian Tribe were contacted concerning unusual resource dependencies or practices or health conditions that could result in potentially disproportionate impacts to minority and low-income populations. Contacts with multiple government entities in Miami-Dade County were attempted (FPL 2014a).

Many agencies had no information concerning activities and health issues of minority populations. Interviews were conducted with the Community Action Agency, Miami-Dade Office of Community Advocacy, Miami-Dade County Community and Economic Development, Countywide Healthcare Planning, Metro Miami Action Plan Trust, and the Miami-Dade Black Advisory Board. No agency reported dependencies or practices, such as subsistence agriculture, hunting, or fishing, or preexisting health conditions through which the populations could be disproportionately or adversely affected by the proposed project. Several agencies alluded to the extreme urban nature of the study area and implied that there was no possibility of any subsistence activity on the part of any group (FPL 2014a).

Contact with the Miccosukee Indian Tribe reported that the Indians residing in the reservation within the 50-mile radius do not depend on hunting, fishing, or gardening for subsistence. The Miccosukee Tribe does lease land from the SFWMD for hunting, fishing, frogging, agriculture, and to carry on the traditional Miccosukee way of life. However, most tribal members rely on modern means to meet their food needs (FPL 2014a).

Table 3.11-1
Cities or Towns Located Totally or Partially within a 50-Mile Radius of PTN (Sheet 1 of 5)

City/Town/Census Designated Place	County	2000 Census Population[(a)]	2010 Census Population[(a)(d)]	2015 Census Population[(a)]	Direction to PTN[(b)(c)]	Distance to PTN[(b)(c)]
Aventura	Miami-Dade	25,267	35,762	37,357	NNE	38
Bal Harbour	Miami-Dade	3,305	2,513	2,677	NNE	34
Bay Harbor Islands	Miami-Dade	5,146	5,628	5,921	NNE	34
Biscayne Park	Miami-Dade	3,269	3,055	3,193	NNE	32
Cooper City	Broward	27,939	28,547	33,382	N	43
Coral Gables	Miami-Dade	42,249	46,776	50,059	N	20
Country Club	Miami-Dade	36,310	47,105	48,622	N	35
Cutler Bay	Miami-Dade	N/A	40,286	43,474	N	10
Dania Beach	Broward	20,061	29,639	30,878	NNE	44
Davie	Broward	75,720	91,992	97,372	N	44
Doral	Miami-Dade	20,438	45,709	51,382	N	27
El Portal	Miami-Dade	2,505	2,325	2,492	NNE	30
Florida City	Miami-Dade	7,843	11,245	12,024	W	9
Fort Lauderdale	Broward	152,397	165,521	173,570	NNE	49
Fountainebleau	Miami-Dade	59,549	59,761	55,596	N	23
Golden Beach	Miami-Dade	919	919	709	NNE	39

Table 3.11-1
Cities or Towns Located Totally or Partially within a 50-Mile Radius of PTN (Sheet 2 of 5)

City/Town/Census Designated Place	County	2000 Census Population[(a)]	2010 Census Population[(a)(d)]	2015 Census Population[(a)]	Direction to PTN[(b)(c)]	Distance to PTN[(b)(c)]
Golden Glades	Miami-Dade	32,623	33,140	33,806	NNE	34
Goulds	Miami-Dade	7,453	10,103	10,909	NNW	9
Hallandale Beach	Broward	34,282	37,113	38,725	NNE	39
Hialeah	Miami-Dade	226,419	224,667	234,714	N	29
Hialeah Gardens	Miami-Dade	19,297	21,744	23,092	N	30
Hollywood	Broward	139,357	140,768	146,791	NNE	41
Homestead	Miami-Dade	31,909	60,509	64,676	WNW	9
Homestead ARB	Miami-Dade	446	964	1,141	NW	6
Indian Creek	Miami-Dade	33	86	60	NNE	33
Islamorada, Village of Islands	Monroe	6,846	6,119	6,386	SSW	40
Kendale Lakes	Miami-Dade	56,901	56,148	59,354	NNW	19
Kendall	Miami-Dade	75,226	75,371	76,267	N	17
Kendall West	Miami-Dade	38,034	36,154	39,347	NNW	20
Key Biscayne	Miami-Dade	10,507	12,344	12,888	NNE	21
Key Largo	Monroe	11,886	10,433	10,496	SSW	25
Lauderdale Lakes	Broward	31,705	32,593	34,103	N	51

Table 3.11-1
Cities or Towns Located Totally or Partially within a 50-Mile Radius of PTN (Sheet 3 of 5)

City/Town/Census Designated Place	County	2000 Census Population[(a)]	2010 Census Population[(a)(d)]	2015 Census Population[(a)]	Direction to PTN[(b)(c)]	Distance to PTN[(b)(c)]
Lauderhill	Broward	57,585	66,887	69,979	N	49
Leisure City	Miami-Dade	22,152	22,655	25,952	NW	7
Medley	Miami-Dade	1,098	838	998	N	28
Miami	Miami-Dade	362,470	399,508	424,632	NNE	25
Miami Beach	Miami-Dade	87,933	87,778	91,564	NNE	28
Miami Gardens	Miami-Dade	2,706	107,166	112,021	N	35
Miami Lakes	Miami-Dade	22,676	29,361	30,728	N	33
Miami Shores	Miami-Dade	10,380	10,493	10,784	NNE	31
Miami Springs	Miami-Dade	13,712	13,809	14,397	N	27
Miramar	Broward	72,739	122,041	131,384	N	39
Naranja	Miami-Dade	4,034	8,303	9,392	NW	8
North Bay Village	Miami-Dade	6,733	7,137	7,689	NNE	30
North Key Largo	Monroe	1,049	1,244	1,024	S	12
North Miami	Miami-Dade	59,880	58,912	62,042	NNE	33
North Miami Beach	Miami-Dade	40,786	41,523	43,489	NNE	36
Opa-locka	Miami-Dade	14,951	15,219	16,139	N	33

Table 3.11-1
Cities or Towns Located Totally or Partially within a 50-Mile Radius of PTN (Sheet 4 of 5)

City/Town/Census Designated Place	County	2000 Census Population[(a)]	2010 Census Population[(a)(d)]	2015 Census Population[(a)]	Direction to PTN[(b)(c)]	Distance to PTN[(b)(c)]
Palmetto Bay	Miami-Dade	N/A	23,410	24,443	N	13
Pembroke Park	Broward	6,299	6,102	6,244	NNE	39
Pembroke Pines	Broward	137,427	154,019	162,243	N	40
Pinecrest	Miami-Dade	19,055	18,223	19,174	N	16
Plantation	Broward	82,934	84,955	89,904	N	48
Princeton	Miami-Dade	10,090	22,038	26,992	NW	9
Richmond West	Miami-Dade	28,082	31,973	35,693	NNW	14
South Miami	Miami-Dade	10,741	11,657	12,156	N	19
South Miami Heights	Miami-Dade	33,522	35,696	38,255	NNW	12
Southwest Ranches	Broward	N/A	7,345	7,676	N	43
Sunny Isles Beach	Miami-Dade	15,315	20,832	21,837	NNE	38
Sunrise	Broward	85,779	84,439	89,942	N	50
Surfside	Miami-Dade	4,909	5,744	5,987	NNE	33
Sweetwater	Miami-Dade	14,226	13,499	20,739	N	23
Tamiami	Miami-Dade	54,788	55,267	57,195	NNW	23
The Hammocks	Miami-Dade	47,379	51,003	55,713	NNW	18

Table 3.11-1
Cities or Towns Located Totally or Partially within a 50-Mile Radius of PTN (Sheet 5 of 5)

City/Town/Census Designated Place	County	2000 Census Population[(a)]	2010 Census Population[(a)(d)]	2015 Census Population[(a)]	Direction to PTN[(b)(c)]	Distance to PTN[(b)(c)]
University Park	Miami-Dade	26,538	26,995	25,870	N	22
Virginia Gardens	Miami-Dade	2,348	2,375	2,957	N	26
West Little River	Miami-Dade	32,498	34,699	30,749	N	30
West Miami	Miami-Dade	5,863	5,965	6,400	N	23
West Park	Broward	N/A	14,156	14,779	NNE	39
Westchester	Miami-Dade	30,271	29,862	30,585	N	22
Weston	Broward	49,286	65,333	68,423	N	46

N/A = No available data.

a. (USCB 2017a)
b. (USDOT 2016)
c. Distance and direction are approximate and measured in miles from the PTN center point to the city center or U.S. census place centroid.
d. 2010 USCB count was revised for specific municipalities; see 2010 census count resolution.

Table 3.11-2
County Populations Totally or Partially Included within a 50-Mile Radius of PTN

State and County	2000 Population[a]	2010 Population[a]	2015 Population Estimate[a]	2053 Projected Permanent Population[b]	2053 Projected Total Population[b]
Florida (four counties)	4,207,346	4,639,133	5,024,329	6,792,623	6,890,445
Broward	1,623,018	1,748,066	1,896,425	2,330,780	2,364,346
Collier	251,377	321,520	357,305	555,399	563,397
Miami-Dade[c]	2,253,362	2,496,457	2,693,117	3,828,962	3,884,104
Monroe	79,589	73,090	77,482	77,482	78,598

a. (USCB 2017b)
b. (VFL 2017)
c. The Miami-Dade County 2010 USCB count was revised on October 18, 2012. See 2010 census count resolution (USCB 2017b).

Table 3.11-3
Miami-Dade County, Florida, Population Growth, 2010–2053

	2010[a]	2015	2020	2030	2040	2050	2053
Population	2,496,457	2,693,117	2,832,036	3,155,342	3,423,646	3,738,900	3,828,962
Average Annual Growth %		1.53	1.01	1.09	0.82	0.88	0.80

(USCB 2017b; VFL 2017)

a. The Miami-Dade County 2010 USCB count was revised on October 18, 2012; see 2010 census count resolution (USCB 2017b).

Note: Projected population values are based on the population projection growth trend for the years reported by the Florida Demographic Estimating Conference (FOEDR 2017).

Table 3.11-4
Minority Populations Evaluated Against Criterion

Geographic Area	Florida[a]			50-Mile Radius (Region)[b]		
Total Population	**19,645,772**			**3,709,070**		
Census Categories	**State Population by Census Category[a]**	**Percent[c]**	**Criteria**	**Regional Population by Census Category[b]**	**Percent[c]**	**Criteria**
Black or African American	3,171,108	16.1	36.1	776,146	20.9	40.9
American Indian or Alaska Native	54,569	0.3	20.3	6,533	0.2	20.2
Asian	509,085	2.6	22.6	81,942	2.2	22.2
Native Hawaiian/Other Pacific Islander	11,024	0.1	20.1	1,170	0.03	20.03
Some Other Race	493,202	2.5	22.5	100,520	2.7	22.7
Two or More Races	472,082	2.4	22.4	67,284	1.8	21.8
Aggregate of All Races	4,711,070	24.0	44.0	1,033,595	27.9	47.9
Hispanic or Latino	4,660,733	23.7	43.7	2,067,575	55.7	50.0
Aggregate and Hispanic[d]	8,632,023	43.9	50.0	2,912,470	78.5	50.0

a. (USCB 2017e)
b. (USCB 2017g)
c. Percent values were calculated by dividing each census minority category's population by the state or region total population values.
d. Includes everyone except persons who identified themselves as White, not Hispanic or Latino (NRC 2013c).

Table 3.11-5
Minority and Low-Income Census Block Group Counts, 50-Mile Radius of PTN

	Individual State Method		50-Mile Radius (Region)	
	Census Block Groups		Census Block Groups	
Total Number of Block Groups with Population within 50-mi Radius	**2,154**		**2,154**	
Census Categories	**Number of Block Groups with Identified Minority and Low Income Category**	**Percentage of Block Groups within Region**	**Number of Block Groups with Identified Minority and Low Income Category**	**Percentage of Block Groups within Region**
Black or African American	459	21.3	426	19.8
American Indian or Alaska Native	1	0	1	0
Asian	8	0.4	8	0.4
Native Hawaiian/Other Pacific Islander	0	0	0	0
Some Other Race	22	1	21	1
Two or More Races	3	0.1	4	0.2
Aggregate of All Races	482	22.4	436	20.2
Hispanic or Latino	1,217	56.5	1,074	49.9
Aggregate and Hispanic	1,748	81.2	1,748	81.2
Low Income (Individuals)	283	13.1	241	11.2
Low Income (Families)	307	14.3	232	10.8

(USCB 2017g; USCB 2017c)

Table 3.11-6
Low-Income Population Criteria Using Two Geographic Areas

	Florida[(a)]			50-Mile Radius (Region)[(b)]		
(Income) Total Population	**19,228,208**			**3,661,606**		
(Income) Total Families	**7,300,494**			**1,219,131**		
Census Category	**State Population by Census Category**	**Percent[(c)]**	**Criteria**	**State Population by Census Category**	**Percent[(c)]**	**Criteria**
Low Income–Number of Persons Below Poverty Level	3,180,109	16.5	36.5	681,443	18.6	38.6
Low Income–Number of Families Below Poverty Level	1,100,556	15.1	35.1	226,724	18.6	38.6

a. (USCB 2017e)
b. (USCB 2017g)
c. Percent values were calculated by dividing each census category's population by the state and regional total population values.

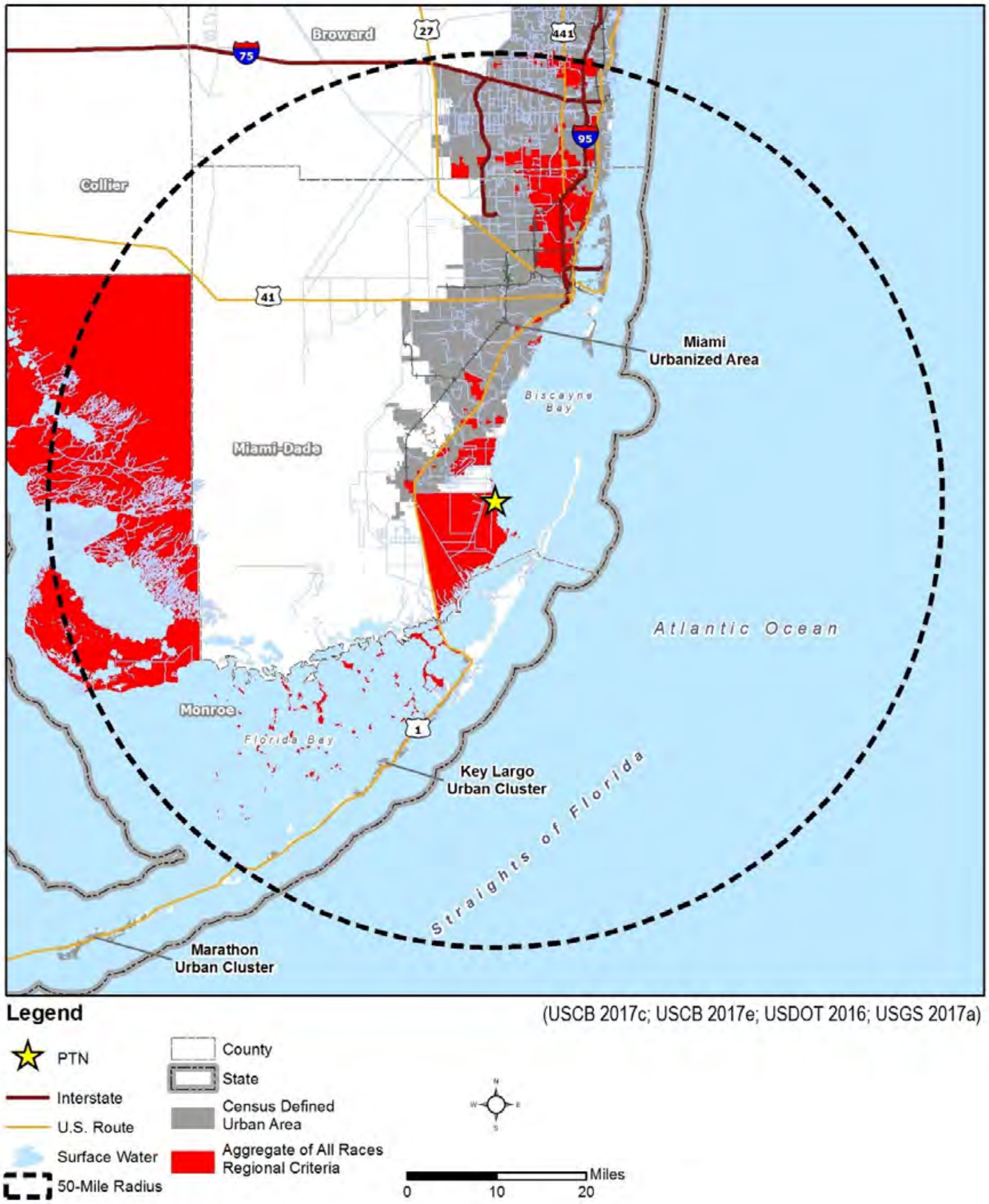

Figure 3.11-1
Census—Aggregate of All Races Populations (Regional)

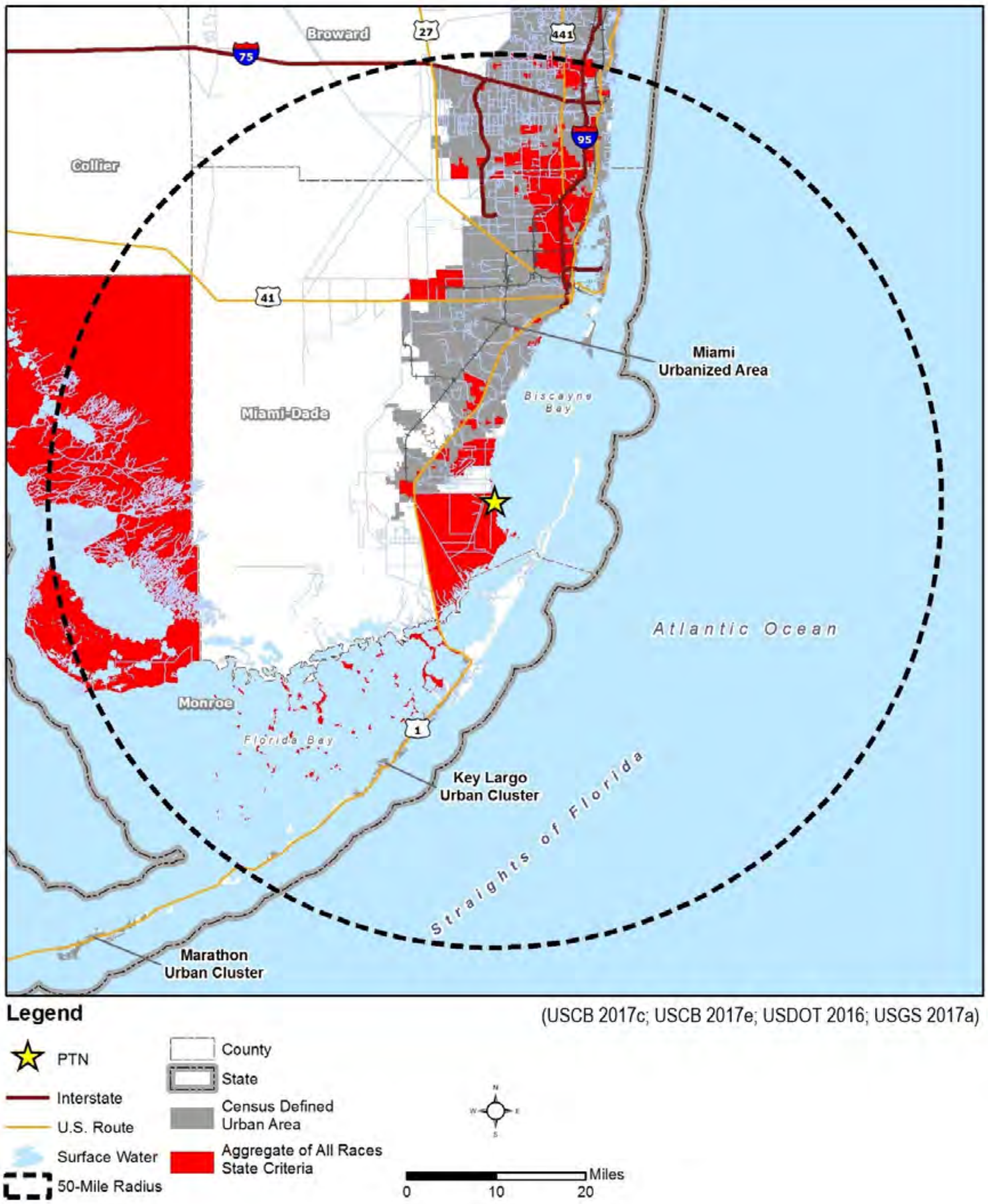

Figure 3.11-2
Census—Aggregate of All Races Populations (Individual State)

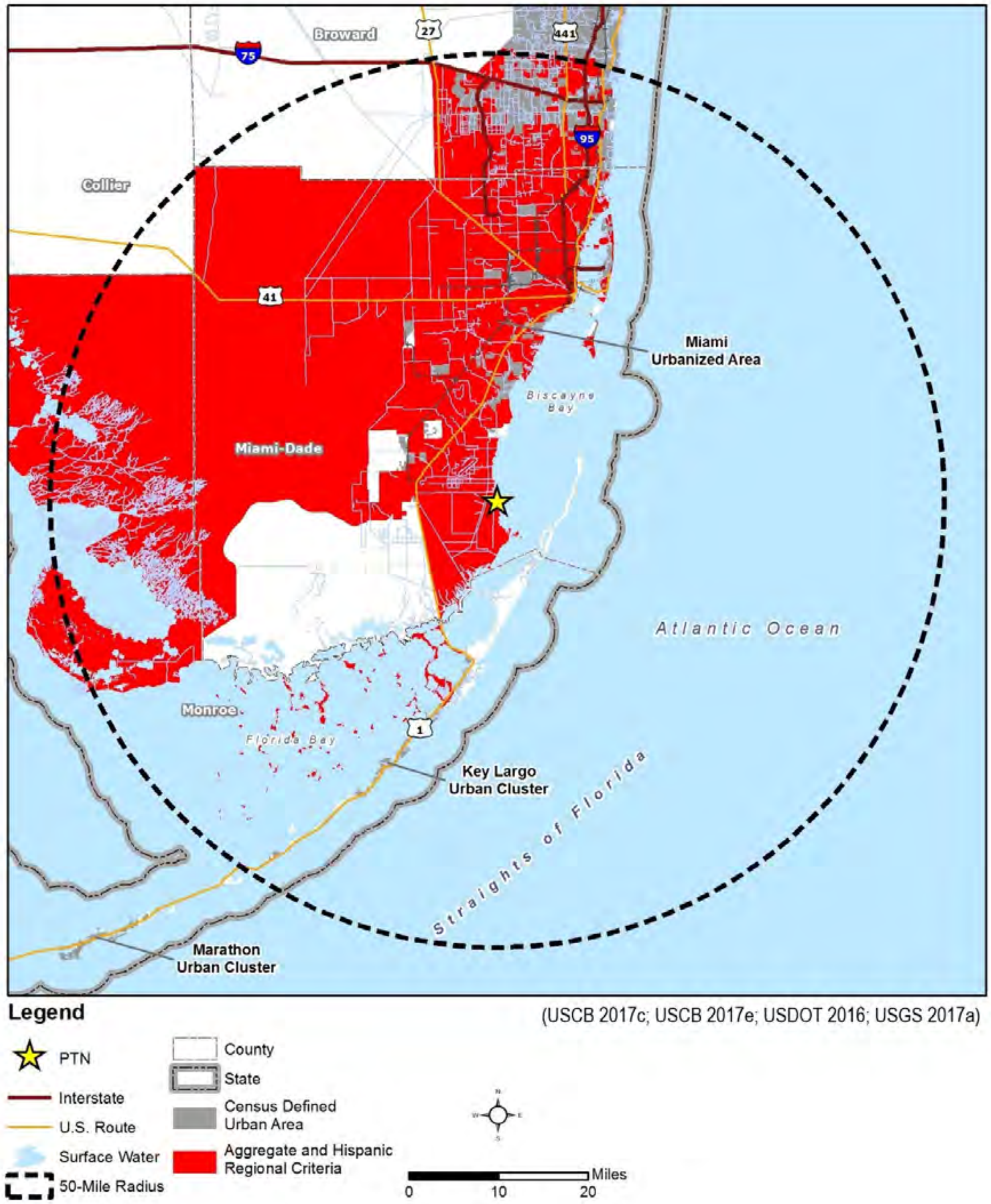

Figure 3.11-3
Census—Aggregate and Hispanic Populations (Regional)

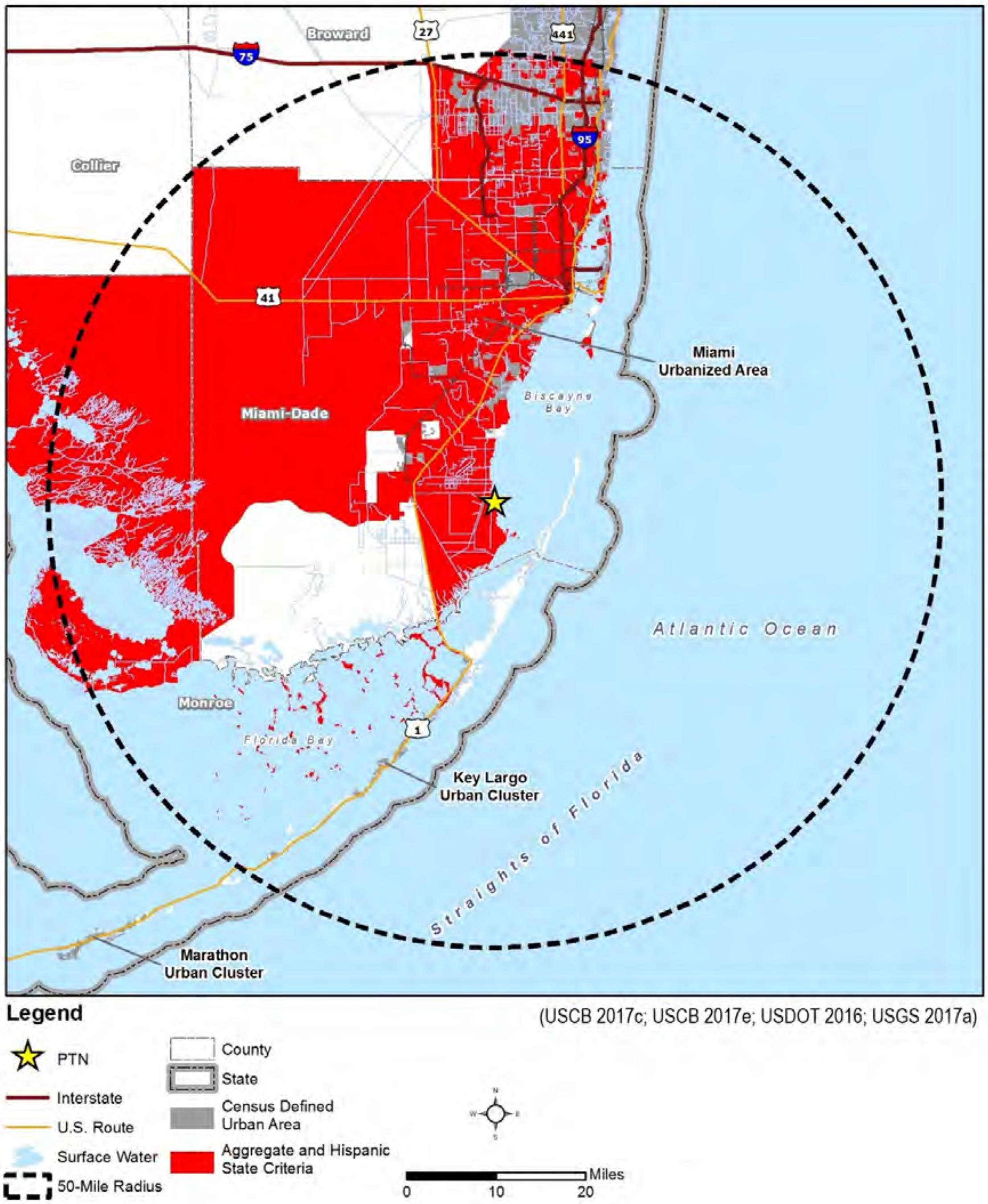

Figure 3.11-4
Census—Aggregate and Hispanic Populations (Individual State)

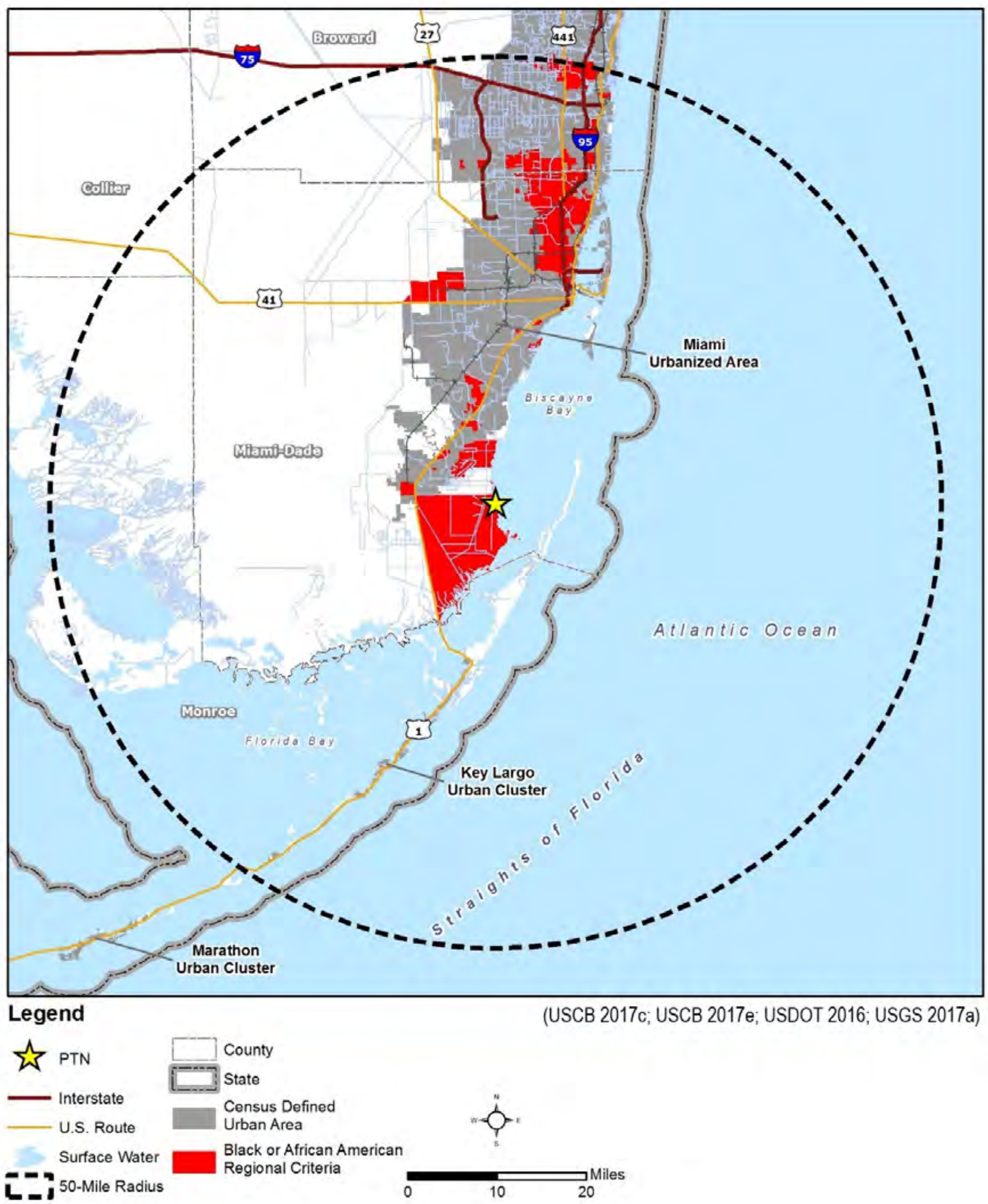

Figure 3.11-5
Census—Black or African American Populations (Regional)

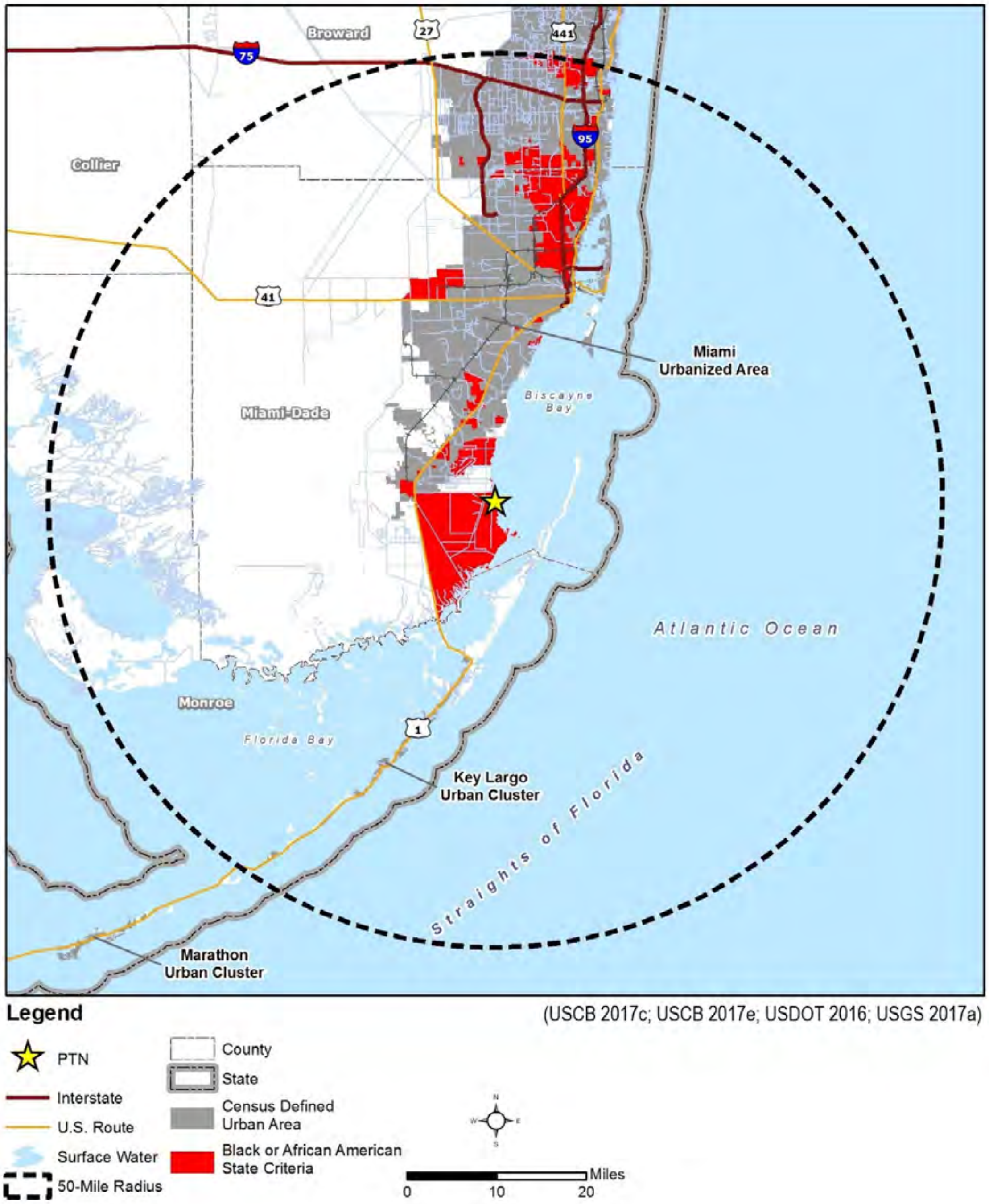

Figure 3.11-6
Census—Black or African American Populations (Individual State)

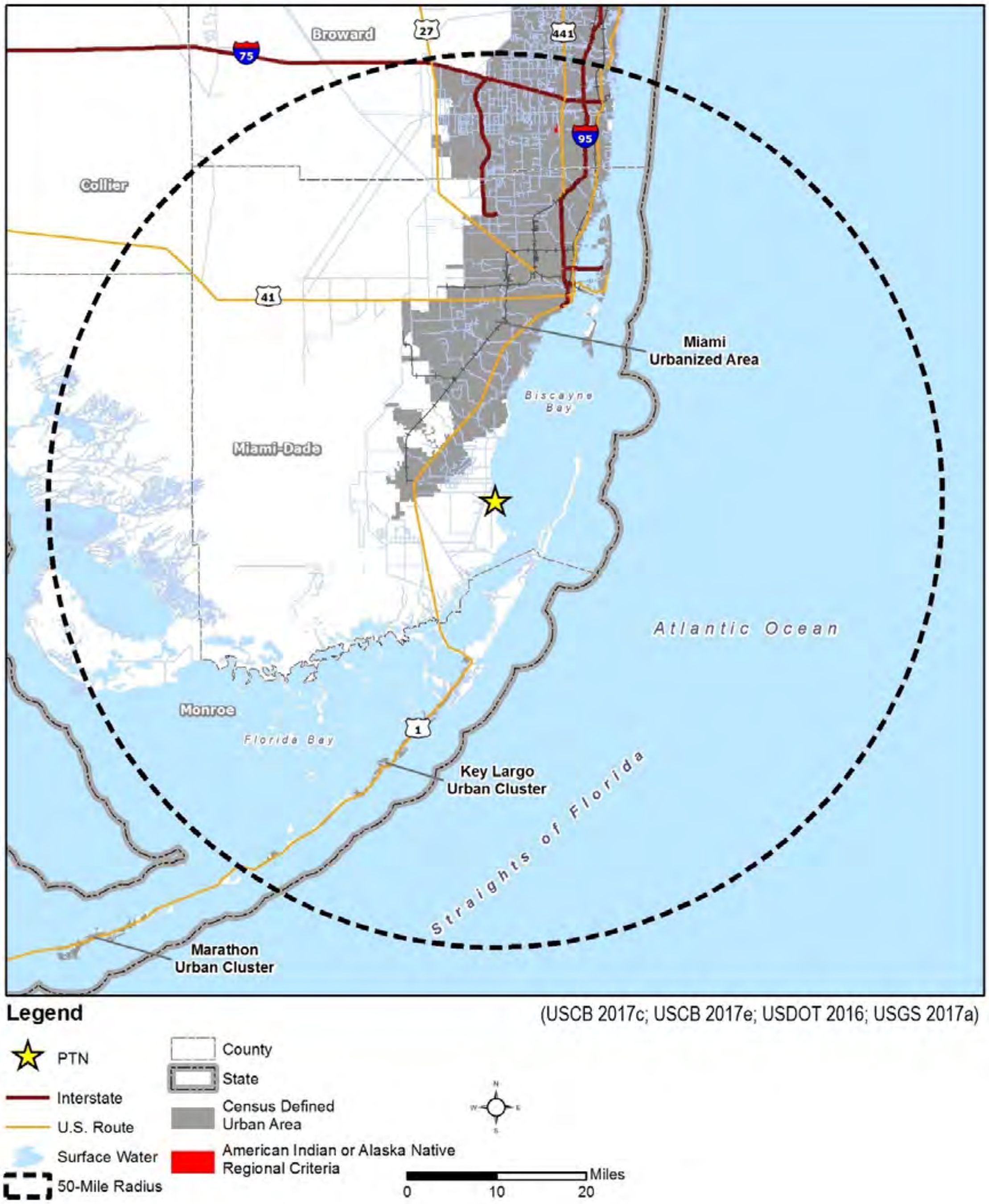

Figure 3.11-7
Census—American Indian or Alaska Native (Regional)

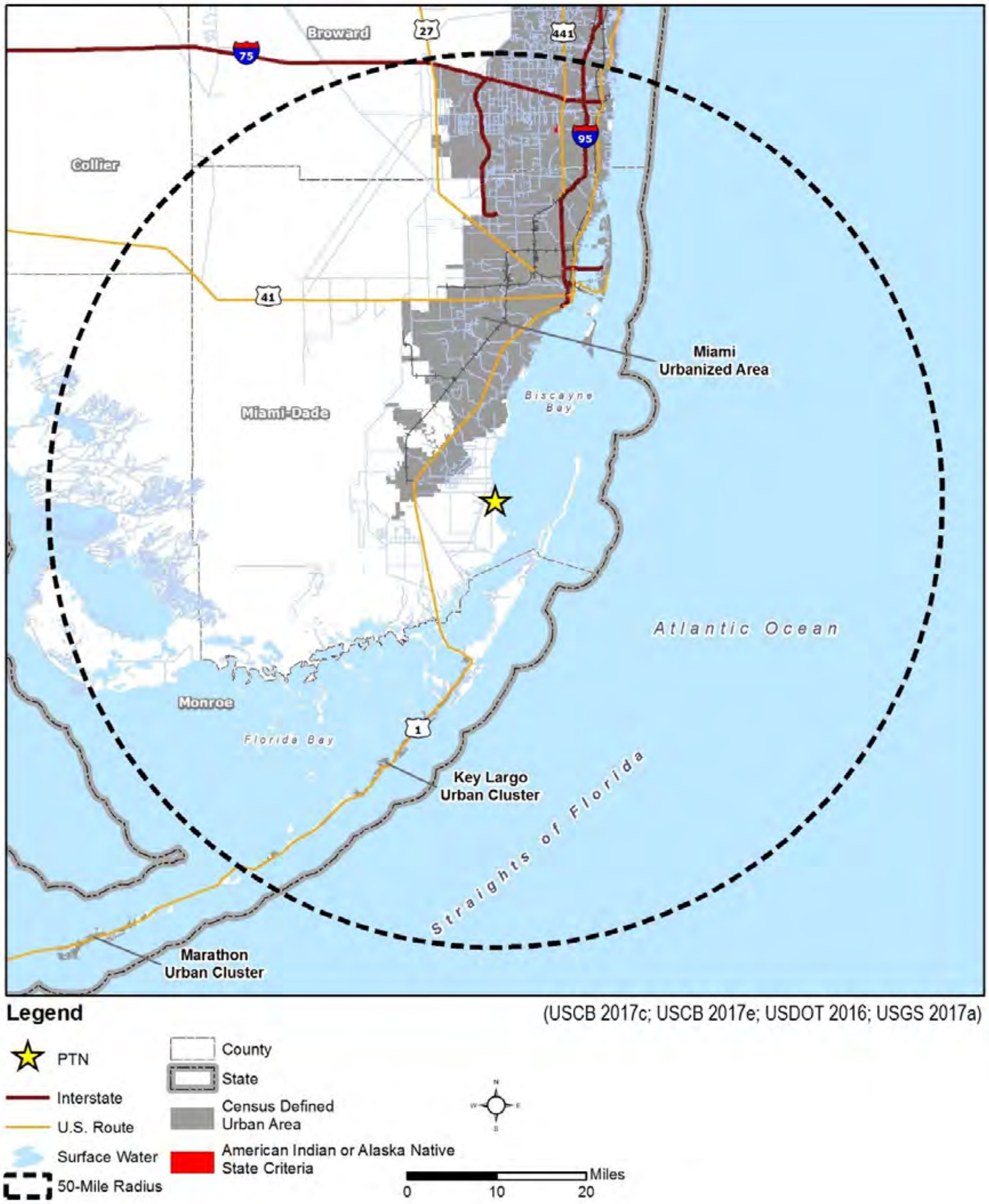

Figure 3.11-8
Census—American Indian or Alaska Native (Individual State)

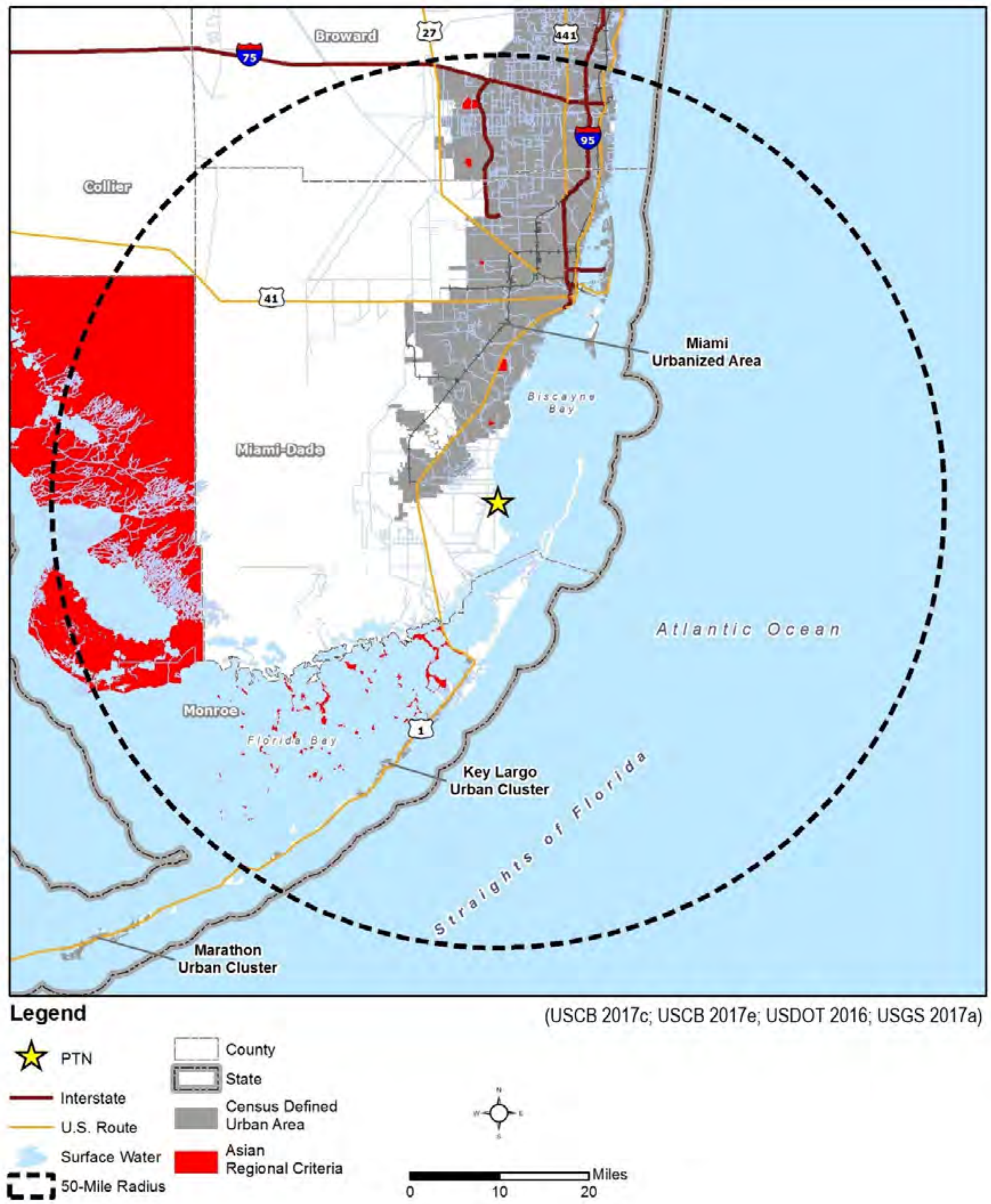

Figure 3.11-9
Census—Asian Populations (Regional)

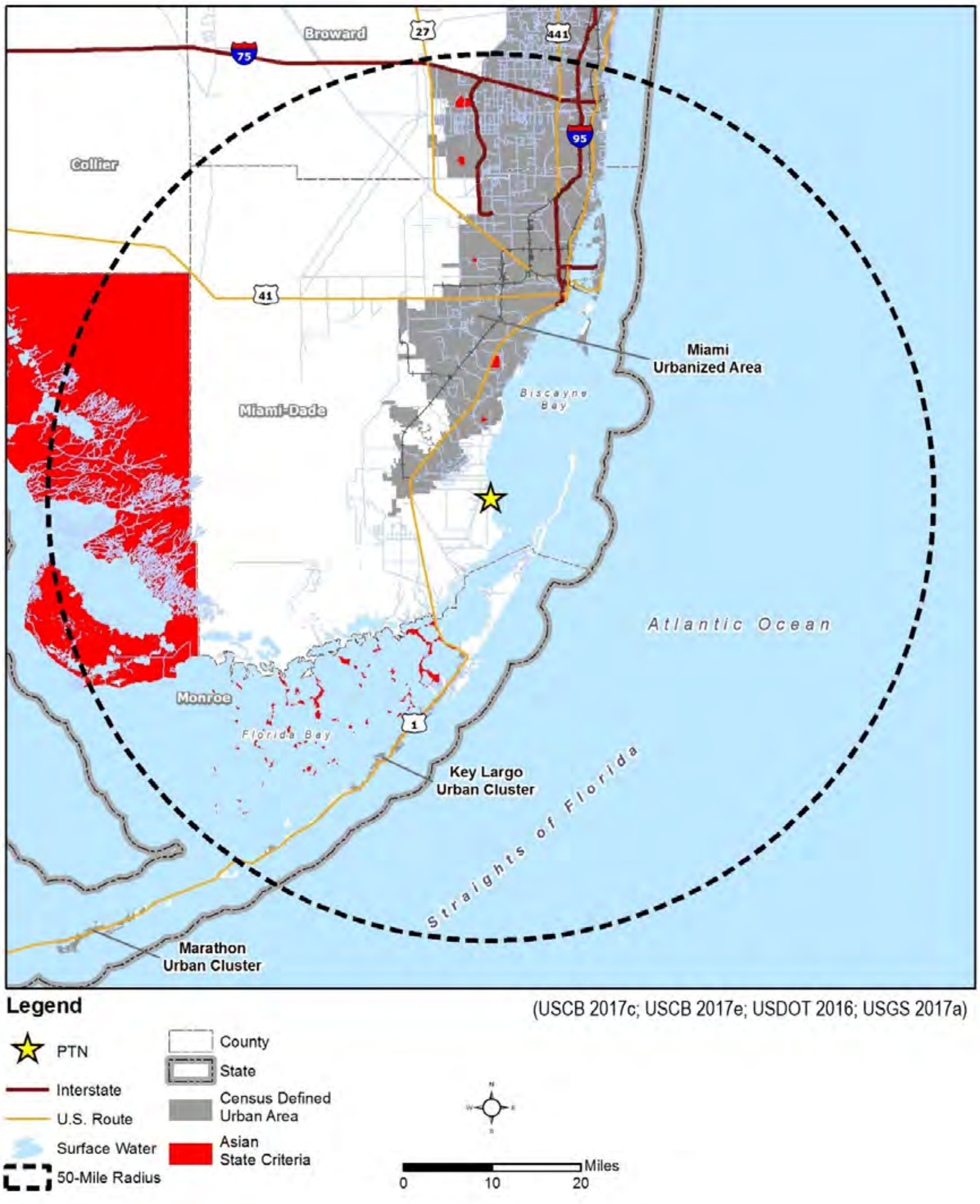

Figure 3.11-10
Census—Asian Populations (Individual State)

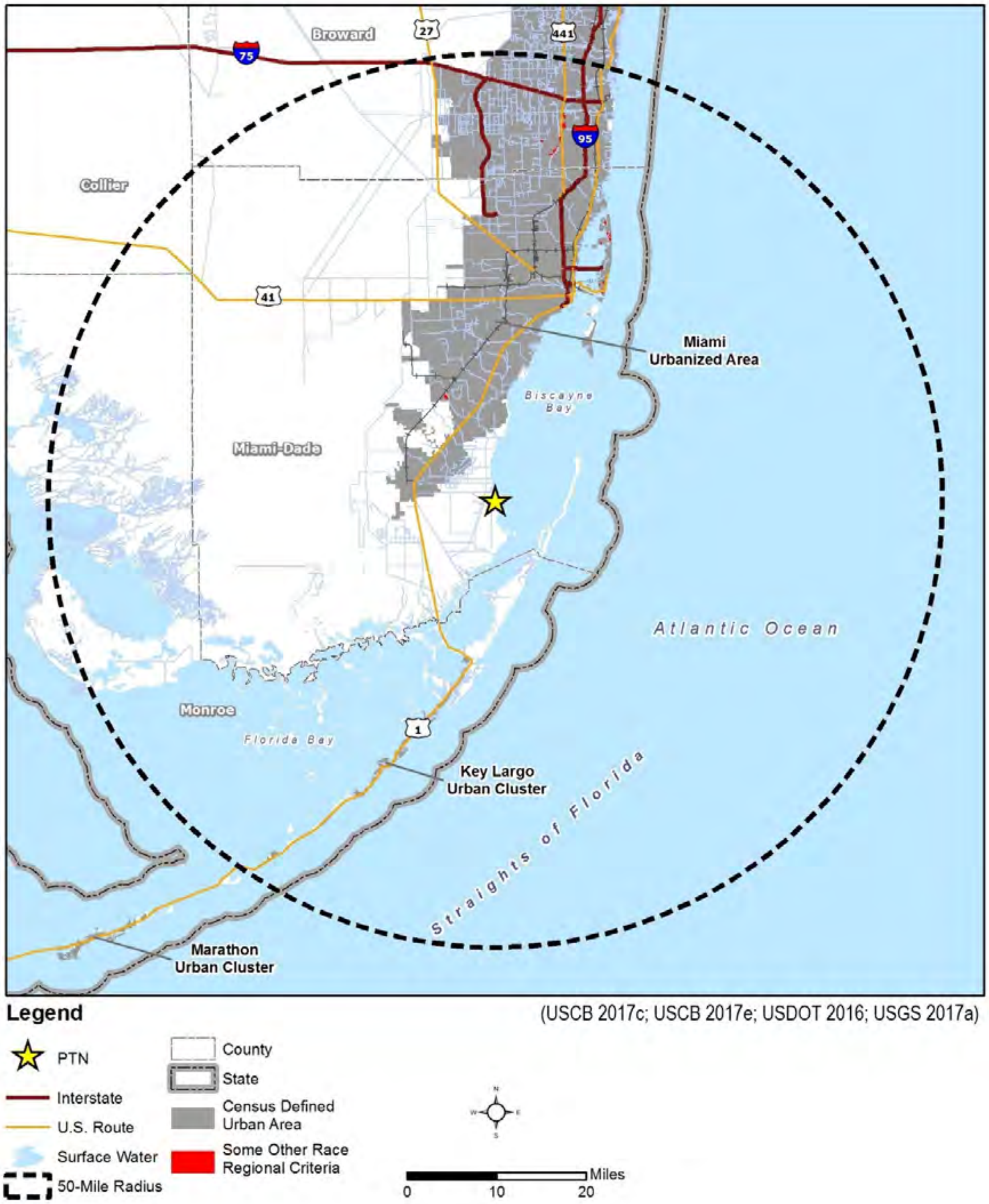

Figure 3.11-11
Census—Some Other Race Populations (Regional)

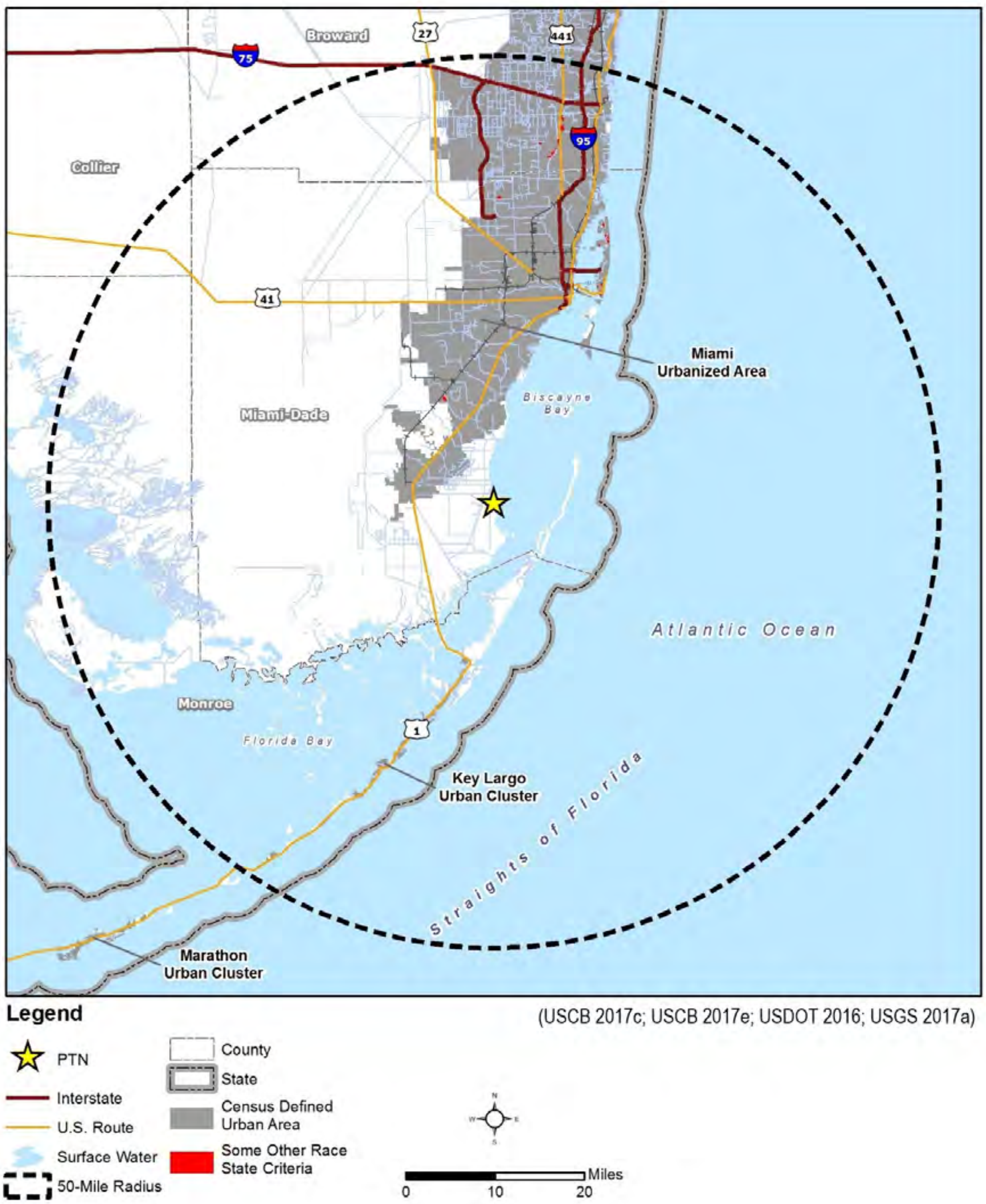

Figure 3.11-12
Census—Some Other Race Populations (Individual State)

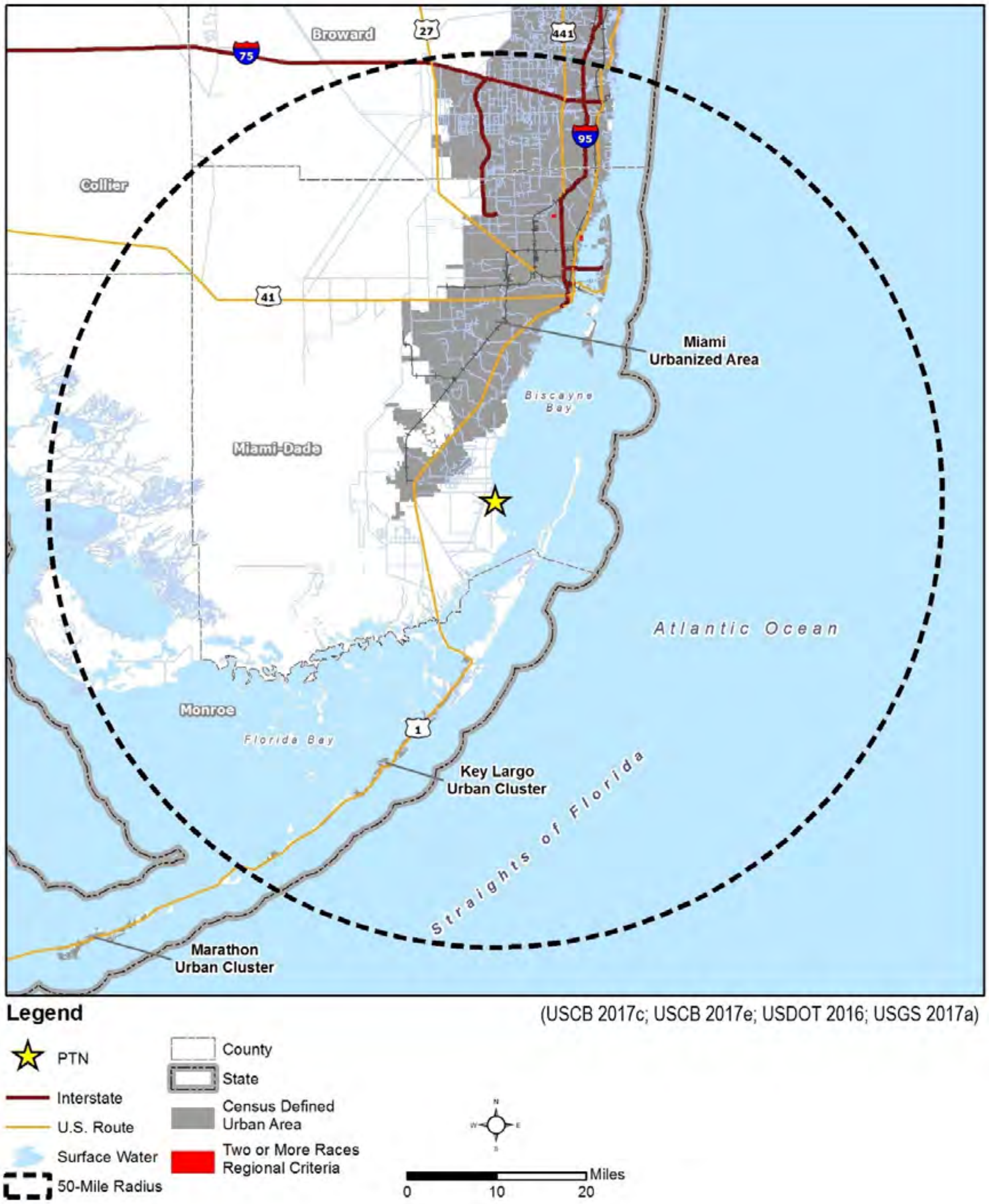

Figure 3.11-13
Census—Two or More Races Populations (Regional)

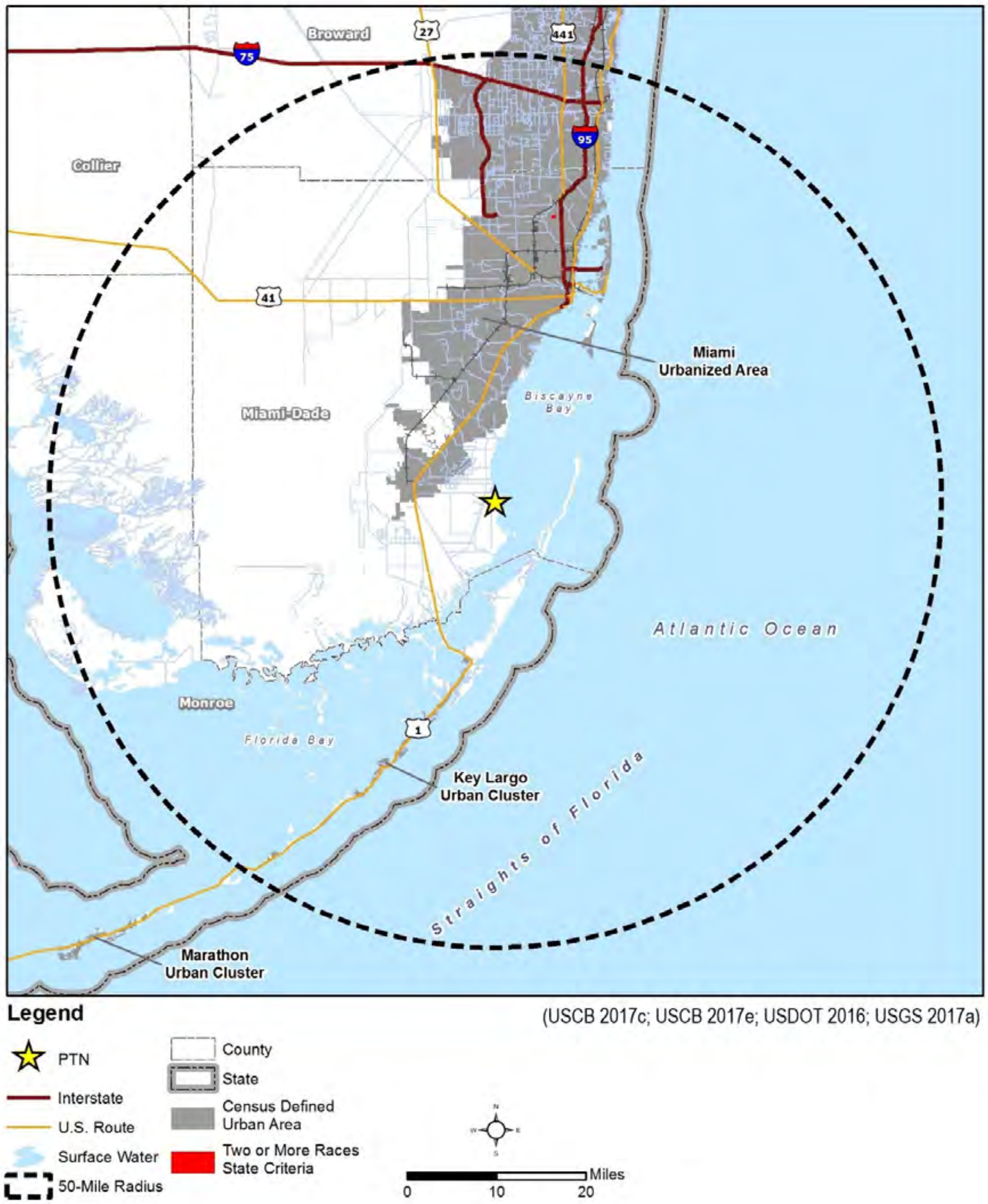

Figure 3.11-14
Census—Two or More Races Populations (Individual State)

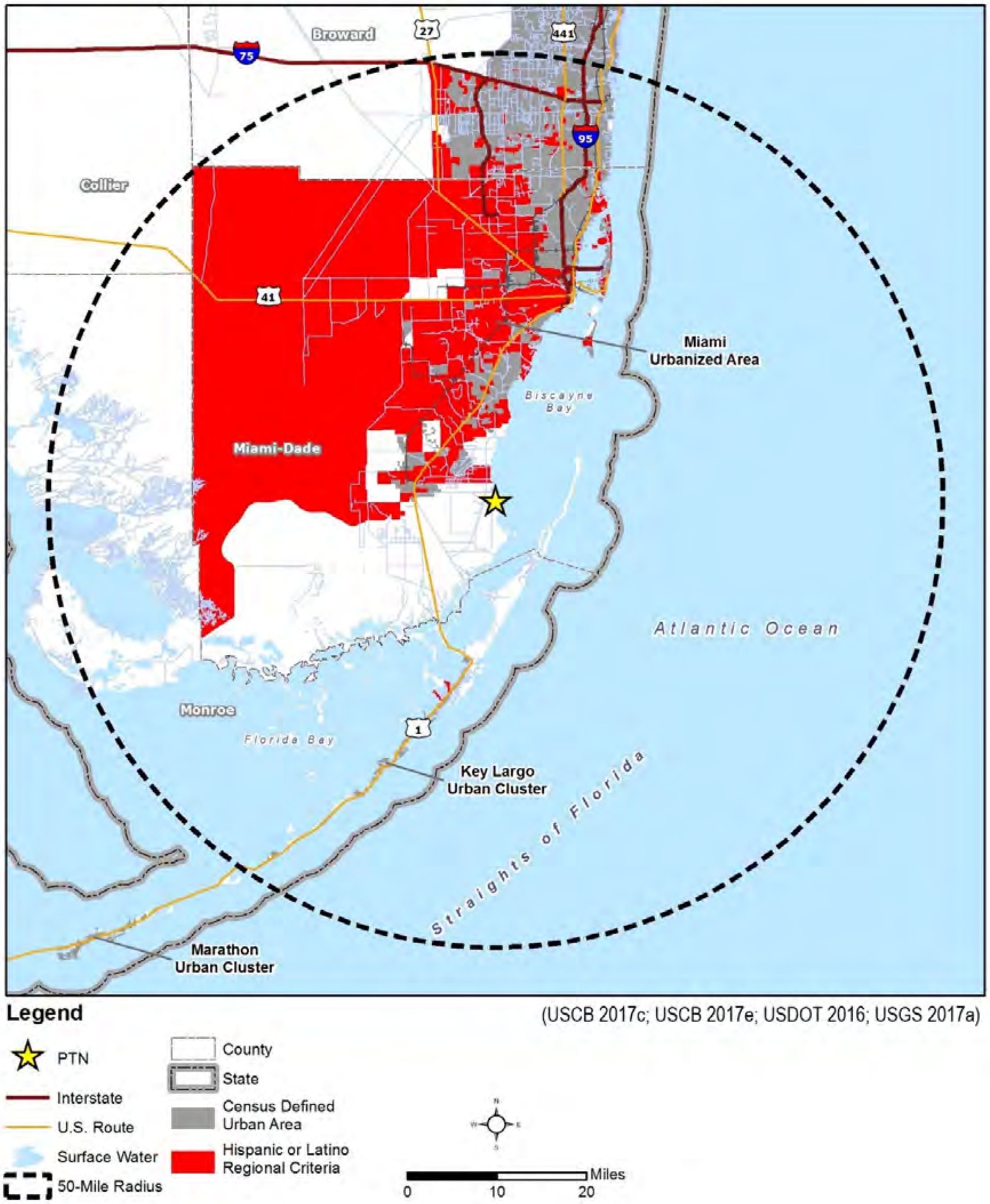

Figure 3.11-15
Census—Hispanic or Latino Populations (Regional)

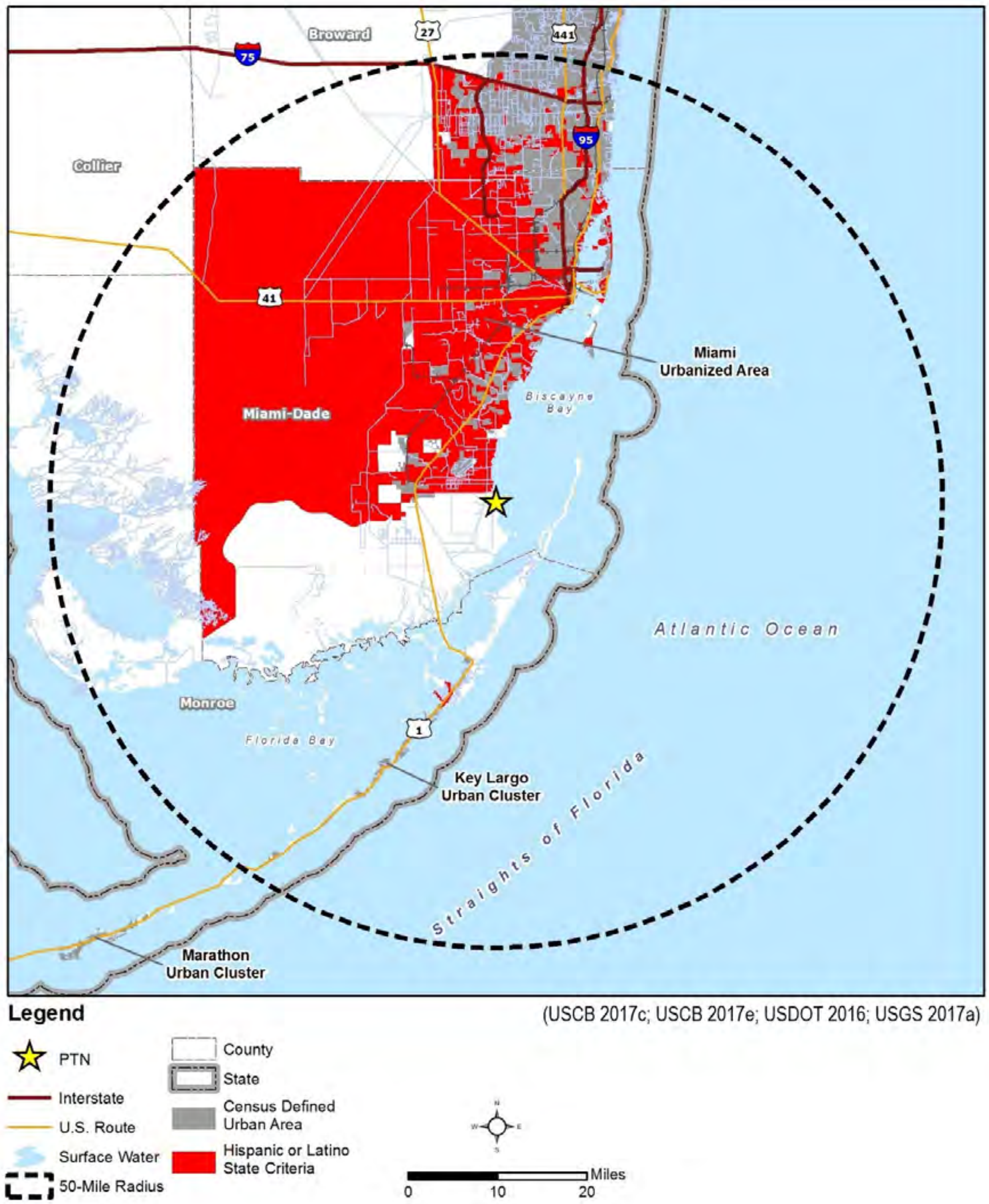

Figure 3.11-16
Census—Hispanic or Latino Populations (Individual State)

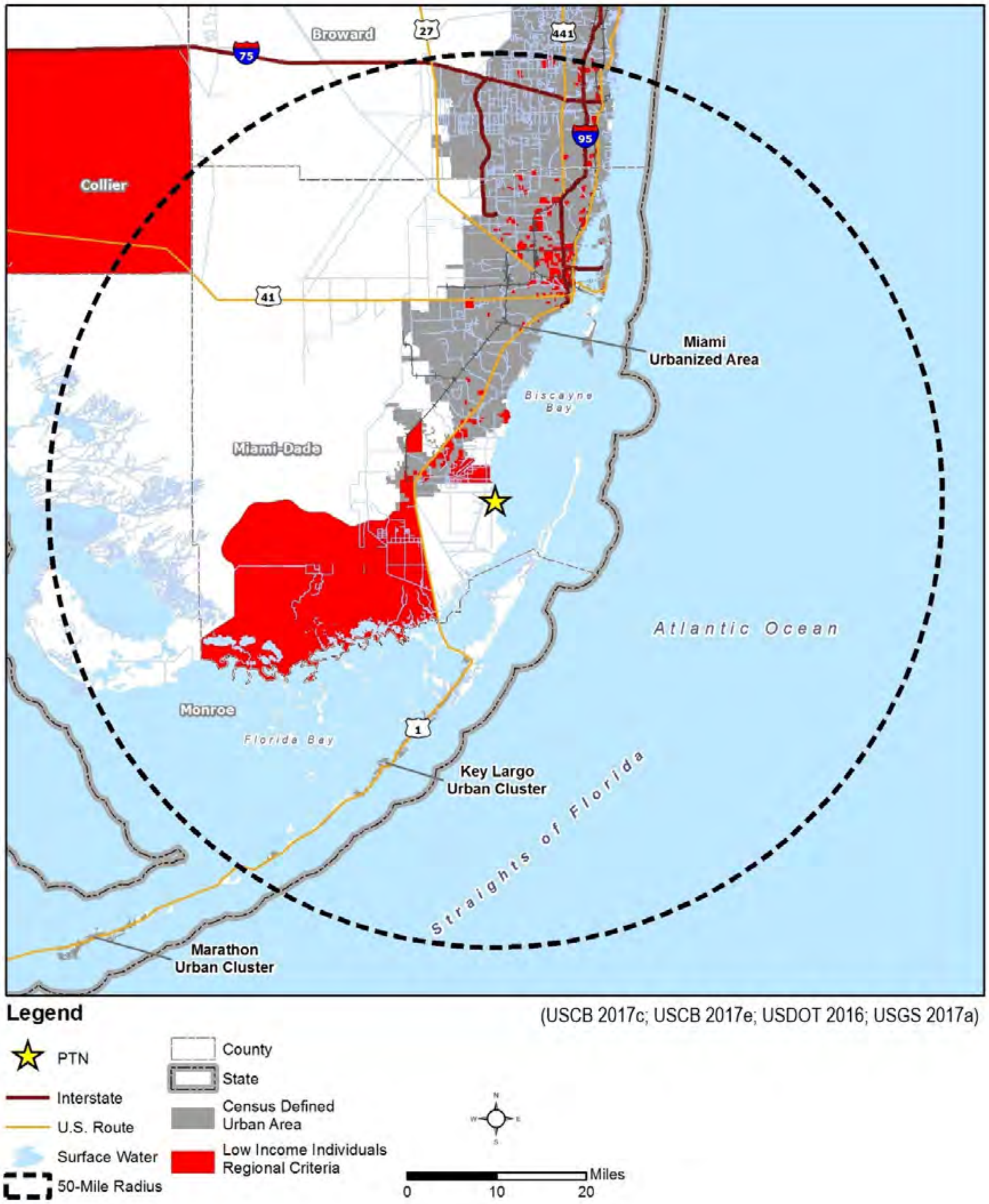

Figure 3.11-17
Census—Low Income Individuals (Regional)

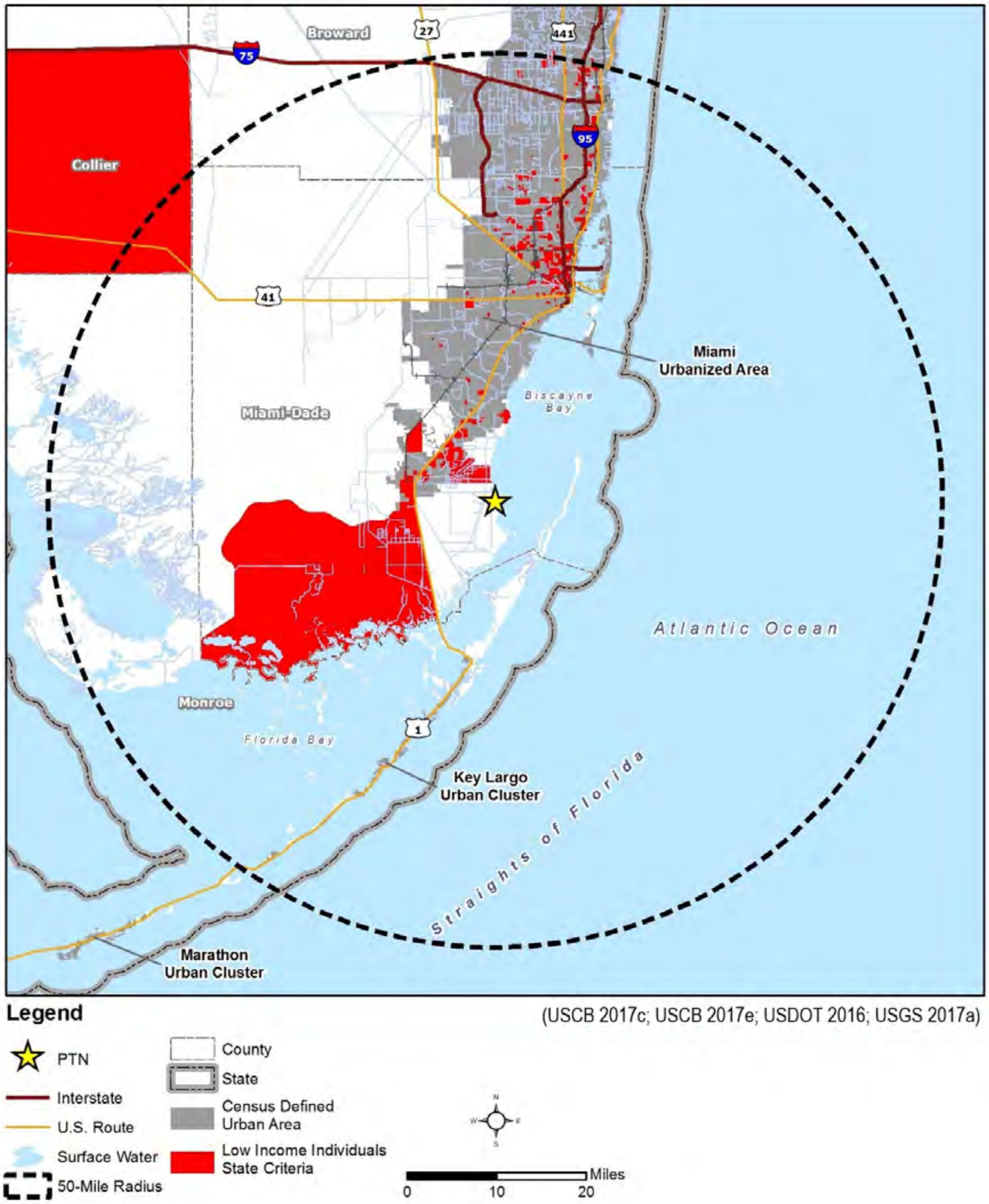

Figure 3.11-18
Census—Low Income Individuals (Individual State)

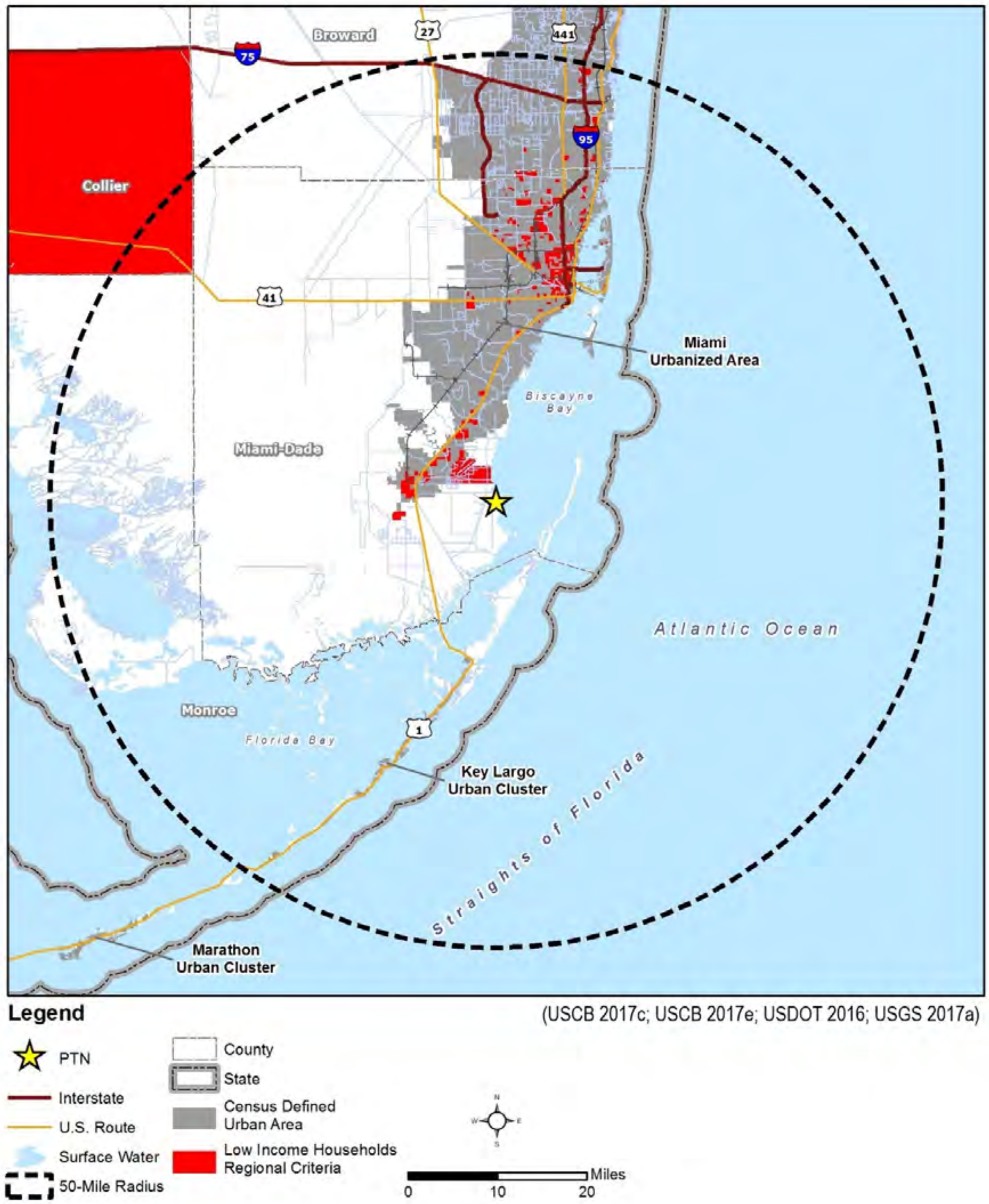

Figure 3.11-19
Census—Low Income Households (Regional)

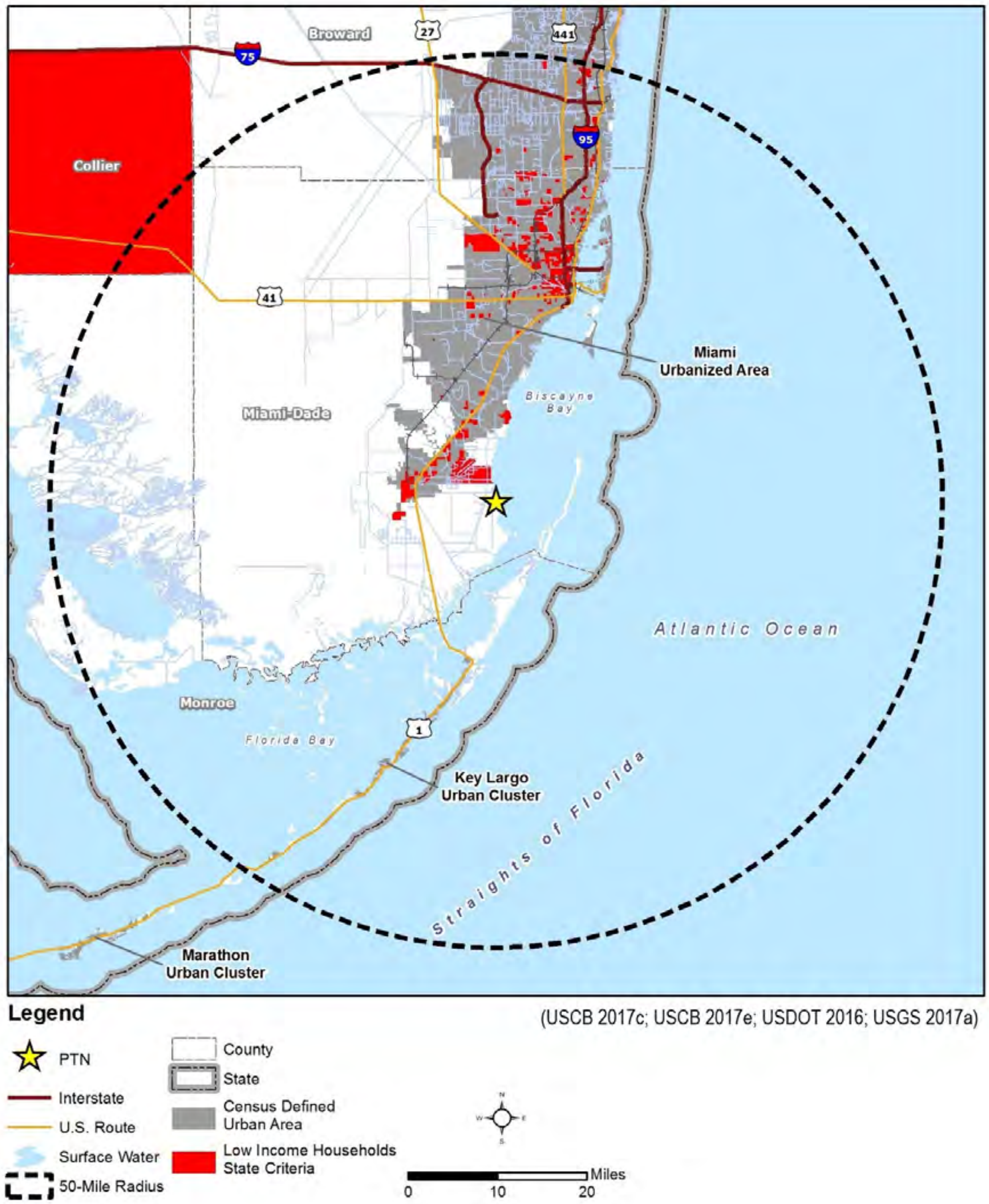

Figure 3.11-20
Census—Low Income Households (Individual State)

3.12 Waste Management

PTN has systems for managing radioactive and nonradioactive waste stream generated by plant operations. The following sections address radioactive and nonradioactive waste management.

3.12.1 Radioactive Waste Management

Section 2.2.6 describes the systems and controls used for the plant's liquid, gaseous, and solid radioactive waste streams including mixed waste. Section 2.2.6 discusses the treatment and disposal facilities used by PTN for its radioactive and mixed waste streams.

3.12.2 Nonradioactive Waste Management

Section 2.2.7 describes the nonradioactive waste streams generated during plant operations, which includes nonhazardous waste, hazardous waste, and universal waste. Section 2.2.7 also describes the waste management and waste minimization programs used at PTN and the offsite facilities used for treatment and disposal of PTN's nonradioactive wastes.

4.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND MITIGATING ACTIONS

> The report must contain a consideration of alternatives for reducing adverse impacts . . . for all Category 2 license renewal issues . . . . [10 CFR 51.53(c)(3)(iii)]
>
> The environmental report must include an analysis that considers . . . the environmental effects of the proposed action . . . and alternatives available for reducing or avoiding adverse environmental effects. [10 CFR 51.45(c)]
>
> The environmental report shall . . . discuss . . . the impact of the proposed action on the environment. Impacts shall be discussed in proportion to their significance. [10 CFR 51.45(b)(1)]
>
> The information submitted . . . should not be confined to information supporting the proposed action but should also include adverse information. [10 CFR 51.45(e)]

The NRC has identified and analyzed 78 environmental issues that it considers to be associated with nuclear power plant license renewal and has designated the issues as Category 1, Category 2, or not categorized (NRC 2013a). The NRC designated an issue as Category 1 if the following criteria were met:

- The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic.
- A single significance level (i.e., small, moderate, or large) has been assigned to the impacts that would occur at any plant, regardless of which plant is being evaluated (except for offsite radiological impacts—collective impacts from other than the disposal of spent fuel and high-level waste [HLW]).
- Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely to be not sufficiently beneficial to warrant implementation.

If the NRC concluded that one or more of the Category 1 criteria could not be met, the NRC designated the issue Category 2, which requires plant-specific analysis. The NRC designated one issue as not categorized (human health chronic effects of electromagnetic fields), signifying that the categorization and impact definitions do not apply to this issue. Until such time that this NA issue is categorized, applicants for license renewal are not required to submit information on this issue [10 CFR Part 51, Subpart A, Appendix B, Table B-1, Footnote 6]; therefore, this issue is not included in Tables 4.0-1, 4.0-2, or 4.0-3, nor is it addressed in Section 4.9. NRC rules do not require analyses of Category 1 issues that were resolved using generic findings [10 CFR Part 51, Subpart A, Appendix B, Table B-1] as described in the GEIS. Therefore, an applicant may reference the GEIS findings for Category 1 issues, absent new and significant information.

4.0.1 Category 1 License Renewal Issues

> The environmental report for the operating license renewal stage is not required to contain analyses of the environmental impacts of the license renewal issues identified as Category 1 issues in Appendix B to subpart A of this part. [10 CFR 51.53(c)(3)(i)]
>
> [A]bsent new and significant information, the analyses for certain impacts codified by this rulemaking need only be incorporated by reference in an applicant's environmental report for license renewal . . . . [61 FR 28483]

FPL has determined that, of the 60 Category 1 issues, 9 are not applicable to PTN. Table 4.0-1 lists these 9 issues and provides a brief explanation of why they are not applicable to the site. Table 4.0-2 lists the 51 Category 1 issues applicable to the site. FPL reviewed the NRC findings on these 51 Category 1 issues and identified no new and significant information that would invalidate the findings for the site (Chapter 5). The new and significant review did evaluate new information such as the findings of state and local agencies regarding the westward movement of hypersaline groundwater. Finding compliance with CAs and orders would result in insignificant impacts for the SLR term.Therefore, FPL adopts by reference the NRC findings for these Category 1 issues.

4.0.2 Category 2 License Renewal Issues

> The environmental report must contain analyses of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with license renewal and the impacts of operation during the renewal term, for those issues identified as Category 2 issues in Appendix B to subpart A of this part. [10 CFR 51.53(c)(3)(ii)]
>
> The report must contain a consideration of alternatives for reducing adverse impacts, as required by § 51.45(c), for all Category 2 license renewal issues . . . . [10 CFR 51.53(c)(3)(iii)]

The NRC designated 17 issues as Category 2. FPL has determined that, of the 17 issues shown in Table 4.0-3, five issues are not applicable to PTN because they apply to plants with natural setting features that do not exist at the facility, or the regulatory basis or requirement of the issue does not apply. Where the issue does not apply to the site, the section explains the basis.

For the 12 issues applicable to the site, the corresponding sections contain the required analyses. These analyses include conclusions regarding the significance of the impacts relative to renewal of the PTN OLs and, when applicable, discuss potential mitigation alternatives to the extent appropriate. With the exception of threatened and endangered species/EFH, historic and cultural resources, and environmental justice, FPL has identified the significance of the impacts associated with each issue as SMALL, MODERATE, or LARGE consistent with the criteria the NRC established in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, Footnote 3, as follows:

> **SMALL**: Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.
>
> **MODERATE**: Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
>
> **LARGE**: Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource. For issues where probability is a key consideration (i.e., accident consequences), probability was a factor in determining significance.

Threatened and endangered species/EFH, historic and cultural resources, and environmental justice were not assigned a significance impact of SMALL, MODERATE, or LARGE in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. Therefore consistent with NRC guidance, FPL identified the significance of the impacts for these three Category 2 issues as follows:

- For threatened and endangered species (ESA), the significance of the effects from license renewal can be characterized based on a determination of whether continued nuclear power plant operations, including refurbishment, (1) would have no effect on federally listed species; (2) are not likely to adversely affect federally listed species; (3) are likely to adversely affect federally listed species; or (4) are likely to jeopardize a federally listed species or adversely modify designated critical habitat. For EFH (MSA), the significance of effects from license renewal can be characterized based on a determination of whether continued nuclear power plant operations, including refurbishment, would have (1) no adverse impact; (2) minimal adverse impact; or (3) substantial adverse impact to the essential habitat of federally managed fish populations.

- For historic and cultural resources (NHPA), the significance of the effects from license renewal can be characterized based on a determination that (1) no historic properties are present (no effect); (2) historic properties are present but not adversely affected (no adverse effect); or (3) historic properties are adversely affected (adverse effect).

- For environmental justice, impacts would be based on disproportionately high and adverse human health and environmental effects on minority and low-income populations.

In accordance with NEPA practice, FPL considered ongoing and potential additional mitigation in proportion to the significance of the impact to be addressed (i.e., impacts that are small receive less mitigation consideration than impacts that are large).

4.0.3 Uncategorized License Renewal Issues

The NRC determined that its categorization and impact-finding definitions did not apply to chronic effects of electromagnetic fields. Because the categorization and impact finding definitions do not apply as noted in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, Footnote 5, applicants are not currently required to submit information on this issue.

4.0.4 Format of Issues Reviewed

The review and analysis of the Category 1 and 2 issues identified in NRC Regulatory Guide 4.2, Supplement 1, Revision 1 (NRC 2013b), are discussed in the following sections. The format for the review of these issues is described below. Although Chapter 5 describes the process by which Category 1 issues have been evaluated for new and significant information, specific issues are also being listed in this chapter for consistency purposes with the recommended NRC Regulatory Guide 4.2, Supplement 1 format.

Issue: Title of the issue.

Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1: The findings for the issue from 10 CFR Part 51, Subpart A, Appendix B, Table B-1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants.

Requirement: Restatement of the applicable 10 CFR 51.53 requirement.

Background: A background excerpt from the applicable section of the GEIS. The specific section of the GEIS is referenced for the convenience of the reader.

Analysis: An analysis of the environmental impact, taking into account information provided in the GEIS and 10 CFR Part 51, Subpart A, Appendix B, as well as current site-specific information. If an issue is not applicable, the analysis lists the explanation. The analysis section also provides a summary conclusion of the environmental impacts and identifies, as applicable, either ongoing or additional planned mitigation measures to reduce adverse impacts. For Category 1 issues listed in this chapter, an analysis is not required absent new and significant information.

Table 4.0-1
Category 1 Issues Not Applicable to PTN

Resource Issue	Comment
Land Use	
Offsite land use in transmission line ROWs	All in-scope transmission lines subject to the evaluation of environmental impacts for license renewal are located completely within the PTN site.
Surface Water Resources	
Altered current patterns at intake and discharge structures	PTN relies on cooling canals that are manmade features without natural currents that affect waters of the U.S.
Altered thermal stratification of lakes	PTN does not withdraw water from or discharge to a lake.
Surface water use conflicts (plants with once-through cooling systems)	PTN does not use a once-through cooling system.
Temperature effects on sediment transport capacity	PTN does not discharge to a natural water body that has sediment transport capacity.
Groundwater Resources	
Groundwater use conflicts (plants that withdraw less than 100 gallons per minute)	PTN withdraws groundwater at quantities greater than 100 gallons per minute.
Terrestrial Resources	
Cooling tower impacts on vegetation (plants with cooling towers)	PTN does not use cooling towers.
Aquatic Resources	
Impingement and entrainment of aquatic organisms (plants with cooling towers)	PTN does not use cooling towers.
Thermal impacts on aquatic organisms (plants with cooling towers)	PTN does not use cooling towers.

Table 4.0-2
Category 1 Issues Applicable to PTN (Sheet 1 of 3)

Resource Issue	Subcategory
Land Use	Onsite land uses
	Offsite land uses
Visual Resources	Aesthetic impacts
Air Quality	Air quality impacts (all plants)
	Air quality effects of transmission lines
Noise	Noise impacts
Geologic Environment	Geology and soils
Surface Water Resources	Surface water use and quality (non-cooling system impacts)
	Altered salinity gradients
	Scouring caused by discharged cooling water
	Discharge of metals in cooling system effluent
	Discharge of biocides, sanitary wastes, and minor chemical spills
	Effects of dredging
Groundwater Resources	Groundwater contamination and use (non-cooling system impacts)
	Groundwater quality degradation resulting from water withdrawals
	Groundwater quality degradation (plants with cooling ponds in salt marshes)
Terrestrial Resources	Exposure of terrestrial organisms to radionuclides
	Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds)
	Bird collisions with plant structures and transmission lines
	Transmission line ROW management impacts on terrestrial resources
	Electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)

Table 4.0-2
Category 1 Issues Applicable to PTN (Sheet 2 of 3)

Resource Issue	Subcategory
Aquatic Resources	Entrainment of phytoplankton and zooplankton (all plants)
	Infrequently reported thermal impacts (all plants)
	Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication
	Effects of nonradiological contaminants on aquatic organisms
	Exposure of aquatic organisms to radionuclides
	Effects of dredging on aquatic organisms
	Effects on aquatic resources (non-cooling system impacts)
	Impacts of transmission line ROW management on aquatic resources
	Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses
Socioeconomics	Employment and income, recreation and tourism
	Tax revenues
	Community services and education
	Population and housing
	Transportation
Human Health	Radiation exposures to the public
	Radiation exposures to plant workers
	Human health impact from chemicals
	Microbiological hazards to plant workers
	Physical occupational hazards
Postulated Accidents	Design-basis accidents

Table 4.0-2
Category 1 Issues Applicable to PTN (Sheet 3 of 3)

Resource Issue	Subcategory
Waste Management	Low-level waste storage and disposal
	Onsite storage of spent nuclear fuel
	Offsite radiological impacts of spent nuclear fuel and high-level waste disposal
	Mixed-waste storage and disposal
	Nonradioactive waste storage and disposal
Uranium Fuel Cycle	Offsite radiological impacts—individual impacts from other than the disposal of spent fuel and high-level waste
	Offsite radiological impacts—collective impacts from other than the disposal of spent fuel and high-level waste
	Nonradiological impacts of the uranium fuel cycle
	Transportation
Termination of Nuclear Power Plant Operations and Decommissioning	Termination of plant operations and decommissioning

Table 4.0-3
Category 2 Issues Applicability to PTN (Sheet 1 of 2)

Resource Issue	Applicability	ER Section
Surface Water Resources		
Surface water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river)	Not applicable	4.5.1
Groundwater Resources		
Groundwater use conflicts (plants that withdraw more than 100 gallons per minute)	Applicable	4.5.3
Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river)	Not applicable	4.5.2
Groundwater quality degradation (plants with cooling ponds at inland sites)	Not applicable	4.5.4
Radionuclides released to groundwater	Applicable	4.5.5
Terrestrial Resources		
Effects on terrestrial resources (non-cooling system impacts)	Applicable	4.6.5
Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river)	Not applicable	4.6.4
Aquatic Resources		
Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	Applicable	4.6.1
Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds)	Applicable	4.6.2
Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river)	Not applicable	4.6.3
Special Status Species and Habitats		
Threatened, endangered, and protected species and essential fish habitat	Applicable	4.6.6
Historic and Cultural Resources		
Historic and cultural resources	Applicable	4.7

Table 4.0-3
Category 2 Issues Applicability to PTN (Sheet 2 of 2)

Resource Issue	Applicability	ER Section
Human Health		
Microbiological hazards to the public (plants with cooling ponds or canals or cooling towers that discharge to a river)	Applicable	4.9.1
Electric shock hazards	Applicable	4.9.2
Postulated Accidents		
Severe accidents	Applicable	4.15
Environmental Justice		
Minority and low-income populations	Applicable	4.10.1
Cumulative Impacts		
Cumulative impacts	Applicable	4.12

4.1 Land Use and Visual Resources

The following sections address the land use issues applicable to PTN, providing background on the issues and the analyses regarding the SLR period.

4.1.1 Onsite Land Use

4.1.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Changes in onsite land use from continued operations and refurbishment associated with license renewal would be a small fraction of the nuclear power plant site and would involve only land that is controlled by the licensee.

4.1.1.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.1.1.3 Background [GEIS Section 4.2.1.1]

Operational activities at a nuclear power plant during the license renewal term would be similar to those occurring during the current license term. Generally, onsite land use conditions would remain unchanged. However, additional spent nuclear fuel and LLRW generated during the license renewal term could require the construction of new or expansion of existing onsite storage facilities. Should additional storage facilities be required, this action would be addressed in separate license reviews conducted by the NRC. Refurbishment activities, such as steam generator and vessel head replacement, have not permanently changed onsite land use conditions.

4.1.1.4 Analysis

Onsite land use information is presented in Section 3.2.1. No license renewal-related refurbishment activities have been identified, as discussed in Section 2.3. In addition, no license renewal-related construction activities have been identified. Therefore, no changes in onsite land use during the SLR period are anticipated.

In the GEIS, the NRC determined that onsite land use impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.2.1.1). Based on FPL's review, no new and significant information was identified as it relates to onsite land use, and further analysis is not required.

4.1.2 Offsite Land Use

4.1.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Offsite land use would not be affected by continued operations and refurbishment associated with license renewal.

4.1.2.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.1.2.3 Background [GEIS Section 4.2.1.1]

The impacts of continued plant operations during the license renewal term and refurbishment on offsite land use were evaluated separately in the 1996 GEIS. It was predicted that impacts associated with refurbishment and changes in population and tax revenue on offsite land use could range from SMALL to MODERATE. License renewal reviews, however, have shown no power plant-related population changes or significant tax revenue changes due to license renewal. Non-outage employment levels at nuclear power plants have remained relatively unchanged or have decreased. With no increase in the number of workers, there has been no increase in housing, infrastructure, or demand for services beyond what has already occurred. Operational activities during the license renewal term would be similar to those occurring during the current license term and would not affect offsite land use beyond what has already been affected.

For plants that have the potential to impact a coastal zone or coastal watershed, as defined by each state participating in the national Coastal Zone Management Program, applicants for license renewal must submit to the affected state a certification that the proposed license renewal is consistent with the state Coastal Zone Management Program. Applicants must coordinate with the state agency that manages the state Coastal Zone Management Program to obtain a determination that the proposed nuclear plant license renewal would be consistent with the state program.

4.1.2.4 Analysis

Offsite land use information is presented in Section 3.2.2. As discussed in Section 2.5, there are no plans to add workers to support plant operations during the SLR period and, as discussed in Section 2.3, no license renewal-related refurbishment activities have been identified. Therefore, no changes in offsite land use during the SLR period are anticipated.

In the GEIS, the NRC determined that offsite land use impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.2.1.1). Additionally, as detailed in Section 9.5.10, PTN has fulfilled the regulatory requirement to certify to the licensing agency that the proposed activity would be consistent with the state's federally approved coastal zone management program. Based on FPL's review, no new and significant information was identified as it relates to offsite land use, and further analysis is not required.

4.1.3 Offsite Land Use of Transmission Line Rights-of-Way

4.1.3.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Use of transmission line ROWs from continued operations and refurbishment associated with license renewal would continue with no change in land use restrictions.

4.1.3.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.1.3.3 Background [GEIS Section 4.2.1.1]

Operational activities in offsite transmission line ROWs, within this scope of review, during the license renewal term, would be similar to those occurring during the current license term and would not affect offsite land use in transmission line ROWs beyond what has already been affected. Certain land-use activity in the ROW is usually restricted. Land cover is generally managed through a variety of maintenance procedures so that vegetation growth and building construction do not interfere with power line operation and access. Land use within ROWs are limited to activities that do not endanger power line operation; these include recreation, off-road vehicle use, grazing, agricultural cultivation, irrigation, roads, environmental conservation, and wildlife areas. Transmission lines do not preclude the use of the land for farming or environmental and recreational use. Transmission lines connecting nuclear power plants to the electrical grid are no different from transmission lines connecting any other power plant.

4.1.3.4 Analysis

As discussed in Section 2.2.5, in-scope transmission lines are located completely within PTN property (see Figure 2.2-4). Therefore, this issue is not applicable, and further analysis is not required.

4.1.4 Aesthetics Impacts

4.1.4.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. No important changes to the visual appearance of plant structures or transmission lines are expected from continued operations and refurbishment associated with license renewal.

4.1.4.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.1.4.3 Background [GEIS Section 4.2.1.2]

A case study performed for the 1996 GEIS found a limited number of situations where nuclear power plants had a negative effect on visual resources. Negative perceptions were based on aesthetic considerations (for instance, the plant is out of character or scale with the community or the viewshed), physical environmental concerns, safety and perceived risk issues, an anti-plant attitude, or an anti-nuclear orientation. It is believed that these negative perceptions would persist regardless of mitigation measures.

In addition, the visual appearance of transmission lines is not expected to change during the license renewal term. After the containment building and cooling towers, transmission line towers are probably the most frequently observed structure associated with nuclear power plants. Transmission lines from nuclear power plants are generally indistinguishable from those from other power plants. Because electrical transmission lines are common throughout the United States, they are generally perceived with less prejudice than the nuclear power plant itself. Also, the visual impact of transmission lines tends to wear off when viewed repeatedly.

4.1.4.4 Analysis

The visual appearance of the plant is presented in Section 3.2.3. As described in Section 2.2.5 and shown in Figure 2.2-4, the in-scope transmission lines do not contribute to the visual impacts of the site. As discussed in Section 3.2.3, Turkey Point is located in an unincorporated area in southeastern Miami-Dade County, Florida. There is sufficient vegetation to screen the existing units from roadways and recreational areas on land. The existing units are not visible from most areas within Biscayne National Park and Homestead Bayfront Park. The site is not visible beyond 6 miles from land. However, the site is visible for many miles from Biscayne Bay. At night, light from PTN is visible from several points in the vicinity. No refurbishment or construction activities have been identified that would change the aesthetics of the Turkey Point facility during the SLR term. Therefore, no changes in visual resources during the SLR period are anticipated.

In the GEIS, the NRC determined that aesthetic impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.2.1.2). Based on FPL's review, no new and significant information was identified as it relates to visual resources, and further analysis is not required.

4.2 Air Quality

The following sections address the air quality issues applicable to PTN, providing background on the issues and the analyses regarding the SLR period.

4.2.1 Air Quality Impacts (all plants)

4.2.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

The NRC has made the following generic findings for all plants regarding air quality impacts from nuclear plants:

SMALL. Air quality impacts from continued operations and refurbishment associated with license renewal are expected to be small at all plants. Emissions resulting from refurbishment activities at locations in or near air quality nonattainment or maintenance areas would be short-lived and would cease after these refurbishment activities are completed. Operating experience has shown that the scale of refurbishment activities has not resulted in exceedance of the *de minimis* thresholds for criteria pollutants, and BMPs including fugitive dust controls and the imposition of permit conditions in state and local air emissions permits would ensure conformance with applicable state or tribal implementation plans.

Emissions from emergency diesel generators (EDGs) and fire pumps and routine operations of boilers used for space heating would not be a concern, even for plants located in or adjacent to nonattainment areas. Impacts from cooling tower particulate emissions even under the worst-case situations have been small.

4.2.1.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.2.1.3 Background [GEIS Section 4.3.1.1]

Impacts on air quality during normal plant operations can result from operations of fossil fuel-fired equipment needed for various plant functions. Each licensed plant typically employs EDGs for use as a backup power source. EDGs and fire pumps typically require state or local operating permits. These diesel generators are typically tested once a month with several test burns of various durations (e.g., 1 to several hours). In addition to these maintenance tests, longer-running endurance tests are also typically conducted at each plant. Each generator is typically tested for 24 hours on a staggered test schedule (e.g., once every refueling outage).

In addition to the EDGs, fossil fuel (i.e., diesel-, oil-, or natural gas-fired) boilers are used primarily for evaporator heating, plant space heating, and/or feed water purification. These units typically operate at a variable load on a continuous basis throughout the year unless end use is restricted to one application, such as space heating. The utility boilers at commercial plants are relatively small when compared with most industrial boilers and are typically regulated through state-level operating permits.

As discussed in Section 3.3 of the GEIS, cooling tower drift can increase downwind PM concentrations, impair visibility, ice roadways, cause drift deposition, and damage vegetation and painted surfaces. Thus, although there is the potential for some air quality impacts to occur as a result of equipment and cooling tower operations, even in the worst-case situation (Hope Creek), the impacts have been small, and licensees would be required to operate within state permit requirements.

In the 1996 GEIS, the NRC concluded that the impacts from plant refurbishment associated with license renewal on air quality could range from SMALL to LARGE, although these impacts were expected to be SMALL for most plants. However, findings from license renewal Supplemental Environmental Impact Statements (SEISs) published since the 1996 GEIS have shown that refurbishment activities, such as steam generator and vessel head replacement, have not required the large numbers of workers and months of time, as well as the degree of land disturbance that was conservatively estimated in the 1996 GEIS. Presumed air pollutant emissions, including levels of fugitive dust, have therefore not been realized.

4.2.1.4 Analysis

Air quality information is presented in Section 3.3.3. No license renewal-related refurbishment activities have been identified, as discussed in Section 2.3. As stated in the GEIS (NRC 2013a), BMPs, including fugitive dust controls and the imposition of permit conditions in FDEP air emissions permits, would ensure conformance with applicable state implementation plans.

As discussed in Section 3.3.3.1, Miami-Dade County is in attainment with the NAAQS for all criteria air pollutants. As discussed in Section 3.3.3.2, no future upgrade or replacement activities (e.g., diesel generators, diesel pumps) that would increase or decrease air emissions over the SLR period were identified as necessary for plant operations. As indicated in Section 3.3, a pump replacement is planned and the Title V permit would be amended as necessary.

The Turkey Point Title V facility is composed of two separate co-located power plants: the fossil plant (Unit 5) and the nuclear plant (Units 3 and 4). The non-nuclear operations of PTN are permitted by a Title V air emissions permit (Permit No. 0250003-021-AV). The operations of the fossil plant are addressed in a separate Title V permit. (FDEP 2014a) As discussed in Section 3.3.3.2 and Chapter 9, PTN and ancillary facilities have received a site certification in accordance with the Florida PPSA. This process provides a certification that encompasses all licenses and permits needed for affected Florida state, regional, and local agencies. The conditions of certification require FPL to comply with the provisions and limitations set forth in its Title V air operation permit (FDEP 2016a). The PTN air permit contains conditions established by the FDEP to protect Florida's ambient air quality standards and ensure impacts are maintained at acceptable levels. Appropriate permit conditions would regulate any future PTN activities that may increase air pollutants or threaten the attainment status of Miami-Dade County. Compliance with current and future air emissions regulatory requirements, applicable emissions control measures, and reporting requirements will ensure continued SMALL impact on ambient air quality.

In the GEIS, the NRC determined that air quality impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.3.1.1). Based on FPL's review, no new and significant information was identified as it relates to air quality, and further analysis is not required.

4.2.2 Air Quality Effects of Transmission Lines

4.2.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases.

4.2.2.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.2.2.3 Background [GEIS Section 4.3.1.1]

Small amounts of ozone and substantially smaller amounts of oxides of nitrogen are produced by transmission lines during corona, a phenomenon that occurs when air ionizes near isolated irregularities on the conductor surface such as abrasions, dust particles, raindrops, and insects. Several studies have quantified the amount of ozone generated and concluded that the amount produced by even the largest lines in operation (765 kV) is insignificant.

Ozone concentrations generated by transmission lines are therefore too low to cause any significant effects. The minute amounts of oxides of nitrogen produced are similarly insignificant. A finding of SMALL significance for transmission lines, within this scope of review is supported by the evidence that production of ozone and oxides of nitrogen are insignificant and does not measurably contribute to ambient levels of those gases.

4.2.2.4 Analysis

Based on the GEIS, it was determined through several studies that the amount of ozone generated by even the largest lines in operation (765 kV) would be insignificant (NRC 2013a, Section 4.3.1.1). As discussed in Section 2.2.5, Turkey Point's in-scope transmission lines are 230 kV. Therefore, the production of ozone and oxides of nitrogen would be *de minimis*.

In the GEIS, the NRC determined that air quality effects of transmission lines from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.3.1.1). Based on FPL's review, no new and significant information was identified as it relates to air quality effects of transmission lines, and further analysis is not required.

4.3 Noise

The following sections address the noise issues applicable to PTN, providing background on the issues and the analyses regarding the SLR period.

4.3.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Noise levels would remain below regulatory guidelines for offsite receptors during continued operations and refurbishment associated with license renewal.

4.3.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.3.3 Background [GEIS Section 4.3.1.2]

Major sources of noise at operating nuclear power plants are cooling towers, turbines, transformers, large pumps, and cooling water system motors. Nuclear plant operations have not changed appreciably with time, and no change in noise levels or noise-related impacts are expected during the license renewal term. Because no change is expected in the amount of noise generated during the license renewal term, the only issue of concern is the number of people now living close to the nuclear power plant who are exposed to operational noise.

Given the industrial nature of the power plant and the number of years of plant operation, noise from a nuclear plant is generally nothing more than a continuous minor nuisance. However, noise levels may sometimes exceed the 55 dBA level that the EPA uses as a threshold level to protect against excess noise during outdoor activities. However, according to the EPA, this threshold does "not constitute a standard, specification, or regulation," but was intended to provide a basis for state and local governments establishing noise standards. Nevertheless, noise levels at the site boundary are expected to remain well below regulatory standards for offsite residents.

Noise would also be generated by construction-related activities and equipment used during refurbishment. However, this noise would occur for relatively short periods of time (several weeks) and is not expected to be distinguishable from other operational noises at the site boundary nor create an adverse impact on nearby residents.

4.3.4 Analysis

Noise associated with plant operations is presented in Section 3.4. As discussed in Section 3.4, a noise monitoring survey which included noise from PTN was performed in June 2008 as part of the Turkey Point Units 6 and 7 COL application ER. The survey indicated that the baseline Ldn value is below the 65 dBA acceptance limit. Turkey Point Units 6 and 7 would be collocated with PTN; therefore, the noise study is also considered applicable to PTN.

No license renewal-related refurbishment activities have been identified, as discussed in Section 2.3. As discussed in Section 3.4, because Turkey Point is located in a rural area away from urban areas, it is unlikely that noise levels from Turkey Point would affect offsite residences. The nearest residence to PTN, as defined in the PTN AREOR, is located approximately 1.7 miles west-northwest of the PTN generating station area. These are identified as the FPL daycare center and shooting range near the entrance to PTN. The Homestead Bayfront Park complex is located 1.9 miles north of the plant and has occasional overnight recreational occupancy. (PTN 2017b) There are no applicable state or local environmental noise regulations for unincorporated areas of Miami-Dade County, where Turkey Point is located. As discussed in Section 3.4, there have been no noise complaints associated with Turkey Point's plant operations in the previous 5 years (2012–2016).

In the GEIS, the NRC determined that noise impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.3.1.2). Based on Turkey Point's review, no new and significant information was identified as it relates to noise, and further analysis is not required.

4.4 Geology and Soils

The following sections address the geology and soils issues applicable to PTN, providing background on the issues and the analyses regarding the SLR period.

4.4.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. The effect of geologic and soil conditions on plant operations and the impact of continued operations and refurbishment activities on geology and soils would be small for all nuclear power plants and would not change appreciably during the license renewal term.

4.4.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.4.3 Background [GEIS Section 4.4.1]

The impact of continued operations and refurbishment associated with license renewal on geologic and soil resources would consist of soil disturbance, including sediment and/or any associated bedrock, for projects, such as replacing or adding buildings, roads, parking lots, and below-ground and above-ground utility structures. Implementing BMPs would reduce soil erosion and subsequent impacts on surface water quality. These practices include, but are not limited to, minimizing the amount of disturbed land, stockpiling topsoil before ground disturbance, mulching and seeding in disturbed areas, covering loose materials with geotextiles, using silt fences to reduce sediment loading to surface water, using check dams to minimize the erosive power of drainages, and installing proper culvert outlets to direct flows in streams or drainages.

Detailed geotechnical analyses would be required to address the stability of excavations, foundation footings, and slope cuts for building construction, road creation, or other refurbishment-related construction projects. Depending on the plant location and design, riverbank or coastline protection might need to be upgraded, especially at water intake or discharge structures, if natural flows, such as storm surges, cause an increase in erosion. In addition, the FPPA [7 USC 4201 et seq.] requires federal agencies to take into account agency actions affecting the preservation of farmland, including prime and other important farmland soils, as described in Section 3.4 of the GEIS.

4.4.4 Analysis

Geology and soils information is presented in Section 3.5. Routine infrastructure, renovation, and maintenance projects would be expected during continued operation. As discussed in Section 3.5.3.2, stabilization measures are in place to prevent erosion and sedimentation impacts to the site and vicinity because PTN has been operational since the early 1970s.

In the GEIS, the NRC determined that geology and soil impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.4.1). Based on FPL's review, no new and significant information was identified as it relates to geology and soils, and further analysis is not required.

4.5 Water Resources

The following sections address the water resources issues applicable to PTN, providing background on the issues and the analyses regarding the SLR period.

4.5.1 Surface Water Use Conflicts (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a River)

4.5.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL or MODERATE. Impacts could be of small or moderate significance, depending on makeup water requirements, water availability, and competing water demands.

4.5.1.2 Requirement [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action on water availability and competing water demands, the flow of the river . . . must be provided.

4.5.1.3 Background [GEIS Section 4.5.1.1]

Nuclear power plant cooling systems may compete with other users relying on surface water resources, including downstream municipal, agricultural, or industrial users. Closed-cycle cooling is not completely closed, because the system discharges blowdown water to a surface water body and withdraws water for makeup of both the consumptive water loss due to evaporation and drift (for cooling towers) and blowdown discharge. For plants using cooling towers, the makeup water needed to replenish the consumptive loss of water to evaporation can be significant and is reported at 60 percent or more of the condenser flow rate. Cooling ponds will also require makeup water as a result of naturally occurring evaporation, evaporation of the warm effluent, and possible seepage to groundwater.

Consumptive use by plants with cooling ponds or cooling towers using makeup water from a river during the license renewal term is not expected to change unless power uprates, with associated increases in water use, are proposed. Such uprates would require an environmental assessment by the NRC. In the 1996 GEIS, application of this issue applied only to rivers with low flow so as to define the difference between plants located on "small" versus "large" rivers. However, any river, regardless of size, can experience low flow conditions of varying severity during periods of drought and changing conditions in the affected watershed such as upstream diversions and use of river water. NRC has subsequently determined that use of the term "low flow" in categorizing river flow is of little value considering that all rivers can experience low flow conditions.

Population growth around nuclear power plants has caused increased demand on municipal water systems, including systems that rely on surface water. Municipal intakes located downstream from a nuclear power plant could experience water shortages, especially in times of drought. Similarly, water demands upstream from a plant could impact the water availability at the plant's intake.

Water use conflicts associated with plants with cooling ponds or cooling towers using makeup water from a river with low flow were considered to vary among sites because of differing site-specific factors, such as makeup water requirements, water availability (especially in terms of varying river flow rates), changing or anticipated changes in population distributions, or changes in agricultural or industrial demands.

4.5.1.4 Analysis

As discussed in Section 2.2.3, Turkey Point utilizes a closed-cycle CCS for condenser cooling purposes, but does not withdraw makeup water from a river. PTN does not have a permit to use surface water for consumptive use nor have any plans for surface water consumptive use during the license renewal period. PTN uses approximately 690 gpm of water from the Miami-Dade public water supply system. Plant water use includes process (primary demineralizer water makeup), potable, and fire protection water. (FPL 2014a, Section 2.3.2.1.4.1) The use of municipal water for plant use will be significantly reduced by the end of 2017, when production from the Upper Floridan Aquifer will begin. Therefore, this issue is not applicable, and further analysis is not required.

4.5.2 Groundwater Use Conflicts (Plants with Closed-Cycle Cooling Systems that Withdraw Makeup Water from a River)

4.5.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Water use conflicts could result from water withdrawals from rivers during low-flow conditions, which may affect aquifer recharge. The significance of impacts would depend on makeup water requirements, water availability, and competing water demands.

4.5.2.2 Requirement [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action on water availability and competing water demands . . . must be provided. The applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow.

4.5.2.3 Background [GEIS Section 4.5.1.2]

In the case of plants with cooling towers or cooling ponds that rely on a river for makeup of consumed (evaporated) cooling water, it is possible water withdrawals from the river could lead to groundwater use conflicts with other users. This situation could occur because of the interaction between groundwater and surface water, especially in the setting of an alluvial aquifer in a river valley. Consumptive use of the river water, if significant enough to lower the river's water level, would also influence water levels in the alluvial aquifer. Shallow wells of nearby groundwater users could therefore have reduced water availability or go dry. During times of drought, the effect would be occurring naturally, although withdrawals for makeup water would increase the effect.

4.5.2.4 Analysis

As discussed in Section 2.2.3, Turkey Point uses its closed-cycle cooling canals in the CCS for condenser cooling purposes, but does not withdraw makeup water from a river. Therefore, this issue is not applicable, and further analysis is not required.

4.5.3 Groundwater Use Conflicts (Plants that Withdraw more than 100 GPM)

4.5.3.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Plants that withdraw more than 100 gpm could cause groundwater use conflicts with nearby groundwater users.

4.5.3.2 Requirement [10 CFR 51.53(c)(3)(ii)(C)]

If the applicant's plant pumps more than 100 gallons (total onsite) of groundwater per minute, an assessment of the impact of the proposed action on groundwater must be provided.

4.5.3.3 Background [GEIS Section 4.5.1.2]

A nuclear plant may have several wells, with combined pumping in excess of 100 gpm (378 liters per minute [L/min]). Overall site pumping rates of this magnitude have the potential to create conflicts with other local groundwater users if the cone of depression extends to the offsite well(s). Large offsite pumping rates for municipal, industrial, or agricultural purposes may, in turn, lower the water level at power plant wells. For any user, allocation is normally determined through a state-issued permit.

Groundwater use conflicts have not been observed at any nuclear power plants, and no significant change in water well systems is expected over the license renewal term. If a conflict did occur, it might be possible to resolve it if the power plant relocated its well or wellfield to a different part of the property. The siting of new wells would be determined through a hydrogeologic assessment.

4.5.3.4 Analysis

The FDEP (conditions of certification) allows a maximum Floridan Aquifer withdrawal total of 28.06 MGD:14.00 MGD for salinity reduction in the CCS and 14.06 MGD for Unit 5 cooling water and plant process water (FDEP 2016a). The SFWMD (Permit No. 13-06251-W) allows a maximum withdrawal of groundwater from the Biscayne Aquifer of 5,475 million gallons per year (15,000 gpd or 465 million gallons per month) for use in the capture of hypersaline water in the Biscayne Aquifer using the RWS (SFWMD 2017a). Therefore, the combined permitted groundwater maximum withdrawals from the Floridan Aquifer and Biscayne Aquifer Recovery System is 43.06 MGD. These Biscayne and Floridan Aquifer System withdrawals are permitted by FDEP and the SFWMD. During the permitting process, the impacts of the uses on existing land uses, pre-existing water rights, and the environment are fully evaluated and subject to public review and challenge prior to water rights being granted. In addition, in southern Florida, uses of seawater-quality water (dissolved chloride levels of 19,000 mg/L or above) do not require a permit. FPL maintains three such seawater wells constructed into the Biscayne Aquifer (Point Wells) for CCS freshening in the event of extreme salinity events. The combined capacity of these three wells is 45 MGD.

It is not anticipated that groundwater withdrawal increases above permitted quantities will be required during the license period; therefore, FPL concludes that impacts from groundwater withdrawals are SMALL and do not warrant additional mitigation measures.

4.5.4 Groundwater Quality Degradation (Plants with Cooling Ponds at Inland Sites)

4.5.4.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Inland sites with closed-cycle cooling ponds could degrade groundwater quality. The significance of the impact would depend on cooling pond water quality, site hydrogeologic conditions (including the interaction of surface water and groundwater), and the location, depth, and pump rate of water wells.

4.5.4.2 Requirement [10 CFR 51.53(c)(3)(ii)(D)]

If the applicant's plant is located at an inland site and utilizes cooling ponds, an assessment of the impact of the proposed action on groundwater quality must be provided.

4.5.4.3 Background [GEIS Section 4.5.1.2]

Some nuclear power plants that rely on unlined cooling ponds are located at inland sites surrounded by farmland or forest or undeveloped open land. Degraded groundwater has the potential to flow radially from the ponds and reach offsite groundwater wells. The degree to which this occurs depends on the water quality of the cooling pond; site hydrogeologic conditions (including the interaction of surface water and groundwater); and the location, depth, and pump rate of water wells. Mitigation of significant problems stemming from this issue could include lining existing ponds, constructing new lined ponds, or installing subsurface flow barrier walls. Groundwater monitoring networks would be necessary to detect and evaluate groundwater quality degradation. The degradation of groundwater quality associated with cooling ponds has not been reported for any inland nuclear plant sites.

4.5.4.4 Analysis

As discussed in Section 2.2.3, Turkey Point utilizes a closed-loop cooling system with the CCS for condenser cooling purposes. Section 2.2.3 describes the CCS as composed of cooling canals that receive tidal inflow and outflow from the saline aquifer beneath Biscayne Bay. As shown in Section 3.1, Turkey Point's location is coastal rather than inland. Given that this issue is specific to inland sites and the cooling canals groundwater interface is to a marine aquifer, this issue is not applicable, and further analysis is not required. The issue was likewise considered not applicable in the first license renewal ER (FPL 2000b, Section 4.8). The GEIS also identifies Turkey Point's cooling canals as applicable to the Category 1 issue of cooling ponds located in salt marsh (NRC 2013a, Section 4.5.1.2).

4.5.5 Radionuclides Released to Groundwater

4.5.5.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL or MODERATE. Leaks of radioactive liquids from plant components and pipes have occurred at numerous plants. Groundwater protection programs have been established at all operating nuclear power plants to minimize the potential impact from any inadvertent releases. The magnitude of impacts would depend on site-specific characteristics.

4.5.5.2 Requirement [10 CFR 51.53(c)(3)(ii)(P)]

An applicant shall assess the impact of any documented inadvertent releases of radionuclides into groundwater. The applicant shall include in its assessment a description of any groundwater protection program used for the surveillance of piping and components containing radioactive liquids for which a pathway to groundwater may exist. The assessment must also include a description of any past inadvertent releases and the projected impact to the environment (e.g., aquifers, rivers, lakes, ponds, ocean) during the license renewal term.

4.5.5.3 Background [GEIS Section 4.5.1.2]

The issue is relevant to license renewal because all commercial nuclear power plants routinely release radioactive gaseous and liquid materials into the environment. These radioactive releases are designed to be planned, monitored, documented, and released into the environment at designated discharge points. However, within the past several years, there have been numerous events at power reactor sites which involved unknown, uncontrolled, and unmonitored release of liquids containing radioactive material into the groundwater.

The majority of the inadvertent liquid release events involved tritium, which is a radioactive isotope of hydrogen. However, other radioactive isotopes, such as cesium and strontium, have also been inadvertently released into the groundwater. The types of events include leakage from spent fuel pools, buried piping, and failed pressure relief valves on an effluent discharge line.

In 2006, the NRC's Executive Director for Operations chartered a task force to conduct a lessons-learned review of these incidents. On September 1, 2006, the task force issued its report: Liquid Radioactive Release Lessons Learned Task Force Report.

The most significant conclusion dealt with the potential health impacts on the public from the inadvertent releases. Although there were numerous events where radioactive liquid was released to the groundwater in an unplanned, uncontrolled, and unmonitored fashion, based on the data available, the task force did not identify any instances where public health and safety was adversely impacted.

On the basis of the information and experience with these leaks, the NRC concludes that the impact to groundwater quality from the release of radionuclides could be SMALL or MODERATE, depending on the magnitude of the leak, radionuclides involved, hydrogeologic factors, the distance to receptors, and the response time of plant personnel to identify and stop the leak in a timely fashion.

4.5.5.4 Analysis

The Turkey Point groundwater protection program is discussed in Section 3.6.2.5. Table 3.6-2 presents well construction details for the Turkey Point groundwater monitoring wells, while Figures 3.6-10 and 3.6-11 show the location of the wells. Table 3.6-5 presents information on registered water wells within a 5-mile band around the FPL property boundary, while Figure 3.6-12 shows the locations of these registered wells.

As discussed in Section 3.6.4.2.1, tritium migrates with groundwater flow. As discussed in Section 3.6.4.2.1, radwaste releases are discharged to the IWW outfall 001 and mix with waters within the closed-loop IWW/CCS. Radwaste release administrative controls ensure the releases are consistent with the plant permits and do not present an environmental or public health risk. The cooling canals are in direct hydraulic connection to the underlying sediments and coral rock, and a near continuous exchange of surface water in the cooling canals and groundwater within the sediments exists by design. As discussed in Sections 3.6.4.2.1 and 3.6.4.2, groundwater beneath the CCS is saltwater, has been designated as a G-III non-potable groundwater by the FDEP, and is not used as a source of potable or irrigation supply. In addition, facility personnel are provided a municipal source of drinking water. Due to the administrative controls employed for discharges of radwaste, which ensure tritium levels are below public health safety levels, and the use of municipal water for human use, health risks due to human consumption are not credible. The IWW is not open to the public, thereby restricting access. Based on the groundwater and surface water data, none of the potential receptors identified are at a credible risk of exposure to concentrations of tritium. (FPL 2017b, Section 2.10.4)

As discussed in Section 3.6.4.2.1, nine minor unplanned releases of radioactive materials have occurred from 2012 to 2016. All releases have been remediated or monitored to ensure any released radionuclides have not migrated from the release site. Unplanned release events are entered into the CAP for evaluation, correction, and future prevention. For the four unplanned releases with the potential to reach groundwater (e.g., leaks onto soil), Table 3.6-6 presents groundwater monitoring results prior to and for the following year for the unplanned releases. The readings were below reportable levels and do not show a sustained trend. Thus, these unplanned releases would not influence groundwater quality during the SLR term. FPL would continue using its activities to identify unplanned releases, stop them, and enter them into CAP for evaluation, correction, and future prevention.

As discussed in Section 3.6.4.2, Turkey Point's groundwater monitoring program covers the existing quality of groundwater potentially affected by continued operations (as compared to the EPA primary drinking water standards), as well as the current and potential onsite and offsite uses and users of groundwater for drinking and other purposes. As discussed in Section 3.6.4.1.1, low-level liquid radioactive waste effluent from PTN is also discharged by procedurally controlled processes to the IWW facility (CCS). Groundwater tritium levels ranging from non-detectable to 5,500 pCi/L were detected in on-site well PTN-MW-5s in the first quarter of 2016, as shown in Table 4.5-1. This tritium concentration decreased to 480 pCi/L by the fourth quarter of 2016. (PTN 2017b) Since the groundwater monitoring program was initiated in 2010, no plant-related gamma isotopes or hard-to-detect radionuclides have been detected. Therefore, due to continued operations within the requirements of established operating procedures, permits, and site monitoring programs, FPL concludes that impacts from radionuclides to groundwater are SMALL and do not warrant additional mitigation measures beyond PTN's existing groundwater monitoring program and administrative controls.

Table 4.5-1
Turkey Point Groundwater Monitoring Results, Tritium Activity Concentration (pCi/L), 2016 (Sheet 1 of 2)

Well	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
PTPED-1	488	< MDC	< MDC	320
CD-1	545	751	481	< MDC
P-94-2	2,010	N/A	386	N/A
P-94-4	2,200	1,310	1,170	903
STP-1	< MDC	N/A	< MDC	N/A
PTN-MW-1S	< MDC	N/A	< MDC	N/A
PTN-MW-1I	700	N/A	380	N/A
PTN-MW-1D	1,760	N/A	1,950	N/A
PTN-MW-2S	< MDC	N/A	< MDC	N/A
PTN-MW-3S	< MDC	N/A	< MDC	N/A
PTN-MW-4S	1,050	< MDC	343	< MDC
PTN-MW-4I	3,570	< MDC	< MDC	< MDC
PTN-MW-4D	< MDC	< MDC	3,720	< MDC
PTN-MW-5S	5,500	1,320	884	480
PTN-MW-5I	521	2,610	542	344
PTN-MW-5D	2,500	2,760	2,880	2,700
PTN-MW-6S	< MDC	N/A	< MDC	N/A
PTN-MW-6D	1,530	N/A	1,960	N/A
PTN-MW-7S	649	756	886	916
PTN-MW-7I	1,760	1,730	2,400	2,370
PTN-MW-7D	< MDC	< MDC	< MDC	< MDC
PTN-MW-8S	1,020	2,910	3,900	964
PTN-MW-9S	561	455	< MDC	422
PTN-MW-10S	< MDC	N/A	< MDC	N/A
PTN-MW-10I	1,290	N/A	< MDC	N/A

Table 4.5-1
Turkey Point Groundwater Monitoring Results, Tritium Activity Concentration (pCi/L), 2016 (Sheet 2 of 2)

Well	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
PTN-MW-10D	< MDC	N/A	< MDC	N/A
PTN-MW-11S	< MDC	< MDC	< MDC	< MDC
PTN-MW-12S	1,140	1,080	1,040	868

(PTN 2017b)

N/A = Not applicable, sampling not required for this quarter.

< MDC = Value less than 3.00E+02 pCi/L for tritium.

4.6 Ecological Resources

The following sections address the ecological resource issues applicable to PTN, providing background on the issues and the analyses regarding the SLR period.

4.6.1 Impingement and Entrainment of Aquatic Organisms (Plants with Once-Through Cooling Systems or Cooling Ponds)

4.6.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. The impacts of impingement and entrainment are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems, depending on cooling system withdrawal rates and volumes and the aquatic resources at the site.

4.6.1.2 Requirement [10 CFR 51.53(c)(3)(ii)(B)]

If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations or equivalent state permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from impingement and entrainment.

4.6.1.3 Background [GEIS Section 4.6.1.2]

Impingement occurs when organisms are held against the intake screen or netting placed within intake canals. Most impingement involves fish and shellfish. At some nuclear power plants, other vertebrate species may also be impinged on the traveling screens or on intake netting placed within intake canals.

Entrainment occurs when organisms pass through the intake screens and travel through the condenser cooling system. Aquatic organisms typically entrained include ichthyoplankton (fish eggs and larvae), larval stages of shellfish and other macroinvertebrates, zooplankton, and phytoplankton. Juveniles and adults of some species may also be entrained if they are small enough to pass through the intake screen openings, which are commonly 0.38 in. (1 cm) at the widest point.

The magnitude of the impact would depend on plant-specific characteristics of the cooling system (including location, intake velocities, screening technologies, and withdrawal rates) and characteristics of the aquatic resource (including population distribution, status, management objectives, and life history).

4.6.1.4 Analysis

As discussed in Section 2.2.3, PTN withdraws water from the CCS, which is not classified as waters of the U.S. by the EPA.

Entrainment of Fish and Shellfish in Early Life Stages

For plants with cooling ponds, including the Turkey Point CCS, entrainment of fish and shellfish in early life stages into cooling water systems associated with nuclear power plants is considered a Category 2 issue, requiring a site-specific assessment before license renewal. (NRC 2002a, Section 4.1.1)

The closed-loop, recirculating Turkey Point CCS neither withdraws nor discharges surface water to any surface water of the United States or the State of Florida. Therefore, impacts of entrainment on early life stages are limited to the CCS, and there are no impacts from entrainment of fish and shellfish in early life stages on biotic resources of Biscayne Bay, Card Sound, or other waters. (NRC 2002a, Section 4.1.1)

A species list or faunal survey for the fish and shellfish of the CCS is not available. Suitable spawning habitat for game species that favor ocean passes or open bays, such as the common snook and tarpon, is not present in the CCS. Table 3.7-1 details fish species historically documented as occurring in the CCS. As reported in the 2002 PTN EIS, game fish numbers in the CCS declined to very low numbers due to lack of spawning habitat. The 2002 EIS states that the predominant fish in the canals are killifish and other live-bearers. (NRC 2002a, Section 4.1.1) The absence of any hydrological connection between the CCS and adjacent waters prevents the establishment of new fish and shellfish populations in the CCS. Therefore, it is reasonable to conclude that killifish and live-bearers remain the dominant fish species in these waters.

Based on this review, the potential impacts of the cooling-water-intake system's entrainment of fish and shellfish in early life stages are SMALL, and mitigation is not warranted.

Impingement of Fish and Shellfish

For plants with once-through cooling systems, including the Turkey Point CCS, impacts of fish and shellfish on debris screens of cooling-water systems associated with nuclear power plants is considered a Category 2 issue, requiring a site-specific assessment before license renewal. (NRC 2002a, Section 4.1.2)

The closed-loop, recirculating Turkey Point CCS neither withdraws nor discharges surface water to the waters of the State. Therefore, impacts from impingement of fish and shellfish are limited to fish and shellfish in the cooling canals, and there are no impacts from impingement on fish and shellfish of Biscayne Bay, Card Sound, or other waters. (NRC 2002a, Section 4.1.2)

Impacts from impingement of fish and shellfish are limited to the populations of fish and shellfish residing in the CCS. A species list or faunal survey for the fish and shellfish of the CCS is not available.· Suitable spawning habitat for game species that favor ocean passes or open bays, such as the common snook and tarpon, is unlikely to occur in the CCS, although the 2002 PTN EIS reported that some gamefish spawning in the canals may still be occurring at that time. The 2002 EIS states that the dominant fish species in the CCS are killifish and other live-bearers (NRC 2002a, Section 4.1.2). The absence of any hydrological connection between the CCS and adjacent waters prevents the establishment of new fish and shellfish populations in the CCS. Therefore, it is unlikely that species not documented in the previous EIS are present in the CCS, and killifish and live-bearers likely remain the dominant fish species in these waters. The preferred habitat for killifish and other live-bearers are shallows and aquatic vegetation, and individuals are not widely ranging. It is unlikely that populations of such species would be greatly affected by impingement in the intakes of the nuclear plants. Any impacts on fish and shellfish populations within the CCS from impingement would not impact recreational or commercial fishing, because the cooling canals are closed to fishing or other resource-based uses. (NRC 2002a, Section 4.1.2)

Based on the available information relative to potential impacts of the cooling water intake system on the impingement of fish and shellfish, the potential impacts are SMALL, and mitigation is not warranted.

4.6.2 Thermal Impacts on Aquatic Organisms (Plants with Once-Through Cooling Systems or Cooling Ponds)

4.6.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Most of the effects associated with thermal discharges are localized and are not expected to affect overall stability of populations or resources. The magnitude of impacts, however, would depend on site-specific thermal plume characteristics and the nature of aquatic resources in the area.

4.6.2.2 Requirement [10 CFR 51.53(c)(3)(ii)(B)]

If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of a 316(a) variance in accordance with 40 CFR Part 125, or equivalent state permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from thermal changes

4.6.2.3 Background [GEIS Section 4.6.1.2]

Because characteristics of both the thermal discharges and the affected aquatic resources are specific to each site, NRC classified heat shock as a Category 2 issue that required a site-specific assessment for license renewal. The NRC found the potential for thermal discharge impacts to be greatest at plants with once-through cooling systems, primarily because of the higher discharge temperatures and larger thermal plume area compared to plants with cooling towers.

The impact level at any plant depends on the characteristics of its cooling system (including location and type of discharge structure, discharge velocity and volume, and three-dimensional characteristics of the thermal plume) and characteristics of the affected aquatic resources (including the species present and their physiology, habitat, population distribution, status, management objectives, and life history).

4.6.2.4 Analysis

PTN discharges to the CCS, which is not classified as waters of the U.S. by the EPA and is therefore not subject to CWA jurisdiction, and not subject to 316(a) regulations.

However, site conditions of certification require temperature monitoring in the canals and Biscayne Bay. The Fifth Supplemental Agreement requires monitoring of temperature in the canal system and adjacent surface and groundwater and ecological impacts from the canals. This information is reported annually, per the conditions of the Fifth Supplemental Agreement. (SFWMD 2009)

The 2002 LRA for PTN determined that use of the CCS would not result in thermal impacts to adjacent Waters of the U.S., including Biscayne Bay and Card Sound (NRC 2002a). However, the PTN uprate was anticipated to result in a temperature increase in the CCS. The Fifth Supplemental Agreement, authorizing the uprate, mandates temperature monitoring in the CCS and the adjacent Card Sound and Biscayne Bay, to ensure that there are no thermal impacts to waters of the U.S. A minimum of 2 years of monitoring was required prior to the uprate (SFWMD 2009). Pre-uprate monitoring data were collected prior to February 26, 2012; interim operating data were collected between February 26, 2012, and May 27, 2013; and post-uprate monitoring began after May 27, 2013.

Post-uprate monitoring did detect an increase in temperature in the CCS. The post-uprate temperatures near the plant discharge into the CCS and near the plant intake were 4.5ºC and 3.2ºC warmer, respectively, than the pre-uprate period. While pre- and post-uprate averages may not be directly comparable because they do not cover the same number of months, the post-uprate water temperatures were consistently warmer. The increase in CCS surface water temperatures during the post-uprate period cannot be explained by the uprate, because the total heat rejection rate to the CCS from Turkey Point Units 1, 2, 3, and 4, operating at full capacity prior to the uprate monitoring period, would have been higher than the post-uprate heat rejection rate to the CCS for Units 1, 3, and 4 operating at full capacity. Unit 2 was dedicated to operate in a synchronous condenser mode (i.e., not producing steam heat) in the beginning of 2011, thereby requiring no heat rejection from the CCS. FPL's observations have concluded that the temporal increase in average CCS temperature in 2014 (during the post-uprate monitoring period) was the result of a series of events that degraded CCS water quality and negatively affected the heat exchange capacity of the CCS, including the following: lower than average precipitation into the CCS during 2011 through early 2014; reduced circulation within the CCS; periods of degraded water quality in the CCS during 2012 and 2013 (increased salinity, turbidity, and algal concentration); and decreased CCS heat exchange efficiency from historical levels in 2013 and 2014, likely due to significant blockages and increased sediment levels principally in the northern segments of the CCS.

There continue to be no discernable effects of the CCS on Biscayne Bay surface water quality at monitoring stations located out in the bay. For most surface water stations around the CCS, there was no readily apparent change in the influence of CCS water via the groundwater pathway during the post-uprate period, as compared to the pre-uprate data. There were two locations in the surface water canal stations immediately adjacent to the southern end of the CCS (TPSWC-4, located in the S-20 Canal, and TPSWC-5, located in the Card Sound Canal) where there appeared to be some CCS water present/influence during the pre- and post-uprate monitoring periods. Regardless, water quality and tritium data collected during the pre- and post-uprate monitoring period at TPBBSW-4, located at the mouth of the S-20 Canal and Card Sound Canal in Biscayne Bay, did not show evidence of CCS water. This indicates influence immediately adjacent to the CCS but minimal, if any, influence in Biscayne Bay.

In conclusion, while temperature has increased in the CCS, this aquatic feature is not a water of the U.S. and is not subject to CWA 316(a) regulations. Ongoing field studies indicate that thermal dynamics in the CCS do not influence Biscayne Bay or Card Sound, and therefore, impacts are anticipated to be SMALL, and mitigation measures are not warranted.

4.6.3 Water Use Conflicts with Aquatic Resources (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a River)

4.6.3.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL or MODERATE. Impacts on aquatic resources in stream communities affected by water use conflicts could be of moderate significance in some situations.

4.6.3.2 Requirement [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action on water availability and competing water demands, the flow of the river, and related impacts on stream (aquatic) ecological communities must be provided.

4.6.3.3 Background [GEIS Section 4.6.1.2]

Increased temperatures and/or decreased rainfall would result in lower river flows, increased cooling pond evaporation, and lowered water levels in the Great Lakes or reservoirs. Regardless of overall climate change, droughts could result in problems with water supplies and allocations.

Because future agricultural, municipal, and industrial users would continue to share their demands for surface water with power plants, conflicts might arise if the availability of this resource decreased.

Water use conflicts with aquatic resources could occur when water to support these resources is diminished either because of decreased water availability due to droughts; increased demand for agricultural, municipal, or industrial usage; or due to a combination of such factors. Water use conflicts with biological resources in stream communities are a concern due to the duration of license renewal and potentially increasing demands on surface water.

4.6.3.4 Analysis

As discussed in Sections 2.2.3.2, 4.5.1.4, and 4.5.2.4, PTN does not obtain makeup water from a river. Therefore, this issue is not applicable, and further analysis is not required.

4.6.4 Water Use Conflicts with Terrestrial Resources (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a River)

4.6.4.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL or MODERATE. Impacts on terrestrial resources in riparian communities affected by water use conflicts could be of moderate significance.

4.6.4.2 Requirement [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action on water availability and competing water demands, the flow of the river, and related impacts on . . . riparian (terrestrial) ecological communities must be provided.

4.6.4.3 Background [GEIS Section 4.6.1.1]

Water use conflicts with terrestrial resources in riparian communities could occur when water that supports these resources is diminished either because of decreased availability due to droughts; increased water demand for agricultural, municipal, or industrial usage; or a combination of such factors. For future license renewals, the potential range of impact levels at plants with cooling ponds or cooling towers using makeup water from a river cannot be determined at this time.

4.6.4.4 Analysis

As discussed in Sections 2.2.3.2, 4.5.1.4, and 4.5.2.4, PTN does not obtain makeup water from a river. Therefore, this issue is not applicable, and further analysis is not required.

4.6.5 Effects on Terrestrial Resources (Non-Cooling System Impacts)

4.6.5.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Impacts resulting from continued operations and refurbishment associated with license renewal may affect terrestrial communities. Application of BMPs would reduce the potential for impacts. The magnitude of impacts would depend on the nature of the activity, the status of the resources that could be affected, and the effectiveness of mitigation.

4.6.5.2 Requirement [10 CFR 51.53(c)(3)(ii)(E)]

All license renewal applicants shall assess the impact of refurbishment, continued operations, and other license-renewal-related construction activities on important plant and animal habitats.

4.6.5.3 Background [GEIS Section 4.6.1.1]

Continued operations and refurbishment activities could continue to affect onsite terrestrial resources during the license renewal term at all operating nuclear power plants. Factors that could potentially result in impacts include landscape maintenance activities, stormwater management, and elevated noise levels. These impacts would, for the most part, be similar to past and ongoing impacts.

The characteristics of terrestrial habitats and wildlife communities currently on nuclear power plant sites have generally developed in response to many years of typical operations and maintenance programs. While some may have reached a relatively stable condition, some habitats and populations of some species may have continued to change gradually over time. Operations and maintenance activities during the license renewal term are expected to be similar to current activities. Because the species and habitats present on the sites (i.e., weedy species and habitats they make up) are generally tolerant of disturbance, it is expected that continued operations during the license renewal term would maintain these habitats and wildlife communities in their current state, or maintain current trends of change.

Terrestrial habitats and wildlife could be affected by ground disturbance from refurbishment-related construction activities. Land disturbed during the construction of new ISFSIs would range from about 2.5 to 10 ac (1 to 4 ha). Other activities may include new parking areas for plant employees, access roads, buildings, and facilities. Temporary project support areas for equipment storage, worker parking, and material laydown areas could also result in the disturbance of habitat and wildlife.

Successful application of environmental review procedures, employed by the licensees at many of the operating nuclear plant sites, would result in the identification and avoidance of important terrestrial habitats. In addition, the application of BMPs to minimize the area affected; to control fugitive dust, runoff, and erosion from project sites; to reduce the spread of invasive nonnative plant species; and to reduce disturbance of wildlife in adjacent habitats could greatly reduce the impacts of continued operations and refurbishment activities.

4.6.5.4 Analysis

Refurbishment Activities

As discussed in Section 2.3, no license renewal-related refurbishment activities have been identified. Therefore, there would be no license renewal-related refurbishment impacts to important plant and animal habitats, and no further analysis is required.

Operational Activities

Terrestrial resources are described in Section 3.7.2. No license renewal-related construction activities or changes in operational practices have been identified that would involve disturbing habitats. FPL would continue to conduct ongoing plant operational and maintenance activities during the SLR period. However, these activities are expected to have minimal impacts on terrestrial resources because activities are anticipated to occur within previously disturbed habitats.

Operational and maintenance activities that FPL might undertake during the SLR term, such as maintenance and repair of plant infrastructure (e.g., roadways, piping installations, fencing, and other security infrastructure), would likely be confined to previously disturbed areas of the site. Furthermore, as discussed in Section 9.6, FPL has administrative controls in place at Turkey Point to ensure that operational changes or construction activities are reviewed, and the impacts minimized through implementation of BMPs, permit modifications, or acquisition of new permits as needed. In addition, regulatory programs that the site is currently subject to such as stormwater management, spill prevention, dredging, and herbicide usage further serve to minimize impacts to terrestrial resources.

In summary, adequate management programs and regulatory controls are in place to ensure that important plant and animal habitats are protected during the SLR period.

Therefore, FPL concludes the impacts to the terrestrial ecosystems from SLR are SMALL, and no additional mitigation measures beyond current management programs and existing regulatory controls are required.

4.6.6 Threatened, Endangered, and Protected Species, and Essential Fish Habitat

4.6.6.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

The magnitude of impacts on threatened, endangered, and protected species, critical habitat, and EFH would depend on the occurrence of listed species and habitats and the effects of power plant systems on them. Consultation with appropriate agencies would be needed to determine whether special status species or habitats are present and whether they would be adversely affected by continued operations and refurbishment associated with license renewal.

4.6.6.2 Requirement [10 CFR 51.53(c)(3)(ii)(E)]

All license renewal applicants shall assess the impact of refurbishment, continued operations, and other license renewal-related construction activities on important plant and animal habitats. Additionally, the applicant shall assess the impact of the proposed action on threatened or endangered species in accordance with federal laws protecting wildlife, including but not limited to, the ESA, and EFH in accordance with the MSA.

4.6.6.3 Background [GEIS Section 4.6.1.3]

There are several federal acts that provide protection to certain species and habitats that are treated here under a single issue. The issue includes impacts to biological resources such as threatened and endangered species and their critical habitat under the ESA, EFH as protected under the MSA, and impacts to mammalian species protected under the Marine Mammal Protection Act.

Factors that could potentially result in impacts on listed terrestrial species include habitat disturbance . . . operation and maintenance of cooling systems, transmission line ROW maintenance, collisions with . . . and transmission lines, and exposure to radionuclides. The listed species on or in the vicinity of nuclear power plants also range widely, depending on numerous factors such as the plant location and habitat types present.

Potential impacts of continued operations and refurbishment activities on federally or state-listed threatened and endangered species, protected marine mammals, and EFH could occur during the license renewal term. Factors that could potentially result in impacts to these species and habitats include impacts of refurbishment, other ground-disturbing activities, release of contaminants, effects of cooling water discharge on dissolved oxygen, gas supersaturation, eutrophication, thermal discharges, entrainment, impingement, reduction in water levels due to the cooling system operations, dredging, radionuclides, and transmission line ROW maintenance.

4.6.6.4 Analysis

Refurbishment Activities

As discussed in Section 2.3, no license renewal-related refurbishment activities have been identified. Therefore, there would be no license renewal-related refurbishment impacts to threatened, endangered, and protected species, or EFH, and no further analysis is required.

Operational Activities

As discussed in Section 3.7.8.1, there are 52 federally listed species which are either threatened, endangered, or candidate species within Miami-Dade County. In addition, as discussed in Section 3.7.8.2, the FFWCC has designated 118 plant and animal species as state-listed threatened or endangered, in addition to those that are also listed as endangered or threatened under the federal ESA.

Federally Listed Species

As discussed in Section 3.7.8.1, of the 52 federally listed species, 21 are plant species. No clearing activities are anticipated to occur as the result of continued operations of PTN. Therefore, impacts to federally listed plant species will not be considered further. Further, PTN does not discharge cooling water to Biscayne Bay, Card Sound, or other waters of the U.S. Therefore, the 10 federally listed species inhabiting these waters, including shortnose sturgeon (*Acipenser brevirostrum*), Atlantic sturgeon (*Acipenser oxyrhynchus oxyrhynchus*), Nassau grouper (*Epinephelus striatus*), smalltooth sawfish (*Pristis pectinate*), loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), hawksbill sea turtle (*Eretmochelys imbricate*), Kemp's ridley sea turtle (*Lepidochlys kempii*), and the Florida manatee (*Trichechus manatu*), are excluded from analysis. While federally listed as occurring in Miami-Dade County, habitat associations for 11 species are so restricted, or species occurrences are so rare, that these species are unlikely to occur on the Turkey Point property. These species are Florida leafwing (*Anaea troglodyta floridalis*), Miami tiger beetle (*Cicindelidia floridana*), Miami blue butterfly (*Cyclargus thomasi bethunebakeri*), Schaus' swallowtail (*Papilio aristodemus ponceanus*), Bartram's scrub-hairstreak (*Strymon acis bartrami*), Stock Island tree snail (*Orthalicus reses reses*), gopher tortoise (*Gopherus Polyphemus*), Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*), Audubon's crested caracara (*Polyborus plancus audubonii*), Kirtland's warbler (*Setophaga kirtlandi*), and Bachman's warbler (*Vermivora bachmani*). These species are not included in this analysis based on the low likelihood of occurrence on the Turkey Point property.

Habitat for nine federally listed species may occur on or adjacent to the Turkey Point property: American alligator (*Alligator mississippiensis*), American crocodile (*Crocodylus acutus*), eastern indigo snake (*Drymarchon corais couperi*), rufa red knot (*Calidris canutus*), piping plover (*Charadrius melodus*), wood stork (*Mycteria americana*), snail kite (*Rostrhamus sociabili*), Florida bonneted bat (*Eumops floridanus*), and Florida panther (*Puma concolor coryi*).

As a requirement of the SCA and Fifth Supplemental Agreement, crocodiles on the site are monitored under FPL's crocodile management plan, which is focused on the creation of an environment and the enhancement of crocodile nesting habitat as well as the monitoring the reproductive success, growth, and survival of hatchlings. PTN is one of three nesting locations in Florida. While the number of successful nests located at the site has decreased in recent years, the American crocodile population continues to remain in a much stronger position than before the Turkey Point CCS was established. Today, crocodiles continue to migrate in and out of the

CCS and call the system home. Despite the environmental changes taking place within the CCS, in 2016 the American crocodiles had eight successful nests, and 127 hatchlings were released at Turkey Point outside of the CCS. Therefore, operation of PTN has positively affected this species. No increase in traffic volume is anticipated to result from the continued operation of PTN, and continued operation of PTN will not result in a loss of habitat. This species is therefore not likely to be adversely affected by continued operation of PTN.

American alligators have the potential to occur on the Turkey Point site. However, while alligators are tolerant to low salinity levels, they are typically more prevalent in fresh and brackish water with salinity levels less than 35 ppt (Fujisaki et al. 2014). Salinity concentrations in the CCS are approximately twice that of Biscayne Bay. (FPL 2014a, Section 2.3.3.1.2) and, therefore, likely too high for the canals to be considered suitable habitat for alligators. Therefore, occurrences of American alligators on the Turkey Point property are unlikely, and the continued operation of PTN is unlikely to affect this species.

Eastern indigo snakes rely on a matrix of habitats to survive, and movement among habitats that contain roads increases the potential for vehicle collision mortality. Snakes in general are prone to collision mortality, because they use road surfaces for thermoregulation and their shape, coloration, and low profile make them difficult for automobile drivers to see. However, increased automobile traffic is not anticipated to occur as a result of continued operation of PTN; therefore, the likelihood of mortality resulting from vehicle collisions is low. (NRC 2016a, Section 5.3.1.3) Continued operation of PTN will not result in a loss of habitat. This species is therefore not likely to be adversely affected by continued operation of PTN.

Piping plovers and red knots are shorebirds that use open habitats, such as beaches and mudflats, during winter in southern Florida. Both are small birds not known to be exceptionally prone to collision mortality, so the likelihood of collision with tall structures associated with PTN is expected to be minimal, as is collision with vehicles. (NRC 2016a, Section 5.3.1.3) Collisions with in-scope transmission lines are not anticipated because in-scope transmission lines are located in areas with no ecological value to these species. Continued operation of PTN will not result in a loss of habitat. This species is therefore not likely to be adversely affected by continued operation of PTN.

Wood storks occur in a variety of wetlands and have been observed foraging in shallow portions of the CCS. Water within the system is hypersaline, and the prey wood storks consume are adapted to this environment. However, wood storks have not been observed in great numbers within the CCS, and it is not believed to be a major foraging area. Although juvenile wood storks are not particularly adept at flying, the likelihood of avian collision with tall structures is expected to be minimal. Collisions with in-scope transmission lines are not anticipated because in-scope transmission lines are located in areas with no ecological value to these species. Continued operation of PTN will not result in a loss of habitat. Therefore, the continued operation of PTN is not expected to noticeably affect the wood stork population growth in the region. (NRC 2016a, Section 5.3.1.3)

As discussed in Section 3.7.8.1, migratory movements or local flight patterns may result in the occurrence of the snail kite on the site. Habitat for this species may be located on portions of the Turkey Point site. However, activities on the Turkey Point site are conducted within compliance standards of the MBTA. When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. Compliance with all regulatory requirements associated with this species will continue to be an administrative control practiced by FPL for the life of the PTN facility. Adherence to these controls, as well as compliance with laws and regulations, will prevent impacts to this species. Collisions with in-scope transmission lines are not anticipated because in-scope transmission lines are located in areas with no ecological value to these species. Continued operation of PTN will not result in a loss of habitat. The continued operation of PTN is not likely to adversely affect this species.

The Florida bonneted bat may be present on the Turkey Point property. The Turkey Point site does not contain cavity-bearing, mature trees, or other man-made structures that would provide roosting habitat for the bat. FPL's compliance with federal, state, and local laws and regulations will prevent impacts to this species. Continued operation of the PTN facility is not likely to affect this species.

The USFWS recognizes much of Miami-Dade County and southern Florida as a Florida panther focus area. Although the focus area excludes the Turkey Point site, lands immediately adjacent the Turkey Point site to the south and west are contained within the focus area and are also considered to be within the panther's primary zone. Florida panthers are susceptible to vehicle collisions; one in five deaths of or major injuries to radio-collared panthers resulted from a collision with a vehicle. However, no increase in traffic volume is anticipated to result from the continued operation of PTN. Therefore, an increased risk of collision with this species is not anticipated. Continued operation of PTN will not result in a loss of habitat. (NRC 2016a, Section 5.3.1.3) The continued operation of PTN is not likely to adversely affect this species.

State-Listed Species

A total of 104 plant species are listed by the State of Florida as occurring in Miami-Dade County (Table 3.7-15). Many occur in habitats not found on the Turkey Point site. Some of these plants, such as Small's flax (*Linum carteri var. smallii*) and the Bahama ladder brake (*Pteris bahamaensis*) are known to occur in disturbed habitat, and the banded wild-pine (*Tillandsia flexuosa*) is an epiphyte that grows on a variety of other plants that occur in a wide range of habitats. The range of habitats the state-listed plants represent indicates that some of the species could occur within the plant area on the Turkey Point site, but the extent of their occurrence is undetermined. However, because continued operation of PTN do not involve clearing activities, state-listed plant species on the Turkey Point property are not likely to be impacted by continued operation of PTN (NRC 2016a, Section 5.3.1.3).

As discussed in Section 3.7.8.2, suitable habitat for a total of 10 state-listed species is likely to occur on the Turkey Point property. The following species are likely to occur on the Turkey Point property: Florida burrowing owl (*Athene cunicularia floridana*), little blue heron (*Egretta caerulea*), reddish egret (*Egretta rufescens*), tricolored heron (*Egretta tricolor*), southeastern American kestrel (*Falco sparverius paulus*), American oystercatcher (*Haematopus palliatus*), white-crowned pigeon (*Patagioenas leucocephala*), roseate spoonbill (*Platalea ajaja*), black skimmer (*Rynchops niger*), least tern (*Sternula antillarum*), southern mink, Southern Florida Pop (*Neovison vison* pop. 1).

One Florida burrowing owl was observed in 2010 within the Turkey Point site CCS. Florida burrowing owls are found in open upland habitat and cleared areas. Although berms among the canals of the CCS could be considered to be potential habitat because they are mostly non-vegetated and the deposition of fill raised them to upland elevations, the occurrence of a single burrowing owl does not necessarily indicate habitat suitable for Florida burrowing owls is present within the CCS. If these berms were, in fact, suitable for burrowing owls, one would expect more than a single observation. Therefore, continued operation of PTN is unlikely to affect this species, because occurrences of this species are rare. (NRC 2016a, Section 5.3.1.3)

Little blue heron, reddish egret, tricolored heron, and roseate spoonbill are all piscivorous wading birds. They all have been observed on the Turkey Point site in shallow wetland habitats. Operational noise may displace some individuals, but their occurrence within suitable habitats despite the current operation of existing plants indicates most adapt to increased noise, activity, and artificial light levels. Continued operation of PTN is not expected to affect populations of these species. (NRC 2016a, Section 5.3.1.3)

The American oystercatcher occurs on large open expanses and forages in shellfish beds. No known shellfish beds would be affected by the continued operation of PTN. Other operational effects, including noise and artificial lighting, are not expected to affect American oystercatchers. (NRC 2016a, Section 5.3.1.3)

As discussed in Section 3.7.8.2, migratory movements or local flight patterns may result in the occurrence of the southeastern American kestrel to the site. Habitat for this species may be located on portions of the Turkey Point site. However, activities on the Turkey Point site are evaluated to ensure compliance under the MBTA. When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. Compliance with all regulatory requirements associated with this species will continue to be an administrative control practiced by FPL for the life of the Turkey Point facility. Adherence to these controls, as well as compliance with laws and regulations, will prevent impacts to this species. The continued operation of PTN is not likely to impact this species.

White-crowned pigeons forage on fruit-bearing trees, especially poisonwood (*Metopium toxiferum*), located north and west of the CCS. Operational noise may displace some individuals, but their occurrence within suitable habitats despite the operation of existing plants indicates most adapt to increased noise, activity, and artificial light levels. Continued operation of PTN is not expected to affect populations of these species. (NRC 2016a, Section 5.3.1.3)

Black skimmers and least terns forage over open water. Least terns have been observed on the Turkey Point site, and dredge spoil may provide suitable nesting habitat for both species. Operational noise may displace skimmers and terns from dredge spoil within the CCS. (NRC 2016a, Section 5.3.1.3)

The Everglades mink may potentially use wetlands within the Turkey Point site. Little is known about the Everglades mink but, as with other species, operational noise may deter mink from using parts of the site nearby the facilities. Mink are primarily active at night. The effects of artificial lighting on mink are not known (NRC 2016a, Section 5.3.1.3). However, the effects of continued operation of PTN does not include refurbishment activities and, therefore, would not alter availability or suitability of wetland habitats for the Everglades mink.

FPL is not aware of any adverse impacts regarding threatened, endangered, and protected species attributable to the site. Maintenance activities necessary to support SLR likely would be limited to previously disturbed areas on site, and no additional land disturbance has been identified for the purpose of SLR. In addition, there are no plans to alter plant operations during the SLR term which would affect threatened, endangered, and protected species. FPL would be required to comply with all applicable federal, state, and local laws, regulations, and permitting requirements to minimize potential impacts on listed species. If operational impacts on state-listed wildlife cannot be avoided, FPL would be required to coordinate with the USFWS and the FFWCC on the need for appropriate mitigation.

As discussed in Section 9.6, FPL has administrative controls in place at Turkey Point to ensure that operational changes or construction activities are reviewed, and the impacts minimized through implementation of BMPs. In addition, regulatory programs, such as those discussed in Chapter 9 that the site is subject to further serve to minimize impacts to any threatened, endangered, and protected species.

In an effort to obtain an independent review, the USFWS and NMFS were also consulted. Based on this independent review, it was determined that there would be no effect on federally and state-listed threatened, endangered, and protected species or on designated critical habitat as a result of PTN SLR. In addition, NMFS concluded no designated EFH would be impacted by continued operation of PTN. Copies of the consultation letters to the USFWS and NMFS are included in Attachment B.

In summary, no license renewal-related refurbishment activities have been identified. As discussed above, the continued operation of PTN would have no adverse effect on any federally or state-listed species. Therefore, FPL concludes that SLR would have no effect on threatened, endangered, and protected species in the vicinity of Turkey Point, and mitigation measures beyond FPL current management programs and existing regulatory controls are not warranted.

4.7 Historic and Cultural Resources

The following sections address the historic and cultural resource issues applicable to PTN, providing background on the issues and the analyses regarding the SLR period.

4.7.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

Continued operations and refurbishment associated with license renewal are expected to have no more than small impacts on historic and cultural resources located onsite and in the transmission line ROW because most impacts could be mitigated by avoiding those resources. The NHPA requires the federal agency to consult with the SHPO and appropriate Native American tribes to determine the potential effects on historic properties and mitigation, if necessary.

4.7.2 Requirement [10 CFR 51.53(c)(3)(ii)(K)]

All applicants shall identify any potentially affected historic or archaeological properties and assess whether any of these properties will be affected by future plant operations and any planned refurbishment activities in accordance with the NHPA.

4.7.3 Background [GEIS Section 4.7.1]

The NRC will identify historic and cultural resources within a defined APE. The license renewal APE is the area that may be impacted by land-disturbing or other operational activities associated with continued plant operations and maintenance during the license renewal term and/or refurbishment. The APE typically encompasses the nuclear power plant site, its immediate environs, including viewshed, and the transmission lines within this scope of review. The APE may extend beyond the nuclear plant site and transmission lines when these activities may affect historic and cultural resources.

Continued operations during the license renewal term and refurbishment activities at a nuclear power plant can affect historic and cultural resources through (1) ground-disturbing activities associated with plant operations and ongoing maintenance (e.g., construction of new parking lots or buildings), landscaping, agricultural or other use of plant property; (2) activities associated with transmission line maintenance (e.g., maintenance of access roads or removal of danger trees); and (3) changes to the appearance of nuclear power plants and transmission lines. Licensee renewal environmental reviews have shown that the appearance of nuclear power plants and transmission lines has not changed significantly over time; therefore additional viewshed impacts to historic and cultural resources are not anticipated.

4.7.4 Analysis

4.7.4.1 Refurbishment Activities

As discussed in Section 2.3, no license renewal-related refurbishment activities have been identified. Therefore, there would be no license renewal-related refurbishment impacts to historic and cultural resources, and no further analysis is required.

4.7.4.2 Operational Activities

As discussed in Section 3.7.2.2, Turkey Point property contains 7,996 acres of wetland, lake, and riverine waters (approximately 85 percent of the Turkey Point property). As discussed in Section 3.8.5, there have been seven previous cultural resource investigations conducted on the Turkey Point property. There are no recorded cultural resources on the 9,460-acre Turkey Point property, and there are no NRHP-listed resources within a 6-mile radius of Turkey Point.

As discussed in Section 3.8.6, although no license renewal-related ground-disturbing activities have been identified, FPL has administrative controls in place for management of cultural resources ahead of any future ground-disturbing activities at the plant. These consist of the 2016 conditions of certification and the Environmental Control Program for PTN. Therefore, no adverse effects are anticipated during the SLR term.

The area within a 2-mile radius of the site, especially along Biscayne Bay, may be archaeologically sensitive based on the location of archaeological sites in areas that have been surveyed for cultural resources (Table 3.8-1). However, adverse impacts would only occur to such sites as a result of soil-intrusive activities. Because FPL has no plans to conduct such soil-intrusive activities at any location outside of the Turkey Point property boundary under an SLR, no adverse effects to these archaeological sites would occur.

There are also no NRHP-listed aboveground historic properties within a 6-mile radius of PTN. As such, no potential adverse effects to any NRHP-listed properties, including viewshed, aesthetic, and noise impacts, as a result of the continued operation of PTN are expected. Two sites (Table 3.8-2) are eligible for the NRHP based on SHPO review, but based on the vegetation, topography, and distance, Turkey Point is not within the viewshed of these cultural resources. Due to no refurbishment activities being associated with the SLR, including construction and ground disturbances, no adverse effects to the NRHP-eligible resources are expected.

As discussed above, no license renewal-related refurbishment or construction activities have been identified. No offsite NRHP-listed historic properties will be adversely impacted as a result of continued operation of PTN, and there are no plans to alter operations, expand existing facilities, or disturb additional land for the purpose of SLR. As described in Section 3.8, the Florida SHPO/DHR, and Native American groups recognized as potential stakeholders, have been notified by FPL of the proposed action (Attachment C).

Therefore, FPL concludes that there will be no adverse effects as a result of continued operation of PTN during the SLR period, and additional mitigation measures beyond FPL's existing procedural administrative controls are not warranted.

4.8 Socioeconomics

The following sections address the socioeconomic issues applicable to PTN, providing background on the issues and the analyses regarding the SLR period.

4.8.1 Employment and Income, Recreation and Tourism

4.8.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Although most nuclear plants have large numbers of employees with higher than average wages and salaries, employment, income, recreation, and tourism impacts from continued operations and refurbishment associated with license renewal are expected to be small.

4.8.1.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.8.1.3 Background [GEIS Section 4.8.1.1]

Employees receive income from the nuclear power plant in the form of wages, salaries, and benefits. Employees and their families, in turn, spend this income on goods and services within the community thereby creating additional opportunities for employment and income. In addition, people and businesses in the community receive income for the goods and services sold to the power plant. Payments for these goods and services create additional employment and income opportunities in the community. The measure of a communities' ability to support the operational demands of a power plant depends on the ability of the community to respond to changing socioeconomic conditions.

Some communities experience seasonal transient population growth due to local tourism and recreational activities. Income from tourism and recreational activities creates employment and income opportunities in the communities around nuclear power plants.

Nevertheless, the effects of nuclear power plant operations on employment, income, recreation, and tourism are ongoing and have become well established during the current license term for all nuclear power plants. The impacts from power plant operations during the license renewal term on employment and income in the region around each nuclear power plant are not expected to change from what is currently being experienced. In addition, tourism and recreational activities in the vicinity of nuclear plants are not expected to change as a result of license renewal.

4.8.1.4 Analysis

Information related to employment and income, and recreational facilities is presented in Sections 3.9.1 and 3.9.7. No license renewal-related refurbishment activities have been identified as discussed in Section 2.3. In addition, as discussed in Section 2.5, there are no plans to add workers to support plant operations during the SLR period. As previously discussed in Section 3.2.3, there is sufficient vegetation and distance to screen the existing units from most areas. As a result, the site does not visually impact most local areas that have a high degree of visitor or recreational use. Therefore, no changes in employment and income, and recreation and tourism during the SLR period are anticipated.

In the GEIS, the NRC determined that employment and income, and recreation and tourism impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.8.1.1). Based on FPL's review, no new and significant information was identified as it relates to employment and income, and recreation and tourism, and further analysis is not required.

4.8.2 Tax Revenues

4.8.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Nuclear plants provide tax revenue to local jurisdictions in the form of property tax payments, payments in lieu of tax (PILOT), or tax payments on energy production. The amount of tax revenue paid during the license renewal term as a result of continued operations and refurbishment associated with license renewal is not expected to change.

4.8.2.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.8.2.3 Background [GEIS Section 4.8.1.2]

Nuclear power plants and the workers who operate them are an important source of tax revenue for many local governments and public school systems. Tax revenues from nuclear power plants mostly come from property tax payments or other forms of payments such as payments in lieu of (property) taxes, or PILOT payments, although taxes on energy production have also been collected from a number of nuclear power plants. County and municipal governments and public school districts receive tax revenue either directly or indirectly through state tax and revenue-sharing programs.

Counties and municipal governments in the vicinity of a nuclear power plant also receive tax revenue from sales taxes and fees from the power plant and its employees. Changes in the number of workers and the amount of taxes paid to county, municipal governments, and public schools can affect socioeconomic conditions in the counties and communities around the nuclear power plant.

A review of LRAs received by the NRC since the 1996 GEIS has shown that refurbishment activities, such as steam generator and vessel head replacement, have not had a noticeable effect on the assessed value of nuclear plants, thus changes in tax revenues are not anticipated from future refurbishment activities.

The primary impact of license renewal would be the continuation or change in the amount of taxes paid by nuclear power plant owners to local governments and public school systems. The impact of nuclear plant operations on tax revenues in local communities and the impact that the expenditure of tax revenues has on the region are not expected to change appreciably from the amount of taxes paid during the current license term. Tax payments during the license renewal term would be similar to those currently being paid by each nuclear plant.

4.8.2.4 Analysis

Information related to tax revenues is presented in Section 3.9.5. No license renewal-related refurbishment activities have been identified as discussed in Section 2.3. FPL's annual property taxes are expected to remain relatively constant through the SLR period.

In the GEIS, the NRC determined that tax revenue impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.8.1.2). Based on FPL's review, no new and significant information was identified as it relates to tax revenues, and further analysis is not required.

4.8.3 Community Services and Education

4.8.3.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Changes resulting from continued operations and refurbishment associated with license renewal to local community and educational services would be small. With little or no change in employment at the licensee's plant, value of the power plant, payments on energy production, and PILOT payments expected during the license renewal term, community and educational services would not be affected by continued power plant operations.

4.8.3.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.8.3.3 Background [GEIS Section 4.8.1.3]

Any changes in the number of workers at a nuclear plant will affect the demand for public services from local communities. Environmental reviews conducted by NRC since the 1996 GEIS have shown, however, that the number of workers at relicensed nuclear plants has not changed significantly because of license renewal, so demand-related impacts on community services, including public utilities, are no longer anticipated from future license renewals.

In addition, refurbishment activities, such as steam generator and vessel head replacement, have not required the large numbers of workers and the months of time that were conservatively analyzed in the 1996 GEIS, so significant impacts on community services are no longer anticipated. Because of the relatively short duration of refurbishment-related activities, workers are not expected to bring families and school-age children with them; therefore, impacts from refurbishment on educational services are also no longer anticipated.

Taxes paid by nuclear power plant owners support a range of community services, including public water, safety, fire protection, health, and judicial, social, and educational services. In some communities, tax revenues from power plants can have a noticeable impact on the quality of services available to local residents. Although many of the community services paid for by tax revenues from power plants are used by plant workers and their families, the impact of nuclear plant operations on the availability and quality of community services and education is SMALL and is not expected to change as a result of license renewal.

4.8.3.4 Analysis

Information related to community services and education is presented in Section 3.9.4. No license renewal-related refurbishment activities have been identified as discussed in Section 2.3. In addition, as discussed in Section 2.5, there are no plans to add workers to support plant operations during the SLR period. As discussed in Section 4.8.2.4, FPL's annual property taxes are expected to remain relatively constant through the SLR period.

In the GEIS, the NRC determined that community services and education impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.8.1.3). Based on FPL's review, no new and significant information was identified as it relates to community services and education, and further analysis is not required.

4.8.4 Population and Housing

4.8.4.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Changes resulting from continued operations and refurbishment associated with license renewal to regional population and housing availability and value would be small. With little or no change in employment at the licensee's plant expected during the license renewal term, population and housing availability and values would not be affected by continued power plant operations.

4.8.4.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.8.4.3 Background [GEIS Section 4.8.1.4]

Socioeconomic impact analyses of resources (e.g., housing) affected by changes in regional population are based on employment trends at nuclear power plants. Population growth from increased employment and spending at a nuclear power plant is important because it is one of the main drivers of socioeconomic impacts. As previously discussed, however, employment levels at nuclear power plants are expected to remain relatively constant with little or no population growth or increased demand for permanent housing during the license renewal term. The operational effects on population and housing values and availability in the vicinity of nuclear power plants are not expected to change from what is currently being experienced, and no demand-related impacts are expected during the license renewal term.

The increased number of workers at nuclear power plants during regularly scheduled plant refueling and maintenance outages does create a short-term increase in the demand for temporary (rental) housing units in the region around each plant. However, because of the short duration and the repeated nature of these scheduled outages and the general availability of rental housing units (including portable trailers) in the vicinity of nuclear power plants, employment-related housing impacts have had little or no long-term impact on the price and availability of rental housing. Refurbishment impacts would be similar to what is experienced during routine plant refueling and maintenance outages.

4.8.4.4 Analysis

Information related to population and housing is presented in Section 3.9.2. No license renewal-related refurbishment activities have been identified as discussed in Section 2.3. In addition, as discussed in Section 2.5, there are no plans to add workers to support plant operations during the SLR period.

In the GEIS, the NRC determined that population and housing impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.8.1.4). Based on FPL's review, no new and significant information was identified as it relates to population and housing, and further analysis is not required.

4.8.5 Transportation

4.8.5.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Changes resulting from continued operations and refurbishment associated with license renewal to traffic volumes would be small.

4.8.5.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.8.5.3 Background [GEIS Section 4.8.1.5]

Transportation impacts depend on the size of the workforce, the capacity of the local road network, traffic patterns, and the availability of alternate commuting routes to and from the plant. Because most sites have only a single access road, there is often congestion on these roads during shift changes.

Transportation impacts are ongoing and have become well established during the current licensing term for all nuclear power plants. As previously discussed, it is unlikely that the number of permanent operations workers would increase at a nuclear power plant during the license renewal term. In addition, refurbishment activities, such as steam generator and vessel head replacement, have not required the numbers of workers and the months of time conservatively estimated in the 1996 GEIS. Consequently, employment at nuclear power plants during the license renewal term is expected to remain unchanged.

4.8.5.4 Analysis

Information related to transportation is presented in Section 3.9.6. No license renewal-related refurbishment activities have been identified as discussed in Section 2.3. As discussed in Section 2.5, there are no plans to add workers to support plant operations during the SLR period. In addition, as discussed in Section 3.9.6, roads in the immediate vicinity of the Turkey Point plant site are anticipated to operate at acceptable levels.

In the GEIS, the NRC determined that transportation impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.8.1.5). Based on FPL's review, no new and significant information was identified as it relates to transportation, and further analysis is not required.

4.9 Human Health

The following sections address the human health issues applicable to PTN, providing background on the issues and the analyses regarding the SLR period.

4.9.1 Microbiological Hazards to the Public (Plants with Cooling Ponds or Canals, or Cooling Towers that Discharge to a River)

4.9.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals, or that discharge into rivers. Impacts would depend on site-specific characteristics.

4.9.1.2 Requirement [10 CFR 51.53(c)(3)(ii)(G)]

If the applicant's plant uses a cooling pond, lake, or canal or discharges into a river, an assessment of the impact of the proposed action on public health from thermophilic organisms in the affected water must be provided.

4.9.1.3 Background [GEIS Section 4.9.1.1.3]

N. fowleri, which is the pathogenic strain of the free-living amoebae *Naegleria* spp., appears to be the most likely microorganism that may pose a public health hazard resulting from nuclear power plant operations. Increased populations of *N. fowleri* may have significant adverse impacts.

Because *Naegleria* concentrations in fresh water can be enhanced by thermal effluents, nuclear power plants that use cooling lakes, canals, ponds, or rivers experiencing low-flow conditions may enhance the populations of naturally occurring thermophilic organisms.

Changes in microbial populations and in the public use of water bodies might occur after the OL is issued and the application for license renewal is filed. Other factors could also change, including the average temperature of the water, which could result from climate change that affected water levels and air temperature. Finally, the long-term presence of a power plant might change the natural dynamics of harmful microorganisms within a body of water.

4.9.1.4 Analysis

As discussed in Section 3.10, PTN discharges to the cooling canals, which are owner-controlled and closed to the public. The cooling canals do not discharge to surface waters, and thus the heated water does not have a pathway to enhance the naturally occurring thermophilic organisms within surface water accessible to the public. Also, as discussed in Section 3.10, the salinity concentration of the cooling canals anticipated for the SLR term is an annual average of 34 PSU, which is similar to ocean water and exceeds the freshwater conditions needed for the pathogen, *N. fowleri,* survival. PTN discharges to a 168-mile closed-loop CCS that occupies approximately 5,900 acres. The CCS receives heated effluent from the plant and distributes the flow into 32 feeder canals. The feeder canals discharge into a single collector canal that distributes the water into six return canals. (FPL 2000b, Section 3.1.2) As discussed in

Section 2.2.3.2, the Turkey Point NPDES permit authorizes discharges from the CCS into Class G-III groundwater, which is part of the surficial aquifer system. The permit does not authorize direct discharges to surface waters of the state.

While the cooling canals are closed to the public, FPL workers and contractors do perform work within the canals and thus could be exposed to *N. fowleri* or Legionella spp. The infection route for *N. fowleri* is water or water droplets being introduced into the nasal cavity, and for Legionella spp. the infection route is through inhalation. As discussed in Section 3.10, there are no water sprayers associated with the cooling canals, and work within the canals would be conducted under an occupational safety program.

Given the lack of an exposure pathway between the cooling canals and the public, the non-freshwater condition of the cooling canals, and the conditions and restrictions for the cooling canals minimizing exposure routes, the microbiological hazards to the public during the SLR term would be small, and no mitigation is warranted.

4.9.2 Electric Shock Hazards

4.9.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Electrical shock potential is of small significance for transmission lines that are operated in adherence with the NESC. Without a review of conformance with NESC criteria of each nuclear power plant's in-scope transmission lines, it is not possible to determine the significance of the electrical shock potential.

4.9.2.2 Requirement [10 CFR 51.53(c)(3)(ii)(H)]

If the applicant's transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the NESC for preventing electric shock from induced currents, an assessment of the impact of the proposed action on the potential shock hazard from the transmission lines must be provided.

4.9.2.3 Background [GEIS Section 4.9.1.1.5]

Design criteria for nuclear power plants that limit hazards from steady-state currents are based on the NESC, adherence to which requires that utility companies design transmission lines so that the short-circuit current to ground produced from the largest anticipated vehicle or object is limited to less than 5 mA. With respect to shock safety issues and license renewal, three points must be made. First, in the licensing process for the earlier licensed nuclear plants, the issue of electrical shock safety was not addressed. Second, some plants that received OLs with a stated transmission line voltage may have chosen to upgrade the line voltage for reasons of efficiency, possibly without reanalysis of induction effects. Third, since the initial NEPA review for those utilities that evaluated potential shock situations under the provision of the NESC, land use may have changed, resulting in the need for a reevaluation of this issue. The electrical shock issue, which is generic to all types of electrical generating stations, including nuclear plants, is of SMALL significance for transmission lines that are operated in adherence with the NESC. Without a review of the conformance of each nuclear plant's transmission lines, within this scope of review with NESC criteria, it is not possible to determine the significance of the electrical shock potential generically.

4.9.2.4 Analysis

As depicted in Figure 2.2-4, all in-scope transmission lines are located completely within an owner-controlled area as discussed in Section 3.1.2. Thus, no induced shock hazards would exist for the general public, due to restricted site access.

As discussed in Section 3.10, the FPL analysis to support the initial LR remains applicable. The 2000 analysis considered the lines from the plant's main transformers to the switchyard, as well as those from the switchyard to the Davis, Flagami, Florida City, Levee, and Doral substations. It took into account the FDOT limits on vehicle size and utilized a hypothetical 53-foot long by 13.5-foot high by 8.5-feet wide tractor-trailer. It determined the minimum vertical roadbed clearance is 38.1 feet when ambient temperatures are 120°F. (FPL 2000b, Section 4.13.2; NRC 2002a, Section 4.2.1)

The EPRI guidance methodology was utilized to perform the calculation of maximum short-circuit current. Worst-case parameters (voltage, current, conductor position) were input to the EZEMF computer program to determine the maximum electrical field strength 1 meter above the road. The position of the tractor-trailer was perpendicular to the phase conductors and the maximum short-circuit current was calculated assuming the maximum electric field value was applied to the entire length of the truck. The resulting value of this calculation was 2.00 kV/m. The resulting maximum steady-state short circuit current was 1.60 mA rms. The lines connecting the plant to the switchyard are in compliance with the NESC requirements. Similar calculations were conducted for the lines leaving the switchyard, and they too were determined to be below the allowable 5 mA rms. (FPL 2000b, Section 4.13.2)

The PTN in-scope transmission lines meet the NESC requirements based upon the above analysis, and the potential impacts from electric shock would be SMALL, pursuant to 10 CFR 51.53(c)(3)(ii)(H). Therefore, mitigation is not warranted.

4.10 Environmental Justice

The following sections address the environmental justice issues applicable to PTN, providing background on the issues and the analyses regarding the SLR period.

4.10.1 Minority and Low-Income Populations

4.10.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

Impacts to minority and low-income populations and subsistence consumption resulting from continued operations and refurbishment associated with license renewal will be addressed in plant-specific reviews. See NRC Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions (69 FR 52040; August 24, 2004).

4.10.1.2 Requirement [10 CFR 51.53(c)(3)(ii)(N)]

Applicants shall provide information on the general demographic composition of minority and low-income populations and communities (by race and ethnicity) residing in the immediate vicinity of the plant that could be affected by the renewal of the plant's OL, including any planned refurbishment activities, and ongoing and future plant operations.

4.10.1.3 Background [GEIS Section 4.10.1]

Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant and exceeds the risk or exposure rate for the general population or for another appropriate comparison group. Disproportionately high environmental effects refer to impacts or risk of impact on the natural or physical environment in a minority or low-income community that are significant and appreciably exceed the environmental impact on the larger community. Such effects may include biological, cultural, economic, or social impacts. Minority and low-income populations are subsets of the general public residing around the site and all are exposed to the same risks and hazards generated from operating a nuclear power plant.

Continued reactor operations and other activities associated with license renewal could have an impact on air, land, water, and ecological resources in the region around each nuclear power plant site, which might create human health and environmental effects on the general population. Depending on the proximity of minority and low-income populations in relation to each nuclear plant, the environmental impacts of license renewal could have a disproportionate effect on these populations.

The location and significance of environmental impacts may affect population groups that are particularly sensitive because of their resource dependencies or practices (e.g., subsistence agriculture, hunting, or fishing) that reflect the traditional or cultural practices of minority and low-income populations. The analysis of special pathway receptors can be an important part of the identification of resource dependencies or practices. Special pathways take into account the levels of contaminants in native vegetation, crops, soils and sediments, surface water, fish, and game animals on or near the power plant sites in order to assess the risk of radiological exposure through subsistence consumption of fish, native vegetation, surface water, sediment, and local produce; the absorption of contaminants in sediments through the skin; and the inhalation of airborne particulates.

4.10.1.4 Analysis

4.10.1.4.1 Refurbishment Activities

As discussed in Section 2.3, no license renewal-related refurbishment activities have been identified. Therefore, there would be no license renewal-related refurbishment impacts to minority and low-income populations, and no further analysis is applicable.

4.10.1.4.2 Operational Activities

The consideration of environmental justice is required to assure that federal programs and activities will not have disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. FPL's analyses of the Category 2 issues defined in 10 CFR 51.53(c)(3)(ii) determined that environmental impacts from the continued operation of PTN during the SLR period would either be SMALL or non-adverse. Therefore, high or adverse impacts to the general human population would not occur.

As described in Section 3.10.3, FPL maintains a REMP. In this program, FPL monitors important radiological pathways and considers potential radiation exposure to plant and animal life in the environment surrounding Turkey Point. Monitoring during the period 2011–2016 verified the dose commitment to members of the public resulting from operations at PTN were well within the ALARA criteria established by 10 CFR Part 50, Appendix I, and no adverse trends in the radiological environment were identified. Therefore, no environmental pathways have been adversely impacted and are not anticipated to be impacted during the PTN SLR term.

Section 3.11.2 identifies the locations of minority and low-income populations as defined by NRR Office Instruction LIC-203. Section 3.11.3 describes the search for subsistence populations near Turkey Point, of which none were found. The figures accompanying Section 3.11.2 show the locations of minority and low-income populations within a 50-mile radius of Turkey Point (see Figure 3.11-1 through Figure 3.11-20). None of those locations, when considered in the context of impact pathways described in Chapter 4, are expected to be disproportionately impacted.

Therefore, no disproportionately high and adverse impacts or effects on members of the public, including minority and low-income populations, are anticipated as a result of PTN SLR.

4.11 Waste Management

The following sections address the waste management issues applicable to PTN, providing background on the issues and the analyses regarding the SLR period.

4.11.1 Low-Level Waste Storage and Disposal

4.11.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. The comprehensive regulatory controls that are in place and the low public doses being achieved at reactors ensure that the radiological impacts to the environment would remain small during the license renewal term.

4.11.1.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.11.1.3 Background [GEIS Section 4.11.1.1]

The NRC believes that the comprehensive regulatory controls that are in place and the low public doses being achieved at reactors ensure that the radiological impacts on the environment will remain SMALL during the term of a renewed license. The maximum additional onsite land that may be required for LLW storage during the term of a renewed license and associated impacts would be SMALL. Nonradiological impacts on air and water would be negligible. The radiological and nonradiological environmental impacts of long-term disposal of LLW from any individual plant at licensed sites are SMALL. In addition, the NRC concludes that there is reasonable assurance that sufficient LLW disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.

4.11.1.4 Analysis

FPL would continue to manage and store LLW on site, as discussed in Section 2.2.6.3, in accordance with NRC regulations and dispose of LLW in NRC-licensed treatment and disposal facilities during the SLR period. As discussed above, there are comprehensive regulatory controls in place and FPL's compliance with these regulations and use of licensed treatment and disposal facilities would allow the impacts to remain SMALL during the SLR period. PTN's annual radiological environmental operating reports for years 2011–2016 indicated that doses to members of the public are well within ALARA criteria established by 10 CFR Part 50, Appendix I. Moreover, sampling by the DOH during those years also does not show adverse trends in levels of radiation and radioactive materials in publicly accessible areas. (PTN 2012b; PTN 2013b; PTN 2014c; PTN 2015b; PTN 2016b; PTN 2017b) No new and significant information has been identified for this issue; therefore, no further analysis is required. The issue was also considered in PTN's first license renewal's new and significant review, and no new and significant information was found at that time (FPL 2000b, Table 4.0-2).

4.11.2 Onsite Storage of Spent Nuclear Fuel

4.11.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

During the license renewal term, SMALL. The expected increase in the volume of spent nuclear fuel from an additional 20 years of operation can be safely accommodated onsite during the license renewal term with small environmental impacts through dry or pool storage at all plants.

For the period after the licensed life for reactor operations, the impacts of onsite storage of spent nuclear fuel during the continued storage period are discussed in NUREG-2157 and as stated in § 51.23(b), shall be deemed incorporated into this issue.

4.11.2.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.11.2.3 Background [GEIS Section 4.11.1.2 and NUREG-2157 ES.12 and Table ES-3]

As discussed in Section 3.11.1.2 (GEIS), spent nuclear fuel is currently stored at reactor sites either in spent fuel pools or in ISFSIs. The storage of spent fuel in spent fuel pools was considered for each plant in the safety and environmental reviews at the construction permit and OL stage. This onsite storage of spent fuel and HLW is expected to continue into the foreseeable future.

Interim storage needs vary among plants, with older units likely to lose pool storage capacity sooner than newer ones. Given the uncertainties regarding the final disposition of spent fuel and HLW, it is expected that expanded spent fuel storage capacity will be needed at all nuclear power plants.

NUREG-2157, *Generic EIS for Continued Storage of Spent Nuclear Fuel*, concluded on a generic basis for all nuclear power plants that spent fuel can be stored onsite for 60 years following the license term with small environmental effects.

4.11.2.4 Analysis

The additional 20 years of spent nuclear fuel generated during the SLR term would be stored in the spent fuel pools until adequately cooled and then transferred to dry storage in an ISFSI. The ISFSI is licensed under the general license provided to power reactor licensees under 10 CFR 72.210. The NRC-licensed design and operation of each of these storage options ensures that the increased volume in onsite storage can be safely accommodated with small environmental effects. No new and significant information has been identified for this issue; therefore, no further analysis is required. The issue was also considered in PTN's first license renewal's new and significant review, and no new and significant information was found at that time (FPL 2000b, Table 4.0-2).

4.11.3 Offsite Radiological Impacts of Spent Nuclear Fuel and High-Level Waste Disposal

4.11.3.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

For the HLW and spent-fuel disposal component of the fuel cycle, the EPA established a dose limit of 0.15 millisievert (mSv) (15 mrem) per year for the first 10,000 years and 1.0 mSv (100 mrem) per year between 10,000 years and 1 million years for offsite releases of radionuclides at the proposed repository at Yucca Mountain, Nevada.

NRC concluded that the impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent fuel and HLW disposal, this issue is considered Category 1.

4.11.3.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.11.3.3 Background [GEIS Section 4.11.1.3]

As a result of the *New York v. NRC* decision, and pending the issuance of a generic EIS and revised Waste Confidence Decision and Rule, the NRC has revised the Category 1 issue, "Offsite radiological impacts of spent nuclear fuel and high-level waste disposal." This issue pertained to the long-term disposal of spent nuclear fuel and HLW, including possible disposal in a deep geologic repository. Although the Waste Confidence Decision and Rule did not assess the impacts associated with disposal of spent nuclear fuel and HLW in a repository, it did reflect the Commission's confidence, at the time, in the technical feasibility of a repository and when that repository could have been expected to become available. Without the analysis in the Waste Confidence Decision, the NRC cannot assess how long the spent fuel will need to be stored onsite. Therefore, the NRC reclassifies this GEIS issue from a Category 1 issue with no assigned impact level to an uncategorized issue with an impact level of uncertain. Moreover, the ultimate disposal of spent nuclear fuel in a potential future geologic repository is a separate and independent licensing action that is outside the regulatory scope of license renewal.

4.11.3.4 Analysis

As indicated in GEIS Section 4.11.3.3, NRC's GEIS analysis of the issue was tied to rulemaking for the Waste Confidence Decision, which was pending in 2013 when Revision 1 of the license renewal GEIS was issued. As part of NRC's NEPA actions associated with the Waste Confidence

Decision, NRC reviewed the environmental impacts of away-from-reactor storage and the technical feasibility of disposal in a geologic repository in NUREG-2157, GEIS for Continued Storage of Spent Nuclear Fuel (NRC 2014a). In the final Continued Storage of Nuclear Spent Fuel rulemaking, the listing and classification of license renewal issues found in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 was revised to reclassify the impact determination for this issue as a Category 1 issue with no impact level assigned. This re-classification was upheld in May 2016 (81 FR 31532).

The NRC's August 2016 GEIS Supplement 57, prepared for LaSalle County Station, indicated that NRC is aware of no new and significant information on this issue (NRC 2016b, Section 4.13.1). Based on review of recent NRC documents and that PTN spent nuclear fuel will be disposed of offsite, FPL found no new and significant information, and further analysis is not required. Offsite radiological impacts of spent nuclear fuel and HLW disposal was also considered in PTN's first license renewal's new and significant review, and no new and significant information was found at that time (FPL 2000b, Table 4-2).

4.11.4 Mixed Waste Storage and Disposal

4.11.4.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. The comprehensive regulatory controls and the facilities and procedures that are in place ensure proper handling and storage, as well as negligible doses and exposure to toxic materials for the public and the environment at all plants. License renewal would not increase the small, continuing risk to human health and the environment posed by mixed waste at all plants. The radiological and nonradiological environmental impacts of long-term disposal of mixed waste from any individual plant at licensed sites are small.

4.11.4.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.11.4.3 Background [GEIS Section 4.11.1.4]

Mixed waste is regulated both by the EPA or the authorized state agency under RCRA and by the NRC or the agreement state agency under the Atomic Energy Act (AEA; Public Law 83-703). The waste is either treated onsite or sent offsite for treatment followed by disposal at a permitted landfill. The comprehensive regulatory controls and the facilities and procedures that are in place at nuclear power plants ensure that the mixed waste is properly handled and stored and that doses to and exposure to toxic materials by the public and the environment are negligible at all plants. License renewal will not increase the small but continuing risk to human health and the environment posed by mixed waste at all plants. The radiological and nonradiological environmental impacts from the long-term disposal of mixed waste at any individual plant at licensed sites are considered SMALL for all sites.

4.11.4.4 Analysis

FPL previously established its radiological waste programs and controls as described in Section 2.2.6 in accordance with NRC regulations. FPL has established oversight and controls for handling and storage of hazardous and mixed waste that implements the regulatory requirements for management, storage, inspections, and shipping. Review of PTN's recent annual radiological environmental operating reports indicated that doses to members of the public are well within ALARA criteria established by 10 CFR Part 50, Appendix I. Moreover, sampling by the DOH during those years also does not show adverse trends in levels of radiation and radioactive materials in publically accessible areas. (PTN 2012b; PTN 2013b; PTN 2014c; PTN 2015b; PTN 2016b; PTN 2017b). PTN has not received any violations for hazardous waste management in the past 5 years based on a review of its compliance history (EPA 2017d).

FPL would continue to store and dispose of mixed waste in accordance with NRC, EPA, and state regulations and dispose of the wastes in appropriately permitted treatment and disposal facilities during the SLR period. As indicated in the GEIS (NRC 2013a), continuation of existing systems and procedures to ensure proper storage and disposal would allow the impacts to be of small magnitude. No new and significant information has been identified for this issue; therefore, no further analysis is required. This issue was evaluated as a Category I issue in PTN's first license renewal's new and significant review and found to be bound by the GEIS conclusion of a SMALL impact (FPL 2000b, Table 4.0-2).

4.11.5 Nonradioactive Waste Storage and Disposal

4.11.5.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. No changes to systems that generate nonradioactive waste are anticipated during the license renewal term. Facilities and procedures are in place to ensure continued proper handling, storage, and disposal, as well as negligible exposure to toxic materials for the public and the environment at all plants.

4.11.5.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.11.5.3 Background [GEIS Section 4.11.1.5]

The management of hazardous wastes generated at all of these facilities, both onsite and offsite, is strictly regulated by the EPA or the responsible state agencies per the requirements of RCRA.

As does any industrial facility, nuclear power plants and the rest of the uranium fuel cycle facilities also generate nonradioactive nonhazardous waste. These wastes are managed by following good housekeeping practices and are generally disposed of in local landfills permitted under RCRA Subtitle D regulations.

In the 1996 GEIS, the impacts associated with managing nonradioactive wastes at uranium fuel cycle facilities, including nuclear power plants, were found to be SMALL. It was indicated that no changes to nonradioactive waste generation would be anticipated for license renewal, and that systems and procedures are in place to ensure continued proper handling and disposal of the wastes at all plants.

4.11.5.4 Analysis

Management of nonradioactive waste is discussed in Section 2.2.7. FPL has established oversight and controls for handling and storage of hazardous waste that implements the regulatory requirements for management, storage, inspections, and shipping. PTN has not received any violations for hazardous waste management in the past 5 years based on a review of its compliance history (EPA 2017d).

PTN's nonradiological, nonhazardous waste is disposed of by the Miami-Dade County Department of Solid Waste Management and is collected at the Turkey Point site by an approved solid waste collector (Section 2.2.7).

FPL would continue to store and dispose of hazardous and nonhazardous waste in accordance with EPA, state, and local regulations, and dispose of the wastes in appropriately permitted disposal facilities during the SLR period. As indicated in the GEIS (NRC 2013a), continuation of existing systems and procedures to ensure proper storage and disposal would allow the impacts to be of small magnitude. No new and significant information has been identified for this issue; therefore, no further analysis is required. This issue was evaluated as a Category I issue in PTN's first license renewal's new and significant review, and found to be bound by the GEIS conclusion of a SMALL impact (FPL 2000b, Table 4.0-2).

4.12 Cumulative Impacts

The following sections address the cumulative impacts applicable to PTN, providing background on the issues and the analyses regarding the SLR period.

Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

Cumulative impacts of continued operations and refurbishment associated with license renewal must be considered on a plant-specific basis. Impacts would depend on regional resource characteristics, the resource-specific impacts of license renewal, and the cumulative significance of other factors affecting the resource.

Requirement [10 CFR 51.53(c)(3)(ii)(O)]

Applicants shall provide information about other past, present, and reasonably foreseeable future actions occurring in the vicinity of the nuclear plant that may result in a cumulative effect.

Background [GEIS Section 4.13]

Actions to be considered in cumulative impact analyses include new and continuing activities, such as license renewal, that are conducted, regulated, or approved by a federal agency. The cumulative impacts analysis takes into account all actions, however minor, because impacts from individually minor actions may be significant when considered collectively over time. The goal of the analysis is to identify potentially significant impacts to improve decisions and move toward more sustainable development.

For some resource areas (e.g., water and aquatic resources), the contributions of ongoing actions within a region to cumulative impacts are regulated and monitored through a permitting process (e.g., NPDES) under state or federal authority. In these cases, it may be assumed that cumulative impacts are managed as long as these actions (facilities) are in compliance with their respective permits.

Analysis

The cumulative analysis involves determining if there is an overlapping of the anticipated impacts of the continued operation of PTN during the SLR period and past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. Past and present actions include all actions up to and including the time of the SLRA. Future actions are those that are "reasonably foreseeable" (i.e., they are ongoing and will continue into the future), are funded for future implementation, are included in firm, near-term plans, or generally have a high probability of being implemented. The affected environment sections for each resource area presented in Chapter 3 generally accounts for past and present actions. Future actions would be those anticipated for the time from the SLRA submittal through the 20 years of the SLR period.

The direct and indirect impact analyses presented in Chapter 4 address the incremental impacts of SLR renewal. Those analyses are considered along with reasonably foreseeable future actions that have the potential to combine with the impacts of the proposed action to determine cumulative impacts. Next, the assessment determines if any combined impacts would be significant. Significant cumulative impacts could stem from an impact that may be small by itself but could result in a moderate and/or large impact when considered in combination with the impacts of other actions on the affected resource. If a resource is regionally declining or imperiled, even a small individual impact could be important if it contributes to or accelerates the overall resource decline.

Section 3.1.4 describes other (non-PTN) projects at and in the vicinity of Turkey Point. At the Turkey Point site, FPL operates Turkey Point Units 1 and 2 in synchronous condenser mode to provide voltage support for the transmission system, and Unit 5, a combined-cycle unit (employing four natural gas turbines and one heat-recovery steam-powered generator). No major changes to operations or plans for future expansion of these units are anticipated. Section 3.1.4 also introduces Units 6 and 7, for which FPL is seeking a license from NRC. FPL has not made a decision to construct the units; however, for the purpose of assessing cumulative impacts to support the SLRA, the construction and operation of Units 6 and 7 is considered. There are no Turkey Point site projects anticipated, planned, or projected (other than construction and operation of Turkey Point 6 and 7 and continued operation of PTN and the continued operation of Units 1 and 2 in synchronous condenser mode and continued operation of Unit 5) during the SLR period. Another ongoing project locally and throughout the region is the CERP. These onsite projects and the CERP could result in cumulative impacts.

The overlap of construction of the units with the SLR period is not a matter of certainty. The earliest practical dates for bringing Turkey Point Units 6 and 7 in service are mid-2027 (Unit 6) and mid-2028 (Unit 7) (FPL 2017a). These earliest in-service dates for the units would mean that there would not be an overlap; however, it is reasonable to conservatively assume a site preparation and construction schedule for Units 6 and 7 that is delayed into the SLR period of PTN. Therefore, here and where appropriate, the impacts of construction as well as the impacts of operation of the proposed units is considered in the cumulative impacts analysis.

The NRC recently conducted a cumulative impacts assessment of the construction and operation of the proposed Turkey Point Units 6 and 7 in the EIS prepared for the COL for these proposed units (NRC 2016a). This cumulative impacts assessment considered the operation of PTN with the many past, present, and future projects in the area. The NRC developed a comprehensive list of projects and activities within a 50-mile radius and reviewed the potential for urban development as governed by state and local land use plans. This recent cumulative assessment is applicable to a cumulative impacts assessment for this SLRA for PTN and is the primary resource for this cumulative assessment.

The following sections address the potential for cumulative impacts by resource area.

4.12.1 Land Use and Visual Resources

PTN SLR is not anticipated to require land use changes, but would be a continuation of previously established land use for power generation. As described in Section 3.2.2, the areas surrounding Turkey Point are primarily water (i.e., Biscayne Bay) and wetlands. The large developed areas within a 6-mile vicinity are Homestead ARB and Homestead (Figure 3.2-2). The Adopted 2020–2030 Land Use Plan for Miami-Dade County, Florida (MDC 2016b) shows the lands surrounding Turkey Point as land designated as environmentally protected. The Miami-Dade County 2015−2025 Comprehensive Development Plan designated the unincorporated land in the immediate vicinity of the Turkey Point site as protected land, open land, parkland, or agricultural land (NRC 2016a, Section 7.1). Both the previous plan and the current plan indicate that land use in the vicinity of the Turkey Point site would not be expected to change.

The Units 6 and 7 EIS cumulative land use impacts analysis considered a 10-mile radius beyond the site proposed for the units, which is just south of the PTN location, as the geographic area of interest (NRC 2016a, Section 7.1). Projects considered in the cumulative impacts analysis included many ongoing projects including those on site and the conservation and remediation projects for the environmentally protected land surrounding Turkey Point (NRC 2016a, Table 7-1). In addition, the EIS considered freshening activities for improving water quality in the Turkey Point cooling canals and remediation of the hypersaline plume. The cumulative impact on land use would be MODERATE, with the incremental contribution of construction and operation of Units 6 and 7 being a significant contributor (EIS concluded that the construction and operation of Units 6 and 7 would be MODERATE).

Given that the proposed continued operation of PTN is not anticipated to require land use changes, the contribution of continued operation of PTN would be a small contributor to the overall moderate cumulative impact to land use.

The continued use of existing structures associated with PTN would not alter their visual impact. As discussed in Section 3.2.3, the containment structures are screened by vegetation on the landward side and clearly visible from Biscayne Bay. Proposed Units 6 and 7 would add to this viewscape, but because Units 6 and 7 would be built adjacent to existing units and from materials that are architecturally similar, the contrast with the existing landscape would be reduced; thus, the NRC concluded that the visual impact of Units 6 and 7 would be SMALL. Furthermore, the existing units lighting is visible at night from various locations landward and the addition of operational lighting at the proposed units was deemed to be minor.

The NRC also determined the visual impacts from construction of the units would also be SMALL (NRC 2016a, Sections 4.4.1.6, 4.12, 5.4.1.6, and 5.4.1.7). As mentioned above, the surrounding land is designated as environmentally protected and is thus not anticipated to undergo development. Therefore, the cumulative visual impacts would be those of the existing and proposed units. With the NRC previously determining the new units would have a SMALL visual impact, the combination of the existing units and the proposed units would have a cumulative small visual impacts.

4.12.2 Air Quality and Noise

4.12.2.1 Air Quality

As discussed in Section 3.3.3, Miami-Dade County where Turkey Point is located is in attainment of the NAAQSs. PTN air pollutant emissions are minor air emission sources and their minimal emissions stem from intermittent use and testing of EDGs and diesel pumps. The non-nuclear operations of PTN are permitted by a Title V air emissions permit (Permit No. 0250003-021-AV) (FDEP 2014a). The PTN air permit contains conditions established by the FDEP to protect

Florida's ambient air quality standards and ensure impacts are maintained at acceptable levels. As discussed in Section 2.3, no refurbishment or future upgrades or replacement activities have been identified; therefore, no increase or decrease of air emissions is expected over the SLR period. Section 4.2.1.4 concluded that the impact to air quality from the continued operation of PTN during the SLR term is anticipated to be small as generically determined by the NRC for all nuclear power plants.

The Units 6 and 7 EIS conducted an air quality cumulative impact analysis inclusive of the existing Turkey Point Units 1-5 (with Units 1 and 2 operating in synchronous condenser mode) and other past, present, and future projects (including other existing fossil fuel-fired power plants, planned and existing MSW incinerators, and power generation projects) (NRC 2016a, Table 7-1 and Section 7.6.1). The geographic area of interest was established as Miami-Dade County, and the county was in attainment for the NAAQSs at that time, as is the current condition. The NRC analysis concluded that cumulative air quality impacts due to criteria pollutants would SMALL to MODERATE. The NRC noted the following contributors to this conclusion to be the potential for growth and the contribution of criteria pollutant emissions from the three landfill gas power-generation projects.

Given the SLR for PTN does not include an increase in air emissions and the recent NRC cumulative analysis concluded SMALL to MODERATE impacts, the cumulative air quality impacts are anticipated to be small to moderate with the continued operation of PTN being only a minor contributor to the cumulative impact. In contrast, as presented in Section 7.2, replacement of PTN with a natural gas plant would be an addition of a major air emission source, resulting in a greater incremental contribution to air pollution.

4.12.2.2 Climate Change

The annual GHG emissions for the period 2012–2016 from PTN are presented in Table 3.3-10. The NRC estimated GHG emissions for the lifetime of a 1,000-MWe reactor at 10,500,000 MT carbon dioxide equivalent (CO_2e). This is equal to approximately 37.5 g CO_2e per kilowatt hour (CO_2e/kWh). (NRC 2013d) The contributions of PTN, which are less than 1,000 MWe each, for the 20 years of operation during the SLR term would be less than the estimate the NRC prepared for the 1,000-MWe reactor.

It is difficult to evaluate cumulative impacts of GHG emissions on a local level; the NRC evaluated GHG cumulative impacts on a global level in its guidance. GHG cumulative impacts on a global level indicate that national and worldwide cumulative impacts of GHG emissions are MODERATE, with or without the GHG estimated for the lifetime of a 1000-MWe reactor. (NRC 2013e)

NRC's EIS for proposed Units 6 and 7 also discussed cumulative impacts of GHG emissions on a global scale as well as on a national scale, concluding that the cumulative impact would be MODERATE based on EPA and U.S. Global Change Research Program reports. The EIS further concluded that the cumulative impacts would be MODERATE, whether or not the proposed units were constructed and operated. (NRC 2016a) The GHG contribution of PTN during the SLR period would be minor and would be less than the contribution from the construction of the proposed Units 6 and 7, which would require mobilization of hundreds of construction workers daily, and transport and manufacturing of building materials and components. Therefore, while the cumulative impact would be moderate, the contribution of continued operation of PTN would be negligible. Moreover, continued operation of PTN avoids millions of tons of carbon dioxide (CO_2) from alternative fossil-fuel generation, positively impacting the climate change factor of CO_2 concentrations.

4.12.2.3 Noise

PTN operations have a small impact on the noise environment as described in Section 4.3.4. As mentioned above, the surrounding land is designated as environmentally protected and is not anticipated to undergo development. Therefore, the cumulative noise impacts would be those of the existing and proposed units. The NRC determined the noise impacts from construction and operation of the proposed Units 6 and 7 would also be SMALL. Peak noise from construction of the proposed Units 6 and 7 was estimated to be below 65 dBA at the nearest residence, a level considered to be a small significance. (NRC 2016a, Sections 4.4.1.1, 4.12, and 5.4.1.1) With the NRC previously determining that even the peak construction noise of the proposed units would have a SMALL noise impact, the combination of the existing units, including continued operation of PTN, and the proposed units would have a cumulative small noise impact.

4.12.3 Geology and Soils

Impacts to geology and soils could result from ground-disturbing activities and stormwater runoff. Routine infrastructure, renovation, and maintenance projects would be expected during continued operation. Stormwater is routed to the cooling canals. As discussed in Section 3.5.3.2, stabilization measures are in place to prevent erosion and sedimentation impacts to the site and vicinity. Section 4.4.4 concluded that PTN's impact on geology and soils would be small. No new development attributable to PTN during the SLR period is anticipated, and any new development would be subject to state and local stormwater management requirements.

Stormwater runoff from the construction and operations period of the proposed Units 6 and 7 would be routed to the cooling canals and stormwater management basins before release to the surrounding wetland area. No direct stormwater discharges would be made to Biscayne Bay. SFWMD reviewed stormwater management and surmised that stormwater mitigation could be achieved through the planned BMPs, and impacts to offsite water resources would be minimal. (NRC 2016a, Sections 4.2.1.1 and 5.2.1.6)

As mentioned in Section 4.12.1, the land surrounding Turkey Point is designated as environmentally protected, indicating that little to no construction activities would be taking place adjacent to the Turkey Point boundary. Given ground disturbances at the PTN site and that the surrounding area would be subject to stormwater permitting and applicable BMPs, the cumulative impact to geology and soils would be small.

4.12.4 Water Resources

4.12.4.1 Surface Water

Surface water resource impacts would stem from alterations in hydrology, withdrawals, discharges, and stormwater. PTN does not withdraw water from surface water resources and the units' discharges, including stormwater, are to the closed-cycle cooling canals. There are no construction or refurbishment plans related to the proposed action, thus no alterations in hydrology are anticipated. The cooling canals, the groundwater wells associated with the cooling canals, and the cooling canals' interface with groundwater are discussed in Section 3.6. The compliance history associated with the cooling canals freshening and hypersaline recovery is presented in Section 3.6.1.4.5. The cooling canals' effect on surface water through the groundwater interface was studied in sampling events in 2010–2017. The results indicated that the groundwater pathway is having no discernable influence on Biscayne Bay (EEI 2017).

NRC's Units 6 and 7 EIS analyzed cumulative impacts to surface water quality in surface waters adjacent to the Turkey Point site. The EIS considered the contributing projects to be those of Turkey Point existing and proposed units, and historical point and non-point-source discharges have affected the water quality of streams and rivers near Turkey Point. The EIS considered that some water bodies near Turkey Point are listed as impaired (CWA 303[d]) and designation of the waters of Biscayne National Park as an Outstanding Florida Water. The EIS analysis determined that cumulative impacts would be MODERATE, with the proposed Units 6 and 7 contribution being of small significance. (NRC 2016a) Given that PTN do not discharge to surface waters and have stormwater controls in place, they likewise would have a contribution of small significance within the MODERATE cumulative impact.

4.12.4.2 Groundwater

PTN operations include groundwater withdrawals for process water and freshening of the cooling canals, recovery of hypersaline groundwater, underground injection of wastewater and, as discussed above, migration of water in the cooling canals of the IWW facility into groundwater. In addition, FPL has groundwater withdrawal wells located at Turkey Point (PW-1, PW-3, and PW-4) for process water for other operating units. All of these wells are discussed in Section 3.6.3.2. Section 4.5.3.4 discusses the impacts of groundwater withdrawals and concluded that the withdrawals are within permitted quantities.

The EIS prepared by NRC for Turkey Point Units 6 and 7 analyzed cumulative impacts to groundwater considering the groundwater withdrawals and injections of PTN and the other Turkey Point facilities and those from other projects and activities in the surrounding area (e.g., impacts of enhanced recharge to the Biscayne Aquifer from activities related to CERP and offsite wastewater-injection operations). The NRC determined the cumulative impacts to be SMALL given the hydrologic characteristics of the affected aquifers, fate and transport processes, and the monitoring and management programs required by the State. (NRC 2016a)

As indicated in Section 4.12 of NRC Regulatory Guide 4.2, Revision 1 (NRC 2013b), it may be assumed that cumulative impacts are managed as long as facility operations are in compliance with their respective permits. Given that FPL continues to comply with its permits for groundwater withdrawals and injection, the FDEP CO for freshening of the cooling canals, and the CA with Miami-Dade County for remediation of the hypersaline plume, cumulative impacts would be managed, and continued operation of PTN during the SLR period would be small.

4.12.4.3 Climate Change

Aside from GHG levels discussed in Section 4.12.2.2, other climate change indicators are trends in increasing air temperature, precipitation, and water temperature. The reliance of PTN on closed-cycle cooling using the cooling canals limits the opportunities for operation of the units to contribute to these factors due to the reuse of water and no discharge. Extensive studies were conducted by FPL to determine the effects, if any, of the CCS on surface water via the groundwater pathway. The results indicated that the groundwater pathway is having no discernable influence on Biscayne Bay. The results indicate that water temperature in Biscayne Bay is influenced by seasonal and meteorological conditions. The increase in cooling canals water temperatures during the post-uprate period do not correspond with commensurately higher air temperatures. As for precipitation, the results from 2010 through 2017 showed differences in rainfall between stations, as may be expected over the large area of sampling. However, there was no increasing trend in rainfall for the stations or relative trends among the stations (EEI 2017, Sections 2.2.2, 2.4.2, and 5.1).

So, while national and global trends may show warming trends, the available data indicate that the no-discharge, closed-loop cooling used by PTN would also be a small contributor to local and regional warming trends. Moreover, continued operation of PTN avoids millions of tons of CO_2 from alternative fossil-fuel generation, positively impacting the climate change factor of CO_2 concentrations.

4.12.5 Ecological Resources

4.12.5.1 Terrestrial

The affected environment for terrestrial ecological communities is described in Section 3.7 and represents the cumulative impact of past and present activities on site and in the surrounding area of environmental protected lands.

As discussed above, FPL conducted pre-and post-uprate studies during the period 2010–2017 to determine the influence of the cooling canals on the surrounding areas through migration of groundwater. The results indicate that the cooling canals do not have any ecological impact on the surrounding areas (PTN 2017, Executive Summary).

The cooling canals are the home to the threatened American crocodile. As discussed in Section 4.6.6.4, the cooling canals provide habitat for the species, and FPL has a management plan in place to support the population and minimize adverse impacts. Section 4.6.6.4 concludes that the continued operation of the site would have no adverse effects on any federally or state-listed species.

As discussed in Sections 3.7.8.1 and 4.6.6.4, habitat for federally and state-listed terrestrial species other than the American crocodile does occur on or immediately adjacent to the Turkey Point site. However, adherence to regulatory and permit requirements to avoid take of protected species and FPL administrative controls, such as those regarding response to avian collisions with transmission lines, will minimize or avoid impact to these species. FPL is not aware of any adverse impacts regarding threatened, endangered, and protected species attributable to the site. Maintenance activities necessary to support SLR likely would be limited to previously disturbed areas on site. Lands adjacent to the Turkey Point site are designated as environmentally protected and, therefore, development is not expected. Therefore, cumulative impacts on protected species would be small.

In its EIS for proposed Units 6 and 7, the NRC concluded that the overall cumulative impacts on terrestrial resources within a 50-mile radius from past, present, and reasonably foreseeable future actions would be MODERATE to LARGE, with particular consideration of the impacts of Units 6 and 7, habitat loss and degradation from past, ongoing, and anticipated regional land development; the sensitivity of terrestrial habitats in the region to hydrological changes; the number and distribution of federally and state-listed species present in the region; and the presence of two national parks and numerous other conservation lands in the area. The contribution of construction and operation of Units 6 and 7 were assessed by the NRC as a MODERATE contributor to this overall impact significance. (NRC 2016a, Section 7.3.1)

The USFWS biological opinion for federally listed species with regard to the construction and operation of the proposed Turkey Point Units 6 and 7 project concluded that the project as proposed is not likely to jeopardize the continued existence of the crocodile, indigo snake, snail kite, panther, red knot, or wood stork, and it will not adversely modify the critical habitat of the crocodile. The USFWS also concluded that the project was not likely to adversely affect the Florida bonneted bat, Bartram's scrub-hairstreak butterfly, Florida leafwing butterfly, Miami tiger beetle, and Schaus swallowtail butterfly, Beach jacquernontia, Carter's small-flowered flax, crenulate lead-plant, deltoid spurge, Florida brickell-bush, Garber's spurge, Small's milkpea tiny polygala, piping plover, and the West Indian manatee. (USFWS 2017e)

Given that continued operation of PTN does not include the construction of new facilities and that ongoing remediation activities associated with the cooling canals would be conducted in compliance with state and local requirements and monitoring would be conducted to ensure its effectiveness, the contribution to the overall cumulative impacts to terrestrial habitats including wetlands and terrestrial species communities would be small.

4.12.5.2 Aquatic

The aquatic ecological communities could be impacted through discharges to the surface waters and wetlands. PTN's cooling canals are closed loop and do not discharge to surface waters; however, the cooling canals are unlined so they have an interface with underlying groundwater. Stormwater is also routed to the cooling canals. As discussed above, pre- and post-uprate studies and continued monitoring were undertaken to determine any influence on the surrounding surface and groundwater due to seepage from the unlined cooling canals. The studies' data support the conclusion that the cooling canals do not have any ecological impact on the surrounding areas, and there is no evidence of cooling canal water in the surrounding marsh and mangroves areas from a groundwater pathway (EEI 2017, Executive Summary).

NRC's Units 6 and 7 EIS also conducted a cumulative impact assessment for impacts on aquatic ecological communities using a geographic area of interest of all the aquatic resources in southeastern Florida. The NRC determined the cumulative impact to be MODERATE, primarily based on past activities that altered the hydrology of the region. Other activities noted by the NRC were success or failure of existing and pending restoration CERP activities, continued urbanization in southern Florida, and the magnitude of hydrological alterations as a result of climate change. NRC's assessment determined that the proposed and existing Turkey Point units' contribution would be SMALL to the cumulative impacts. The NRC further indicated that their previous assessments of PTN operations indicated that their impact on aquatic communities were limited to those in the cooling canals. (NRC 2016a, Section 7.3.2)

Given that FPL will continue to manage the cooling canals in compliance with its IWW permit, continue to comply with the AO regarding improving water quality in the canals, and continue to implement its American crocodile management plan, the continued contribution of PTN to cumulative impacts during the SLR period would be small.

4.12.5.3 Climate Change

Terrestrial and aquatic species could be vulnerable to the air and water temperature warming trends and rising sea levels. As discussed in Sections 4.12.2.2 and 4.12.4.3, the cumulative impact of climate change on a national level was assessed previously to be MODERATE. Given PTN's no-discharge cooling system and data indicating that cooling water discharges are not indicated in local air, water temperature, and precipitation trends, the continued operation of the PTN would be a small contributor to climate change effects that impact vulnerable species.

4.12.6 Historic and Cultural Resources

As discussed in Sections 3.8.5 and 4.7.4.2, there have been seven previous cultural resource investigations conducted on the Turkey Point site. There are no recorded cultural resources on the Turkey Point site and there are no NRHP-listed resources within a 6-mile radius of Turkey Point. As discussed in Section 3.8.6, FPL has administrative controls in place for management of cultural resources ahead of any future ground-disturbing activities at the plant. These consist of the 2016 conditions of certification (FDEP 2016a) and the Environmental Control Program for PTN. Section 4.7.4.2 concluded that no adverse effects are anticipated during the PTN SLR term.

NRC's Units 6 and 7 EIS cumulative land use impacts analysis considered the direct and indirect APE determined for the construction and operation of proposed Units 6 and 7 as the geographic area of interest. The direct-effects APE is the area that may be physically affected by land-disturbing activities, and the indirect-effects APE is the area that may be visually and/or auditory affected. The Units 6 and 7 project includes construction of the units' onsite and offsite facilities, including transmission corridors. The indirect-effects APE applicable to the onsite portions is determined by the maximum distance from which the tallest structures associated with proposed Units 6 and 7 can be seen from offsite locations. In the case of the Turkey Point site, the indirect-effects APE was determined to be 0.5 miles from the facility. The NRC's cumulative impact assessment, which included consideration of the transmission corridor, was MODERATE; however, the NRC stated that incremental impacts associated with the onsite NRC-authorized activities for Units 6 and 7 would not significantly contribute to the cumulative impact, because no significant historic or cultural resources would be affected by these activities in the geographic area of interest. (NRC 2016a, Sections 2.7 and 7.5)

NRC's Units 6 and 7 EIS assessment and the Section 4.7.4.2 assessment indicates that there would not be an overlap of impacts resulting in cumulative impacts; therefore, cumulative impacts to cultural resources from this SLR are not anticipated.

4.12.7 Socioeconomics

The SLR does not include additional workers (Section 4.8.1.4) so the small adverse impacts that are the result of workers' impact on community services, education, and infrastructure, including transportation, would continue. As discussed in Section 4.5.1.4, the demand for municipal water for plant use is being reduced and this reduced usage would be applicable to the SLR term. Tax payments from the operating plant (Section 4.8.2.4) are anticipated to continue without significant change through the SLR period and the economic contributions of the plant's workers, thus the beneficial socioeconomic impacts would also continue. FPL also does not have currently have plans to expand or contract operations at the other existing units during the SLR period, so their contributions to the taxable value of Turkey Point is anticipated to continue. However, operational Units 6 and 7 would impact the Turkey Point site's taxable value. In addition, construction of the proposed units would impact socioeconomics through increased employment directly and indirectly by adding to the local economy and placing greater demand on community services and infrastructure.

NRC's Units 6 and 7 EIS considered the cumulative impacts of the proposed units, existing units, and other past, present, and future projects using Miami-Dade County as the geographic area of interest. The EIS determined the adverse cumulative impact to be SMALL with the exception of traffic in the vicinity of the proposed units, which would be MODERATE with the proposed units being the principal contributor to the traffic impact. (NRC 2016a)

Given that continued operation of PTN would allow employment levels and tax payments to be consistent with current levels, the cumulative impacts determined in the Units 6 and 7 EIS, considering construction and operation, remain applicable; therefore, cumulative socioeconomic impacts would be small with the exception of moderate traffic impacts in the vicinity of Turkey Point resulting from the addition of the proposed Units 6 and 7.

4.12.8 Human Health

Operating PTN for an additional 20-year period is not expected to cause an increase in annual radioactive effluent releases. The NRC concluded that the cumulative radiological impacts of operating the existing and proposed Turkey Point units and the influence of other manmade sources of radiation nearby would be SMALL (NRC 2016a, Section 7.8). The cumulative impact of the units and the proposed units along with any existing or proposed medical, industrial, and research facilities using radioactive materials in the region during the SLR period would be small, because all routine releases by the facilities and occupational exposure to their employees would be subject to federal and state regulations designed to ensure radioactive emissions and occupational exposure do not significantly impact human health.

4.12.9 Waste Management

As discussed in Section 4.11.1.4, the comprehensive regulatory controls in place for management of radiological waste, FPL's compliance with these regulations, and use of only licensed treatment and disposal facilities would allow the impacts to remain SMALL during the SLR term. There are no other operating nuclear power plants, fuel-cycle facilities, or radiological waste treatment and disposal facilities within a 50-mile radius of PTN. There are industrial, medical, and research facilities in the region that use radioactive materials.

NRC's Units 6 and 7 EIS analyzed the cumulative impacts of managing radioactive waste within a 50-mile radius of PTN and determined the cumulative impact to be SMALL (NRC 2016a, Section 7.8)

FPL would continue its programs of radioactive waste management and comply with waste management guidelines and discharge limits. Given that NRC, EPA, and state authorities would likely continue ensuring licensed facilities are available for waste treatment and disposal, and FPL's ongoing waste management practices, the cumulative impact of radioactive waste management would be small.

Section 4.11.5.4 concluded that continued operation of PTN would have a small impact on nonradioactive waste management facilities given FPL's program for waste management and the availability of treatment and disposal facilities. NRC's Units 6 and 7 EIS analyzed cumulative impacts of nonradioactive waste from the past, present, and future projects in the geographic area of interest of Miami-Dade County. The EIS concluded that cumulative impacts from nonradioactive waste management would be SMALL. (NRC 2016a, Section 7.9) FPL would continue its programs of waste management and comply with permits and waste management regulations. Given that facilities within Miami-Dade County are also required to comply with appropriate EPA and state requirements for the management of hazardous and nonhazardous waste, that state and local authorities would continue ensuring permitted facilities are available for waste treatment and disposal, and FPL's ongoing waste management practices, the cumulative impact of nonradioactive waste management would be small.

4.13 Impacts Common to all Alternatives: Uranium Fuel Cycle

The following sections address the fuel cycle issues applicable to PTN, providing background on the issues and the analyses regarding the SLR period.

4.13.1 Offsite Radiological Impacts—Individual Impacts from other than the Disposal of Spent Fuel and High-Level Waste

4.13.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. The impacts to the public from radiological exposures have been considered by the Commission in Table S-3 of this part. Based on information in the GEIS, impacts to individuals from radioactive gaseous and liquid releases, including radon-222 and technetium-99, would remain at or below the NRC's regulatory limits.

4.13.1.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.13.1.3 Background [GEIS Section 4.12.1.1]

The primary indicators of impact are the concentrations of radionuclides in the effluents from the fuel cycle facilities and the radiological doses received by a maximum exposed individual (MEI) on the site boundary or at some location away from the site boundary. The basis for establishing the significance of individual effects is the comparison of the releases in the effluents and the MEI doses with the permissible levels in applicable regulations. The analyses performed by the NRC in the preparation of Table S-3 and found in the 1996 GEIS indicate that as long as the facilities operate under a valid license issued by either the NRC or an agreement state, the individual effects will meet the applicable regulations. On the basis of these considerations, the NRC has concluded that the impacts on individuals from radioactive gaseous and liquid releases during the license renewal term would remain at or below the NRC's regulatory limits. Accordingly, the NRC concludes that offsite radiological impacts of the uranium fuel cycle (individual effects from sources other than the disposal of spent fuel and HLW) are SMALL.

4.13.1.4 Analysis

This issue concerns the direct individual impacts from facilities involved in supplying nuclear fuel to nuclear power plants. The issue was considered in FPL's new and significant review and no new and significant information was identified as it relates to offsite radiological impacts—individual impacts from other than the disposal of spent fuel and HLW; therefore, no further analysis is required. The issue was also considered in PTN's first license renewal's new and significant review, and no new and significant information was found at that time (FPL 2000b, Table 4.0-2).

4.13.2 Offsite Radiological Impacts—Collective Impacts from other than the Disposal of Spent Fuel and High-Level Waste

4.13.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

There are no regulatory limits applicable to collective doses to the general public from fuel-cycle facilities. The practice of estimating health effects on the basis of collective doses may not be meaningful. All fuel-cycle facilities are designed and operated to meet the applicable regulatory limits and standards. The Commission concludes that the collective impacts are acceptable.

The Commission concludes that the impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the collective impacts of the uranium fuel cycle, this issue is considered Category 1.

4.13.2.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.13.2.3 Background [GEIS Section 4.12.1.1]

There are no regulatory limits applicable to collective doses to the general public from fuel cycle facilities. All regulatory limits are based on individual doses. All fuel cycle facilities are designed and operated to meet the applicable regulatory limits.

As discussed in the 1996 GEIS, despite the lack of definitive data, some judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment in every case. The Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the collective effects of the fuel cycle, this issue was considered Category 1.

4.13.2.4 Analysis

This issue concerns the direct collective impacts from facilities involved in supplying nuclear fuel to nuclear power plants. The issue was considered in FPL's new and significant review and no new and significant information was identified as it relates to offsite radiological impacts—collective impacts from other than the disposal of spent fuel and HLW; therefore, no further analysis is required. The issue was also considered in PTN's first license renewal's new and significant review, and no new and significant information was found at that time (FPL 2000b, Table 4.0-2).

4.13.3 Nonradiological Impacts of the Uranium Fuel Cycle

4.13.3.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. The nonradiological impacts of the uranium fuel cycle resulting from the renewal of an OL for any plant would be small.

4.13.3.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.13.3.3 Background [GEIS Section 4.12.1.1]

Data on the nonradiological impacts of the fuel cycle are provided in Table S-3. These data cover land use, water use, fossil fuel use, and chemical effluents. The significance of the environmental impacts associated with these data was evaluated in the 1996 GEIS on the basis of several relative comparisons. It was noted that the impacts associated with uses of all of the above resources would be SMALL. Any impacts associated with nonradiological liquid releases from the fuel cycle facilities would also be SMALL. As a result, the aggregate nonradiological impact of the uranium fuel cycle resulting from the renewal of an OL for a plant would be SMALL, and it was considered a Category 1 issue in the 1996 GEIS.

4.13.3.4 Analysis

This issue concerns the direct nonradiological impacts from facilities involved in supplying nuclear fuel to nuclear power plants. The issue was considered in FPL's new and significant review, and no new and significant information was identified as it relates to nonradiological impacts of the uranium fuel cycle; therefore, no further analysis is required. The issue was also considered in PTN's first license renewal's new and significant review, and no new and significant information was found at that time (FPL 2000b, Table 4.0-2).

4.13.4 Transportation

4.13.4.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. The impacts of transporting materials to and from uranium-fuel-cycle facilities on workers, the public, and the environment are expected to be small.

4.13.4.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.13.4.3 Background [GEIS Section 4.12.1.1]

The impacts associated with transporting fresh fuel to one 1,000 MWe model light-water reactor and with transporting spent fuel and radioactive waste (LLW and mixed waste) from that light water reactor are provided in Table S-4 in 10 CFR 51.52. Similar to Table S-3, and as indicated in 10 CFR 51.52, every ER prepared for the construction permit stage of a commercial nuclear power plant must contain a statement concerning the transport of fuel and radioactive waste to and from the reactor. A similar statement is also required in LRAs. Table S-4 forms the basis of such a statement.

In 1999, the NRC issued an addendum to the 1996 GEIS in which the agency evaluated the applicability of Table S-4 to future license renewal proceedings, given that the spent fuel is likely to be shipped to a single repository (as opposed to several destinations, as originally assumed in the preparation of Table S-4) and given that shipments of spent fuel are likely to involve more highly enriched fresh fuel (more than 4 percent as assumed in Table S-4) and higher-burnup spent fuel (higher than 33,000 MWd/MTU as assumed in Table S-4). In the addendum, the NRC evaluated the impacts of transporting the spent fuel from reactor sites to the candidate repository at Yucca Mountain and the impacts of shipping more highly enriched fresh fuel and higher-burnup spent fuel. On the basis of the evaluations, the NRC concluded that the values given in Table S-4 would still be bounding, as long as the (1) enrichment of the fresh fuel was 5 percent or less, (2) burnup of the spent fuel was 62,000 MWd/MTU or less, and (3) higher-burnup spent fuel (higher than 33,000 MWd/MTU) was cooled for at least 5 years before being shipped offsite.

4.13.4.4 Analysis

The NRC did not revisit the radiological impact analysis of transporting spent nuclear fuel to away from reactor storage locations in the 2014 GEIS for Continued Storage of Spent Nuclear Fuel and again stated that the radiological impact analysis can be found in Table S-4 (NRC 2014a).

As stated above, the NRC considered the impacts of this issue to be SMALL provided three conditions were met. As discussed in Section 2.2.1, the fuel used at PTN is enriched to a maximum of 5.0 percent, and the equilibrium core maximum fuel discharge burnup rate is approximately 62,000 MWd/MTU. Furthermore, as discussed in Section 2.2.6.5, spent fuel is stored on site in each of the units' spent fuel pools prior to transfer to onsite dry storage. The environmental assessment for the EPU determined that spent fuel management was bounded by the impacts analyzed in Table S-4 (NRC 2012b). The issue was considered in FPL's new and significant review, and no new and significant information was identified as it relates to nonradiological impacts of the uranium fuel cycle; therefore, no further analysis is required. The issue was also considered in PTN's first license renewal's new and significant review, and no new and significant information was found at that time (FPL 2000b, Table 4.0-2).

4.14 Termination of Nuclear Power Plant Operations and Decommissioning

The following sections address the issue of license termination and decommissioning, providing background on the issue and an analysis of the issue as it applies to the SLR period.

4.14.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. License renewal is expected to have a negligible effect on the impacts of terminating operations and decommissioning on all resources.

4.14.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.14.3 Background [GEIS Sections 4.12.2 and 4.12.2.1]

The NRC evaluated the impacts of decommissioning nuclear plants in NUREG-0586, the *Generic Environmental Impact Statement for Decommissioning Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors* (NRC 2002b).

This section describes and discusses the environmental consequences of terminating nuclear power plant operations and decommissioning, but the only impacts attributable to the proposed action (license renewal) are the effects of an additional 20 years of operations on the impacts of decommissioning. The majority of the impacts associated with plant operations would cease with reactor shutdown; however, some impacts would remain unchanged, while others would continue at reduced or altered levels. Some new impacts might also result directly from terminating nuclear power plant operations.

Terminating nuclear power plant operations would result in the cessation of actions necessary to maintain the reactor, as well as a significant reduction in the workforce. NRC presumes that terminating nuclear power plant operations would not immediately lead to the dismantlement of the reactor or other infrastructure, much of which would still be in use to support other units on site that continued to operate. Even for sites with just one unit, some facilities would remain in operation to ensure that the site was maintained in safe shutdown condition.

4.14.4 Analysis

Only the incremental increase in the impacts of termination of plant operations and decommissioning attributable to continued operation during the SLR term is within the scope of this issue. The additional operating years would generate additional spent nuclear fuel to be managed during the decommissioning period, as well as potentially greater volumes of radioactive waste or radioactive materials. The proposal to continue operation during an SLR term does not include construction of additional plant structures that would require decommissioning, and additional workers are not anticipated for the SLR term that would incrementally increase socioeconomic impacts of termination of plant operations. FPL would plan and conduct decommissioning activities in accordance with NRC-reviewed methods and evaluate anticipated environmental impacts to ensure they are bounded by previously issued environmental assessments or are SMALL. No new and significant information has been identified for this issue; therefore, no further analysis is required.

The decommissioning impacts component of this issue was considered in PTN's first license renewal's new and significant review, and no new and significant information was found at that time (FPL 2000b, Table 4.0-2). The GEIS (NRC 2013a) combined several Category 1 decommissioning issues in the 1996 GEIS and added consideration of termination of plant operations.

4.15 Severe Accident Mitigation Alternatives Analysis

The following sections address severe accident mitigation alternatives (SAMAs) analysis applicable to PTN, providing background on the issues and the analyses regarding the SLR period.

In 2000, FPL submitted an application for OL renewal, which was approved in 2002. The original 40-year OLs for PTN were thereby renewed for a period of 20 years. As part of the first license renewal process, a detailed evaluation of potential SAMAs was performed. Of the 169 potential SAMAs identified in the first license renewal, 93 were qualitatively screened from further evaluation (e.g., those that are only applicable to boiling water reactors), and a detailed cost-benefit analysis was performed on the 76 SAMAs that could not be screened (FPL 2000a). The cost-benefit analysis included development of a Level 3 probabilistic risk assessment (PRA) for PTN Unit 3, which was used to calculate conditional offsite population doses and offsite economic consequences for each of the PRA source term categories (STCs). The analysis was developed for Unit 3, and applicable to the license renewal for both units (FPL 2000a). By calculating the reduction in STC frequencies for each potential SAMA, the present value dollar benefit of each was determined, utilizing the guidance of NUREG/BR-0184 (NRC 1997). The benefit was then compared to a cost estimate for each to complete the cost-benefit comparison. The conclusion of the analysis was that none of the proposed SAMAs were cost beneficial to PTN.

As part of the SLRA process to renew the PTN OLs for another 20 years, the PTN PRA was again examined for insights. The purpose was to determine if there was any new and significant information regarding the SAMA analyses that were prepared to support issuance of the initial renewed OLs for PTN. Over the course of plant operation, changes are made to the plant design, operation, and maintenance practices. Periodic updates to the PTN PRA have ensured that the PRA includes the relevant changes and continues to reflect the current plant design and operation. PRA updates also include updates to the plant-specific initiating event and equipment data utilized, and improvements in state-of-the-art analysis of severe accidents. Therefore, the PRA provides valuable insights into the risk significance of the plant changes over time.

The analyses below follow the model approach in NEI 17-04 [Rev. 0] (NEI 2017c), which NEI has submitted for endorsement by the NRC staff for determining whether there is new and significant information regarding the SAMA analyses. For the PTN SLRA, the consideration of new and significant changes since the time of the first license renewal is consistent with the GEIS (NRC 2013a), Supplement 49 (NRC 2014b). Section 5.3.9 of GEIS Supplement 49 states the following:

New information is significant if it provides a seriously different picture of the impacts of the federal action under consideration. Thus, for mitigation alternatives such as SAMAs, new information is significant if it indicates that a mitigation alternative would substantially reduce an impact of the federal action on the environment. Consequently, with respect to SAMAs, new information may be significant if it indicated a given cost-beneficial SAMA would substantially reduce the impacts of a severe accident or the probability or consequences (risk) of a severe accident occurring.

The implication of this statement is that "significance" is not solely related to whether or not a SAMA is cost beneficial, but depends also on a SAMA's potential to significantly reduce risk to the public (NEI 2017c).

4.15.1 Category 1 Issue—Design-Basis Accidents

The following Category 1 issue related to postulated accidents was reviewed for new and significant information that could make the generic finding as described in the GEIS (NRC 2013a) inapplicable to PTN: Issue 65—Design-basis accidents.

The GEIS (NRC 2013a) concluded that because a licensee is required to maintain the plant within acceptable design and performance criteria, including during any license renewal term, impacts from design-basis accidents would not be affected by changes in plant environment because such impacts (1) are based on calculated radioactive releases that are not expected to change; (2) are not affected by plant environment because they are evaluated for the hypothetical maximally exposed individual; and (3) have been previously determined acceptable.

4.15.2 Category 2 Issue—Severe Accidents

The following Category 2 issue (requirement) related to severe accidents has been defined by the NRC in 10 CFR 51.53(c)(3)(ii)(L):

If the staff has not previously considered SAMAs for the applicant's plant in an EIS or related supplement or in an environmental assessment, a consideration of alternatives to mitigate severe accidents must be provided.

The NRC finding regarding severe accidents is stated in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, as follows:

The probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives.

The NRC has ruled that when a plant qualifies for the exception from the requirement to consider SAMAs in 10 CFR 51.53(c)(3)(ii)(L), the exception operates to designate this Category 2 issue as the "functional equivalent" of a Category 1 issue (NRC 2013f). Accordingly, using a review process similar to that used for other Category 1 issues, FPL reviewed this issue for new and significant information that would cause the following generic conclusions in the GEIS (NRC 2013a) concerning this issue to be inapplicable to PTN.

1. The probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are small for all plants.

2. License renewal ERs for plants for which SAMAs have been previously considered need not consider SAMAs.

The subsections below describe the methodology and review for each conclusion.

4.15.3 Methodology for Evaluation of New and Significant SAMAs

4.15.3.1 PTN SLRA SAMA Stage 1 Evaluations—Screening

The evaluations of the PTN SLRA SAMAs are consistent with the NEI 17-04 methodology (NEI 2017c), which describes a three-stage process for determining whether there is any "new and significant" information relevant to a previous SAMA analysis. In Stage 1, the SLRA applicant uses PRA risk insights and/or risk model quantifications to estimate the percent reduction in the maximum benefit (MB) associated with (1) all unimplemented "Phase 2" SAMAs for the analyzed plant and (2) those SAMAs identified as potentially cost beneficial for other U.S. nuclear power plants and which are applicable to the analyzed plant. If one or more of those SAMAs are shown to reduce the MB by 50 percent or more, then the applicant must complete Stage 2 by developing updated averted cost-risk estimates for implementing those SAMAs. If the Stage 2 assessment confirms that one or more SAMAs reduce the MB by 50 percent or more, then the applicant must complete Stage 3 by performing a cost-benefit analysis for the "potentially significant" SAMAs identified in Stage 2. Applicants that are able to demonstrate through the Stage 1 screening process that there is no potentially significant new information are not required to perform the Stage 2 or Stage 3 evaluations. The application of the NEI 17-04 methodology to PTN is described in the following subsections.

4.15.3.1.1 Definitions of New and Significant Information

"New" information pertains to data used in a SAMA analysis that have changed or become available since the time the preceding SAMA analysis was performed.

There are some inputs to the SAMA analysis that are expected to change, or to potentially change, for all plants. These inputs include the following:

- Updated Level 3 PRA model consequence results, which may be impacted by multiple inputs, including, but not limited to, the following:
    - Population, as projected within a 50-mile radius of the plant.
    - Value of farm and non-farm wealth.
    - Core inventory (e.g., due to power uprate).
    - Evacuation timing and speed.
    - Level 3 PRA methodology updates.
- NUREG/BR-0058 (NRC 2004) cost-benefit methodology updates.

In addition, other changes that could be considered "new information" are dependent on plant activities or site-specific changes. These types of changes include the following:

- Identification of a new hazard (e.g., a fault that was not previously analyzed in the seismic analysis).
- Updated plant risk model (e.g., a fire PRA that replaces the individual plant examination of external events [IPEEE] analysis).
    - Impacts of plant changes that are included in the plant risk models will be reflected in the model results and do not need to be assessed separately.

- Non-modeled modifications/changes to the plant.
    - o Modifications determined to have no risk impact need not be included (e.g., replacement of the condenser vacuum pumps), unless they impact a specific input to SAMA (e.g., a new low-pressure turbine in the power conversion system that results in a greater net electrical output).

For risk model updates performed to reflect the latest PRA model state of the practice, it was noted that the actual physical plant risk may not have changed; however, because the best-estimate assessment or understanding of the risk (e.g., plant-specific risk profile) has changed, it was considered to be new information.

The NEI methodology (NEI 2017c) considers a potential SAMA to not be significant unless it reduces the MB, as defined in Section 4.5 of NEI 05-01 [Rev. A], by at least 50 percent. The Stage 1 quantitative screening process evaluates this using the criterion of no STC frequency being reduced by at least 50 percent. Because the MB is the sum total of the contribution of each STC, if no STC decreases by at least 50 percent, then the total MB reduction cannot exceed 50 percent. However, the approach of evaluating every STC is not necessary to ensure the MB reduction is less than 50 percent. In reality, many individual STCs have a frequency that is insignificant, and while an insignificant STC could in theory be reduced by more than 50 percent, its impact on MB would be negligible. Therefore, for this analysis, STC groups (large early release frequency [LERF]; small early release frequency [SERF], etc.) were examined as a whole for percentage reduction. If no STC group frequency was reduced by more than 50 percent, then also the MB would not be reduced by more than 50 percent. Therefore, that SAMA would not be considered potentially significant and would not be evaluated further in assessing the significance of new information.

The quantitative evaluations performed for this analysis use the PTN internal events model for full evaluation of Level 2 STC groups. However, the PTN internal flood and fire models are only capable of quantifying core damage frequency (CDF) and the LERF STC group. PTN does not have a seismic PRA. In 2014, a bounding seismic evaluation was performed for PTN using appropriate seismic hazard curves and a plant-level fragility curve. While the bounding seismic evaluation for PTN was sufficient to demonstrate that seismic risk at PTN is not significant, the nature of the analysis does not lend itself to the detailed evaluations performed for this SLRA.

For consideration of total STC group frequencies being reduced by more than 50 percent, detailed calculations are performed for the internal events STC group and for fire/flood LERF (CDF was also quantified). The fire/flood LERF and CDF calculations provide confidence that their impact from each SAMA is consistent with the internal events calculations, and that the MB would not be reduced by more than 50 percent for any of the SAMAs evaluated. Since PTN does not have a seismic PRA, its impact is considered represented by the internal events analyses. Because the Stage 1 analysis evaluates percentage (and not absolute value) reduction in MB, the percentage reduction in seismic would be consistent with internal events and fire. In terms of internal floods and external event consideration, the percentage reduction in total MB is comparable or conservatively represented by utilizing the internal events models. The flood and fire models utilize the logic from the Level 1 PRA event trees. Most fire and seismic significant contributors would utilize the sequence logic of loss of offsite power (LOOP) and/or station blackout (SBO) events. Therefore, the percentage reduction in MB achieved by each SAMA would be similar to that of the internal events LOOP and SBO analyses. While this would yield some change to the specific contribution on each STC group, the changes are not expected to be significant because of the use of the same supporting event tree logic.

It is also important to note that the FPL internal events model receives a significant contribution to LERF (and also MB) from interfacing systems loss-of-coolant accident (ISLOCA) (19 percent of total internal events MB). The external events analysis, however, does not have any contribution from ISLOCA initiating events. Since ISLOCA events have a significant contribution to the overall MB, this reduces the relative contribution from external events.

Regarding new information about changes in population near the PTN site and changes in methodology (e.g., dollar/person-rem estimates), there are some changes since the first PTN license renewal and SAMA analysis. However, compared to the greater than a factor of 20 decrease in the absolute value of internal events CDF at PTN, the other changes are small. Specifically, the PTN model used to evaluate the SAMA in the initial LRA had an internal events CDF of approximately 1.6E-5/year. The current model of record has a CDF of approximately 7.0E-7/year for each unit.

4.15.4 Analysis

4.15.4.1 Identification and Screening

The list of candidate SAMAs for the PTN SLRA was developed from plant-specific and industry sources. For the plant-specific portion, the first PTN license renewal SAMA evaluation was examined to identify all SAMAs that could not be qualitatively screened, and they were found not to be cost effective. Evaluating these items was appropriate for determining if there was any new and significant information for PTN and the PRA since the time of the first license renewal in regard to the potential plant improvements.

The GEIS (NRC 2013a) includes the SEISs that licensees were required to prepare to address potential environmental impacts and mitigation measures for 23 issues requiring plant-specific review. Potentially cost-beneficial SAMAs were identified by licensees as part of this review and are documented in these plant-specific supplements. As PTN has a large, dry pressurized water reactor containment, the scope of the search was limited to these designs.

The list of SAMAs collected was evaluated qualitatively to screen from further evaluation any SAMAs not applicable to PTN, or that already have been implemented at PTN. In addition, one other screening criterion was applied to eliminate SAMAs that have excessive implementation costs. Specifically, SAMAs were screened from further consideration if they were found to reduce the PTN MB by greater than 50 percent in the first PTN license renewal, but nonetheless were found not to be cost effective due to their high estimated costs of implementation in the first LRA and the related NRC SEIS.

The remaining SAMAs were then grouped based on similarities in mitigation equipment or risk-reduction benefits, and all were evaluated for the impact they would have on the PTN STC group frequencies, assuming those SAMAs were implemented at PTN. If any of the SAMAs were found to reduce at least one STC group frequency by at least 50 percent, then the SAMA would retained for a full Level 3 PRA evaluation of the reduction in MB.

4.15.4.2 Stage 1 Screening Evaluation

Industry internal event and external event SAMAs were collected for evaluation in the PTN SLRA. The total number of PTN-specific SAMAs considered was 76. The total number of industry SAMAs considered was 263. Qualitative screening of each from further analysis resulted in elimination of all external event SAMAs in the PTN SLRA. Qualitative screening of the internal events SAMAs, along with binning of similar SAMAs, reduced the total number of SAMAs requiring further evaluation to 13. The binning of SAMAs was performed in a manner that allowed bounding cases that completely addressed a plant risk contributor to be defined to estimate the maximum possible benefits for any of the grouped SAMAs. For example, all ISLOCA-related SAMAs could be represented by a single case in which all ISLOCA events are set to zero (i.e., the risk of an ISLOCA event was assumed to be completely eliminated by SAMA implementation). This bounding approach ensured a conservative analysis, while limiting the total number of cases requiring more detailed evaluation.

Table 4.15-1 presents the industry internal events SAMAs, combined with the PTN-specific SAMAs selected for quantitative screening analysis. "Quantitative screening" refers to the methodology described in preceding sections and was performed using the full internal events Level 2 PRA and the CDF/LERF portions of the fire and flood PRAs. Specifically, SAMAs are quantitatively screened if the bounding PTN-specific case yields a reduction of less than 50 percent in the frequency of each STC group.

The first column presents a number assigned to each SAMA for tracking purposes. The second column is a case identifier. The third column provides a summary description of each potential SAMA; the fourth column provides the results of the quantitative screening evaluation of the STC group frequencies, and the fifth column presents a summary assessment the screening. As presented in Section 4.15.4.1, the criterion for quantitative screening from further evaluation in the Stage 1 evaluation was that the SAMA does not reduce any STC group frequency by at least 50 percent.

After performing the qualitative and quantitative Stage 1 screening, all potential SAMAs were screened from further evaluation. Therefore, Stage 2 of the NEI methodology was not entered, and an update of the PTN Level 3 PRA was not required.

4.15.5 Conclusions

Based on the Phase 1 qualitative and quantitative screening results, all plant-specific and industry SAMAs were demonstrated to not be new and significant.

Therefore, it is concluded that there is no new and significant information that would alter the conclusions of the original SAMA analysis for PTN.

Table 4.15-1
Quantitative Screening of SAMAs that were not Qualitatively Screened (Sheet 1 of 9)

#	Case Name	Description of Bounding Case	Results				Notes
1	HHSI-PMP	The case represents an additional high pressure safety injection pump with independent pump failures (fails to start, fails to run, pump in test and maintenance (T&M), failure to restore pump from T&M) and failures in high pressure safety injection discharge header and suction header.	**Internal Events[(a)]**	**Base Model Results**	**Case 1**	**% Change**	All internal events STC group frequencies were reduced by less than 50 percent. Fire and flood CDF and LERF were reduced by less than 50 percent.
			CDF (ALLTOPS)	6.97E-07	5.76E-07	-17.36	
			INTACT–TOTAL	3.62E-07	3.27E-07	-9.67	
			LATE–TOTAL	4.20E-07	3.23E-07	-23.10	
			LERF–TOTAL	1.47E-08	1.38E-08	-6.12	
			SERF–TOTAL	8.17E-09	7.98E-09	-2.33	
			Fire				
			CDF (ALLTOPS)	5.82E-05	5.33E-05	-8.42	
			LERF–TOTAL	4.60E-06	4.57E-06	-0.65	
			Flood				
			CDF (ALLTOPS)	1.62E-07	1.62E-07	0.00	
			LERF–TOTAL	8.36E-10	8.36E-10	0.00	

Table 4.15-1
Quantitative Screening of SAMAs that were not Qualitatively Screened (Sheet 2 of 9)

#	Case Name	Description of Bounding Case	Results				Notes
2	EDG	An additional EDG is modeled via setting independent failures (failure to run [FR], failure to start [FS], T&M) for one of the Unit 3 EDGs to a very small value.	**Internal Events[(a)]**	**Base Model Results**	**Case 2**	**% Change**	All internal events STC group frequencies were reduced by less than 50 percent. Fire and flood CDF and LERF were reduced by less than 50 percent.
			CDF (ALLTOPS)	6.97E-07	6.93E-07	-0.57	
			INTACT–TOTAL	3.62E-07	3.62E-07	0.00	
			LATE–TOTAL	4.20E-07	4.15E-07	-1.19	
			LERF–TOTAL	1.47E-08	1.47E-08	0.00	
			SERF–TOTAL	8.17E-09	8.17E-09	0.00	
			Fire				
			CDF (ALLTOPS)	5.82E-05	5.81E-05	-0.17	
			LERF–TOTAL	4.60E-06	4.59E-06	-0.22	
			Flood				
			CDF (ALLTOPS)	1.62E-07	1.62E-07	0.00	
			LERF–TOTAL	8.36E-10	8.36E-10	0.00	
3	RECIRC-SWAP	Remove operator failure [for recirc swap].	**Internal Events[(a)]**	**Base Model Results**	**Case 3**	**% Change**	All internal events STC group frequencies were reduced by less than 50 percent. Fire and flood CDF and LERF were reduced by less than 50 percent.
			CDF (ALLTOPS)	6.97E-07	6.65E-07	-4.59	
			INTACT–TOTAL	3.62E-07	3.29E-07	-9.12	
			LATE–TOTAL	4.20E-07	4.14E-07	-1.43	
			LERF–TOTAL	1.47E-08	1.47E-08	0.00	
			SERF–TOTAL	8.17E-09	8.17E-09	0.00	
			Fire				
			CDF (ALLTOPS)	5.82E-05	5.71E-05	-1.89	
			LERF–TOTAL	4.60E-06	4.57E-06	-0.65	
			Flood				
			CDF (ALLTOPS)	1.62E-07	1.62E-07	0.00	
			LERF–TOTAL	8.36E-10	8.36E-10	0.00	

Table 4.15-1
Quantitative Screening of SAMAs that were not Qualitatively Screened (Sheet 3 of 9)

#	Case Name	Description of Bounding Case	Results				Notes
4	AFW-PMP	A redundant auxiliary feedwater (AFW) pump with independent pump failures and 2 support systems (water supply and steam supply) is added.	**Internal Events[(a)]**	**Base Model Results**	**Case 4**	**% Change**	All internal events STC group frequencies were reduced by less than 50 percent. Fire and flood CDF and LERF were reduced by less than 50 percent.
			CDF (ALLTOPS)	6.97E-07	6.16E-07	-11.62	
			INTACT–TOTAL	3.62E-07	2.88E-07	-20.44	
			LATE–TOTAL	4.20E-07	3.93E-07	-6.43	
			LERF–TOTAL	1.47E-08	1.12E-08	-23.81	
			SERF–TOTAL	8.17E-09	8.17E-09	0.00	
			Fire				
			CDF (ALLTOPS)	5.82E-05	3.98E-05	-31.62	
			LERF–TOTAL	4.60E-06	2.68E-06	-41.74	
			Flood				
			CDF (ALLTOPS)	1.62E-07	1.62E-07	0.00	
			LERF–TOTAL	8.36E-10	8.30E-10	-0.72	
5	H2-CONT	Set all hydrogen (H2)-induced containment failure to zero.	**Internal Events[(a)]**	**Base Model Results**	**Case 5**	**% Change**	All internal events STC group frequencies were reduced by less than 50 percent. Fire and flood CDF and LERF were reduced by less than 50 percent.
			CDF (ALLTOPS)	6.97E-07	6.97E-07	0.00	
			INTACT–TOTAL	3.62E-07	3.63E-07	0.28	
			LATE–TOTAL	4.20E-07	4.20E-07	0.00	
			LERF–TOTAL	1.47E-08	1.42E-08	-3.40	
			SERF–TOTAL	8.17E-09	8.17E-09	0.00	
			Fire				
			CDF (ALLTOPS)	5.82E-05	5.82E-05	0.00	
			LERF–TOTAL	4.60E-06	4.53E-06	-1.52	
			Flood				
			CDF (ALLTOPS)	1.62E-07	1.62E-07	0.00	
			LERF–TOTAL	8.36E-10	6.26E-10	-25.12	

Table 4.15-1
Quantitative Screening of SAMAs that were not Qualitatively Screened (Sheet 4 of 9)

#	Case Name	Description of Bounding Case	Results				Notes
6	CISO	Set containment isolation failure to zero.	**Internal Events[(a)]**	**Base Model Results**	**Case 6**	**% Change**	All internal events STC group frequencies were reduced by less than 50 percent. Fire CDF and LERF were reduced by less than 50 percent. Reduction in internal flooding LERF was 71 percent. However, the absolute value of internal flooding LERF is only 2.40E-10/year, compared to the internal events and fire LERF that are several orders of magnitude larger and only show a reduction in the LERF group of 9.9 percent and 8.3 percent, respectively. Therefore, the flood contribution is negligible, and the total reduction of the LERF STC group for this case is well below 50 percent.
			CDF (ALLTOPS)	6.97E-07	6.97E-07	0.00	
			INTACT–TOTAL	3.62E-07	3.62E-07	0.00	
			LATE–TOTAL	4.20E-07	4.20E-07	0.00	
			LERF–TOTAL	1.47E-08	1.32E-08	-9.91	
			SERF–TOTAL	8.17E-09	8.17E-09	0.00	
			Fire				
			CDF (ALLTOPS)	5.82E-05	5.82E-05	0.00	
			LERF–TOTAL	4.60E-06	4.22E-06	-8.26	
			Flood				
			CDF (ALLTOPS)	1.62E-07	1.62E-07	0.00	
			LERF–TOTAL	8.36E-10	2.40E-10	-71.29	

Table 4.15-1
Quantitative Screening of SAMAs that were not Qualitatively Screened (Sheet 5 of 9)

#	Case Name	Description of Bounding Case	Results				Notes
			Internal Events[(a)]	**Base Model Results**	**Case 7**	**% Change**	
7	NO-SGTR	Set steam generator tube rupture (SGTR) events to zero.	CDF (ALLTOPS)	6.97E-07	6.89E-07	-1.15	All internal events STC group frequencies were reduced by less than 50 percent. Fire and flood CDF and LERF were reduced by less than 50 percent.
			INTACT–TOTAL	3.62E-07	3.62E-07	0.00	
			LATE–TOTAL	4.20E-07	4.20E-07	0.00	
			LERF–TOTAL	1.47E-08	1.46E-08	-0.88	
			SERF–TOTAL	8.17E-09	0.00E+00	(only SGTR initiating events)	
			Fire				
			CDF (ALLTOPS)	5.82E-05	NA	NA	
			LERF–TOTAL	4.60E-06	NA	NA	
			Flood				
			CDF (ALLTOPS)	1.62E-07	NA	NA	
			LERF–TOTAL	8.36E-10	NA	NA	

Table 4.15-1
Quantitative Screening of SAMAs that were not Qualitatively Screened (Sheet 6 of 9)

#	Case Name	Description of Bounding Case	Results				Notes
8	ISLOCA		**Internal Events[(a)]**	**Base Model Results**	**Case 8**	**% Change**	All internal events STC group frequencies were reduced by less than 50 percent. Fire and flood CDF and LERF were reduced by less than 50 percent.
			CDF (ALLTOPS)	6.97E-07	6.95E-07	-0.29	
			INTACT–TOTAL	3.62E-07	3.62E-07	0.00	
			LATE–TOTAL	4.20E-07	4.20E-07	0.00	
			LERF–TOTAL	1.47E-08	1.19E-08	-18.84	
			SERF–TOTAL	8.17E-09	8.17E-09	0.00	
			Fire				
			CDF (ALLTOPS)	5.82E-05	5.82E-05	0.00	
			LERF–TOTAL	4.60E-06	4.60E-06	0.00	
			Flood				
			CDF (ALLTOPS)	1.62E-07	1.62E-07	0.00	
			LERF–TOTAL	8.36E-10	8.36E-10	0.00	
9	AIR-SYS	Set instrument air compressor basic events to zero.	**Internal Events[(a)]**	**Base Model Results**	**Case 9**	**% Change**	All internal events STC group frequencies were reduced by less than 50 percent. Fire and flood CDF and LERF were reduced by less than 50 percent.
			CDF (ALLTOPS)	6.97E-07	6.97E-07	0.00	
			INTACT–TOTAL	3.62E-07	3.62E-07	0.00	
			LATE–TOTAL	4.20E-07	4.20E-07	0.00	
			LERF–TOTAL	1.47E-08	1.47E-08	0.00	
			SERF–TOTAL	8.17E-09	8.17E-09	0.00	
			Fire				
			CDF (ALLTOPS)	5.82E-05	5.82E-05	0.00	
			LERF–TOTAL	4.60E-06	4.60E-06	0.00	
			Flood				
			CDF (ALLTOPS)	1.62E-07	1.62E-07	0.00	
			LERF–TOTAL	8.36E-10	8.36E-10	0.00	

Table 4.15-1
Quantitative Screening of SAMAs that were not Qualitatively Screened (Sheet 7 of 9)

#	Case Name	Description of Bounding Case	Results				Notes
10	CONT-SPRAY	Add an independent containment spray pump.	**Internal Events[a]**	**Base Model Results**	**Case 10**	**% Change**	All internal events STC group frequencies were reduced by less than 50 percent. Fire and flood CDF and LERF were reduced by less than 50 percent.
			CDF (ALLTOPS)	6.97E-07	6.97E-07	0.00	
			INTACT–TOTAL	3.62E-07	3.72E-07	2.76	
			LATE–TOTAL	4.20E-07	4.12E-07	-1.90	
			LERF–TOTAL	1.47E-08	1.48E-08	0.68	
			SERF–TOTAL	8.17E-09	8.17E-09	0.00	
			Fire				
			CDF (ALLTOPS)	5.82E-05	5.82E-05	0.00	
			LERF–TOTAL	4.60E-06	4.60E-06	0.00	
			Flood				
			CDF (ALLTOPS)	1.62E-07	1.62E-07	0.00	
			LERF–TOTAL	8.36E-10	8.36E-10	0.00	
11	NO-ATWS	Eliminate all anticipated transients without scram (ATWS) events to bound benefit.	**Internal Events[a]**	**Base Model Results**	**Case 11**	**% Change**	All internal events STC group frequencies were reduced by less than 50 percent. Fire and flood CDF and LERF were reduced by less than 50 percent.
			CDF (ALLTOPS)	6.97E-07	6.34E-07	-9.04	
			INTACT–TOTAL	3.62E-07	2.95E-07	-18.51	
			LATE–TOTAL	4.20E-07	4.08E-07	-2.86	
			LERF–TOTAL	1.47E-08	1.22E-08	-17.01	
			SERF–TOTAL	8.17E-09	8.17E-09	0.00	
			Fire				
			CDF (ALLTOPS)	5.82E-05	5.82E-05	0.00	
			LERF–TOTAL	4.60E-06	4.60E-06	0.00	
			Flood				
			CDF (ALLTOPS)	1.62E-07	1.61E-07	-0.62	
			LERF–TOTAL	8.36E-10	8.11E-10	-2.99	

Table 4.15-1
Quantitative Screening of SAMAs that were not Qualitatively Screened (Sheet 8 of 9)

#	Case Name	Description of Bounding Case	Results				Notes
12	NO-MSLB	Eliminate the main steam line break (MSLB) initiating events.	**Internal Events[(a)]**	**Base Model Results**	**Case 12**	**% Change**	All internal events STC group frequencies were reduced by less than 50 percent. Fire and flood CDF and LERF were reduced by less than 50 percent.
			CDF (ALLTOPS)	6.97E-07	6.84E-07	-1.87	
			INTACT–TOTAL	3.62E-07	3.48E-07	-3.87	
			LATE–TOTAL	4.20E-07	4.17E-07	-0.71	
			LERF–TOTAL	1.47E-08	1.43E-08	-2.72	
			SERF–TOTAL	8.17E-09	8.17E-09	0.00	
			Fire				
			CDF (ALLTOPS)	5.82E-05	NA	NA	
			LERF–TOTAL	4.60E-06	NA	NA	
			Flood				
			CDF (ALLTOPS)	1.62E-07	NA	NA	
			LERF–TOTAL	8.36E-10	NA	NA	

Table 4.15-1
Quantitative Screening of SAMAs that were not Qualitatively Screened (Sheet 9 of 9)

#	Case Name	Description of Bounding Case	Results				Notes
13	NO-LLOCA	Eliminate the large LOCA initiating event.	**Internal Events[(a)]**	**Base Model Results**	**Case 13**	**% Change**	All internal events STC group frequencies were reduced by less than 50 percent. Fire and flood CDF and LERF were reduced by less than 50 percent.
			CDF (ALLTOPS)	6.97E-07	6.96E-07	-0.14	
			INTACT–TOTAL	3.62E-07	3.61E-07	-0.28	
			LATE–TOTAL	4.20E-07	4.19E-07	-0.24	
			LERF–TOTAL	1.47E-08	1.47E-08	0.00	
			SERF–TOTAL	8.17E-09	8.17E-09	0.00	
			Fire				
			CDF (ALLTOPS)	5.82E-05	NA	NA	
			LERF–TOTAL	4.60E-06	NA	NA	
			Flood				
			CDF (ALLTOPS)	1.62E-07	NA	NA	
			LERF–TOTAL	8.36E-10	NA	NA	

a. CDF (ALLTOPS): core damage frequency (all internal events)
INTACT–TOTAL: total frequency of intact containment end states
LATE–TOTAL: total frequency of late containment failure end states
LERF–TOTAL: total frequency of large, early release containment failure end states
SERF–TOTAL: total frequency of small, early release containment failure end states

5.0 ASSESSMENT OF NEW AND SIGNIFICANT INFORMATION

> The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware. [10 CFR 51.53(c)(3)(iv)]

The NRC has resolved most license renewal environmental issues generically and requires an applicant to analyze only those issues the NRC has not resolved generically. While NRC regulations do not require an applicant's ER to contain analyses of the impacts of those Category 1 environmental issues that have been generically resolved [10 CFR 51.53(c)(3)(i)], the regulations do require that an applicant identify any new and significant information of which the applicant is aware. [10 CFR 51.53(c)(3)(iv)]

5.1 New and Significant Information Discussion

The NRC provides guidance on new and significant information in Regulatory Guide 4.2, Supplement 1, Revision 1 (NRC 2013b). In this guidance, new and significant information is defined as follows:

1. Information that identifies a significant environmental impact issue that was not considered or addressed in the GEIS and, consequently, not codified in Table B-1, "Summary of Findings on NEPA Issues for License Renewal of Nuclear Plants," in Appendix B, "Environmental Effect of Renewing the Operating License of a Nuclear Power Plant," to Subpart A, "National Environmental Policy Act—Regulations Implementing Section 102(2)," of 10 CFR Part 51;

2. Information not considered in the assessment of impacts evaluated in the GEIS leading to a seriously different picture of the environmental consequences of the action than previously considered, such as an environmental impact finding different from that codified in Table B-1; or

3. Any new activity or aspect associated with the nuclear power plant that can act upon the environment in a manner or an intensity and/or scope (context) not previously recognized.

Based on available guidance and the definitions of SMALL, MODERATE, and LARGE impacts provided by NRC in 10 CFR Part 51, Appendix B, Table B-1, Footnote 3, FPL expects that any new information regarding Category 1 issues with moderate or large impacts would be significant. Section 4.0.2 presents the NRC definitions of SMALL, MODERATE, and LARGE impacts.

5.2 New and Significant Information Review Process

FPL's new and significant information assessment process outlined in the following discussion was designed to meet the guidance in the regulatory guide noted above.

FPL's process is collectively carried out through its ongoing environmental planning, assessment, monitoring, and compliance activities performed by corporate and PTN management and staff and ER-specific reviews. This team has collective knowledge of the license renewal process, the site, licensing and permitting, environmental issues, the first license renewal of PTN, the NEPA process, and nuclear industry activities. The team implemented the in-house process for reviewing and evaluating environmental issues that could potentially be new and significant information.

FPL's new and significant review included establishment of applicable and non-applicable Category 1 issues through the following:

- Review of the FPL first license renewal ER (FPL 2000a), the related NRC SEIS (NRC 2002a), and the GEIS Category 1 issues discussion (NRC 2013a).
- Review of recent publicly available information, or information held by the applicant, related to the resource area and each applicable Category 1 impact issue, as summarized in the appropriate section of Chapter 3.
- Identification and review of modifications to PTN since the most recent licensing environmental review and, if any, those anticipated during the proposed SLR operating period, including refurbishment. However, no license renewal-related refurbishment activities have been identified.
- Identification and assessment of potential changes in environmental interfaces since the most recent environmental review and those anticipated during the proposed license renewal period.

FPL applied an investigative process for purposely seeking new information related to the Category I environmental issues through the following:

- Environmental review team discussions with FPL subject matter experts on the Category 1 issues as they relate to the plant.
- Review of permits and reference materials listed in Table 9.1-1 and Chapter 1 related to regulatory compliance status of the plant, environmental issues at the plant, and the environmental resource areas related to Category 1 issues.
- Review of environmental monitoring and reporting required by regulations.

- Review of FPL environmental programs and procedures.
- Review of correspondence and permitting documentation related to oversight of Turkey Point facilities and operations by state and federal regulatory agencies (permanent activities that would bring significant issues to the plant's attention) for the agencies' roles in identifying site-specific environmental concerns.
- Review of previous LRAs for issues relevant to the PTN application.
- Review of previous licensing actions at the Turkey Point site, including but not limited to the PTN Units 3 and 4 EPU and the Turkey Point Units 6 and 7 COL application.
- Review of the environmental assessment for the 2014 UHS amendment and the related licensing board order.

In addition, FPL is made aware of and stays abreast of new and emerging environmental issues and concerns on an ongoing basis through the following:

- Review of other LRAs and nuclear industry publications and participation in nuclear industry organizations.
- Involvement in the recent Turkey Point Units 6 and 7 COL application and NRC reviews.
- Contact with state and federal agencies with regulatory jurisdiction over environmental regulation.
- Review of correspondence and permitting documentation and discussions related to oversight of PTN facilities and operations by state and federal regulatory agencies in their role in identifying site-specific environmental concerns.
- Development and periodic review of regulatory guidance procedures that address ongoing and emergent issues.

Information resulting from the information-seeking process was assessed to determine if it is new, applying the following considerations:

- Was the information included in or available for the GEIS analysis of the Category 1 issue?
- Was the information included in or available for the SEIS for PTN first license renewal?

The following considerations were applied to determine significance:

- Does the information identify an environmental issue not generically considered in the GEIS and consequently not codified in 10 CFR 51, Appendix B, Table B-1?
- Does the information present a seriously different picture of the environmental consequences of the action than previously considered, leading to an impact finding different (i.e., MODERATE or LARGE) from that included in the GEIS or codified in regulation?
- Does the information involve a new activity or aspect associated with the nuclear power plant that can act upon the environment in a manner or an intensity (MODERATE or LARGE impact) and/or scope (context) not previously recognized?

As a result of this review, FPL is aware of no new and significant information regarding the environmental impacts of license renewal associated with PTN. Therefore, the findings in NUREG-1437, Revision 1, for the applicable Category 1 issues are incorporated by reference.

New and significant review methodology and results for the SAMA evaluation are addressed separately in Section 4.15.

6.0 SUMMARY OF LICENSE RENEWAL IMPACTS AND MITIGATING ACTIONS

6.1 License Renewal Impacts

Chapter 4 incorporates by reference NRC findings for the 47 Category 1 issues that apply to PTN (plus the one uncategorized issue for which the NRC came to no generic conclusion), all of which have environmental impacts that are SMALL. The remainder of Chapter 4 analyzes the 17 Category 2 issues. Table 6.1-1 identifies the environmental impacts that renewal of the PTN OL would have on resources associated with the Category 2 issues.

In summary, FPL has reviewed the environmental impacts of subsequent renewal of the PTN OL and has concluded that further mitigation measures beyond those discussed in Section 6.2 and listed in Table 6.1-1 to avoid, reduce the severity of, or eliminate adverse impacts are not warranted. This ER documents the basis for FPL's conclusion.

Table 6.1-1
Environmental Impacts Related to License Renewal at PTN (Sheet 1 of 4)

Resource Issue	ER Section	Environmental Impact
Surface Water Resources		
Surface water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	4.5.1	No impact. Issue is not applicable because FPL utilizes a closed-cycle cooling system for condenser cooling purposes but does not withdraw makeup water from a river.
Groundwater Resources		
Groundwater use conflicts (plants that withdraw more than 100 gallons per minute) [10 CFR 51.53(c)(3)(ii)(C)]	4.5.3	SMALL impact. It is not anticipated that groundwater withdrawal increases above permitted quantities will be required during the SLR period.
Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	4.5.2	No impact. Issue is not applicable because FPL utilizes a closed-cycle cooling system for condenser cooling purposes but does not withdraw makeup water from a river.
Groundwater quality degradation (plants with cooling ponds at inland sites) [10 CFR 51.53(c)(3)(ii)(D)]	4.5.4	No impact. Issue is not applicable because FPL utilizes a closed-cycle cooling system located in a salt marsh for condenser cooling purposes.
Radionuclides released to groundwater [10 CFR 51.53(c)(3)(ii)(P)]	4.5.5	SMALL impact. Currently, groundwater beneath Turkey Point has tritium levels that fall below the 20,000 pCi/L Maximum Contaminant Level regulatory standard. Since the groundwater monitoring program was initiated, no plant-related gamma isotopes or hard-to-detect radionuclides have been detected.
Terrestrial Resources		
Effects on terrestrial resources (non-cooling system impacts) [10 CFR 51.53(c)(3)(ii)(E)]	4.6.5	SMALL impact. No refurbishment or other license renewal-related construction activities have been identified; adequate management programs and regulatory controls are in place to protect important terrestrial ecosystems onsite.

Table 6.1-1
Environmental Impacts Related to License Renewal at PTN (Sheet 2 of 4)

Resource Issue	ER Section	Environmental Impact
Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	4.6.4	No impact. PTN does not obtain make-up water from a river. Therefore, this issue is not applicable and further analysis is not required.
Aquatic Resources		
Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds) [10 CFR 51.53(c)(3)(ii)(B)]	4.6.1	SMALL impact. The closed-loop, recirculating Turkey Point CCS neither withdraws nor discharges surface water to any surface water of the United States or the State of Florida. Therefore, impacts from impingement of aquatic organisms are limited to aquatic organisms in the cooling canals, and there are no impacts from impingement on aquatic organisms of Biscayne Bay, Card Sound, or other waters.
Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds) [10 CFR 51.53(c)(3)(ii)(B)]	4.6.2	SMALL impact. PTN discharges to the CCS, which is not classified as waters of the U.S. by the EPA. However, the conditions of certification require temperature monitoring in the canals and Biscayne Bay. Ongoing field studies indicate that thermal dynamics in the CCS do not influence Biscayne Bay or Card Sound.
Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	4.6.3	No impact. PTN does not obtain make-up water from a river. Therefore, this issue is not applicable.
Special Status Species and Habitats		
Threatened, endangered, and protected species and essential fish habitat [10 CFR 51.53(c)(3)(ii)(E)]	4.6.6	No effect. No refurbishment or other license renewal-related construction activities have been identified, and FPL has management programs in place to protect threatened and endangered species. The continued operation of the site would have no adverse effects to any federally or state-listed species.

Table 6.1-1
Environmental Impacts Related to License Renewal at PTN (Sheet 3 of 4)

Resource Issue	ER Section	Environmental Impact
Historic and Cultural Resources		
Historic and cultural resources [10 CFR 51.53(c)(3)(ii)(K)]	4.7	No adverse effects on historic properties. No refurbishment or other license renewal-related construction activities have been identified; administrative procedure ensures protection of these type resources in the event of excavation activities.
Human Health		
Microbiological hazards to the public (plants with cooling ponds or canals or cooling towers that discharge to a river) [10 CFR 51.53(c)(3)(ii)(G)]	4.9.1	SMALL impact. Impacts from microbiological (thermophilic) organisms are not likely to occur, due to the harsh conditions of the cooling canal environment. *Naegleria folweri* and *Legionella* spp. are freshwater organisms and would not survive in the saline conditions of the CCS. Thus, human health impacts from microbiologic hazards during the SLR operating period would be SMALL.
Electric shock hazards [10 CFR 51.53(c)(3)(ii)(H)]	4.9.2	SMALL impact. Turkey Point transmission lines meet the applicable shock prevention provisions of the NESC, and the in-scope transmission lines connecting the plant to the switchyard are completely within the Turkey Point EAB and are in compliance with NESC requirements. The potential impacts from electric shock would be SMALL.
Postulated Accidents		
Severe accidents [10 CFR 51.53(c)(3)(ii)(L)]	4.15	SMALL impact. No cost-effective SAMAs have been identified that would impact the management of aging effects during the period of extended operation.
Environmental Justice		
Minority and low-income populations [10 CFR 51.53(c)(3)(ii)(N)]	4.10.1	No disproportionately high and adverse impacts or effects on minority and low-income populations were identified.

Table 6.1-1
Environmental Impacts Related to License Renewal at PTN (Sheet 4 of 4)

Resource Issue	ER Section	Environmental Impact
Cumulative Impacts		
Cumulative Impacts [10 CFR 51.53(c)(3)(ii)(O)]	4.12	SMALL to MODERATE impacts. SMALL for visual resources, noise, geology and soils, surface water and groundwater resources, aquatic and terrestrial resources, human health, and waste management; SMALL to MODERATE for air quality and socioeconomics; MODERATE for land use; and no effect on historic and cultural resources.

6.2 Mitigation

6.2.1 Requirements [10 CFR 51.45(c) and 10 CFR 51.53(c)(3)(iii)]

> The environmental report must include an analysis that considers and balances . . . alternatives available for reducing or avoiding adverse environmental effects. [10 CFR 51.45(c)]
>
> The report must contain a consideration of alternatives for reducing adverse impacts . . . for all Category 2 license renewal issues . . . . [10 CFR 51.53(c)(3)(iii)]

6.2.2 Analysis

NRC Regulatory Guide 4.2, Supplement 1, Revision 1, *Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications*, specifies that the applicant should identify any ongoing mitigation and should discuss the potential need for additional mitigation. However, applicants are only required to consider mitigation alternatives in proportion to the significance of the impact. (NRC 2013b)

As discussed in Chapter 4 and Chapter 5 and summarized in Section 6.1, impacts associated with PTN license renewal are not significant (i.e., no impact, small impact, no effect, or no adverse impact) and thus do not warrant the implementation of additional mitigation measures. The permits and programs discussed in Chapter 9 (i.e., NPDES permit; stormwater program; air permit; spill prevention, control, and maintenance [SPCC] plan; hazardous waste management program; cultural resource protection plan; and environmental review programs) continue to satisfactorily mitigate the range of PTN operational environmental impacts. Therefore, additional plant-specific mitigation measures are likely to be not sufficiently beneficial to warrant implementation.

6.3 Unavoidable Adverse Impacts

6.3.1 Requirement [10 CFR 51.45(b)(2)]

> The environmental report shall . . . discuss . . . any adverse environmental effects which cannot be avoided should the proposal be implemented . . . . [10 CFR 51.45(b)(2)]

6.3.2 Analysis

An environmental review conducted at the license renewal stage differs from the review conducted in support of a construction permit, because the facility is in existence at the license renewal stage and has operated for a number of years. As a result, adverse impacts associated with the initial construction have been avoided, have been mitigated, or have already occurred.

As previously discussed in Chapter 4, no license renewal-related refurbishment or construction activities have been identified. Therefore, the environmental impacts to be evaluated for SLR are those associated with continued operation during the renewal term.

FPL adopts by reference NRC findings for the 47 Category 1 issues (NRC 2013a) applicable to PTN, including discussions of any unavoidable adverse impacts. In addition, FPL identified the following site-specific unavoidable adverse impacts associated with SLR:

- The majority of the land use by PTN at Turkey Point would continue to be designated as industrial until PTN is decommissioned (decommissioning must be completed within 60 years).
- Normal plant operations result in IWW discharges containing small amounts of water treatment chemical additives to the CCS at or below FDEP-approved concentrations. Compliance with the NPDES permit would ensure that impacts remain SMALL.
- Operation of PTN results in the generation of spent nuclear fuel and waste material, including LLRW, hazardous waste, and nonhazardous waste. However, specific plant design features in conjunction with a waste minimization program; employee safety training programs and work procedures; and strict adherence to applicable regulations for storage, treatment, transportation, and ultimate disposal of this waste ensure that the impact is SMALL.
- Operation of PTN results in a very small increase in radioactivity in the air and water. The incremental radiation dose to the local population resulting from PTN operations is typically less than the magnitude of the fluctuations that occur in natural background radiation. Doses to the members of the public from PTN's gaseous and liquid effluent releases would be well within the allowable limits of 10 CFR Part 20 and 10 CFR Part 50, Appendix I. There are certain low probability accident events associated with PTN operations that, should they occur, result in radiation exposure to members of the public in offsite locations.

6.4 Irreversible or Irretrievable Resource Commitments

6.4.1 Requirement [10 CFR 51.45(b)(5)]

> The environmental report shall . . . discuss . . . any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented. [10 CFR 51.45(b)(5)]

6.4.2 Analysis

The term "irreversible" applies to the commitment of environmental resources (e.g., permanent use of land) that cannot by practical means be reversed to restore the environmental resources to their former state. In contrast, the term "irretrievable" applies to the commitment of material resources (e.g., irradiated steel, petroleum) that, once used, cannot by practical means be recycled or restored for other uses.

The continued operation of PTN for the period of extended operation will result in the following irreversible and irretrievable resource commitments:

- Irradiated nuclear fuel.
- Land required for continued storage or disposal of spent nuclear fuel, LLRWs, and other nonradioactive plant wastes.
- Elemental materials that will be activated by reactor operation.
- Materials used for the normal industrial operations of PTN that cannot be recovered or recycled, or that are consumed or reduced to unrecoverable forms.

No refurbishment activities are planned and no license renewal-related activities have been identified that would irreversibly or irretrievably commit significant environmental components of land, water, and air.

When PTN permanently ceases operation, a replacement power generation alternative (or combination of alternatives) would be selected and incur new resource commitments during its development.

6.5 Short-Term Use Versus Long-Term Productivity of the Environment

6.5.1 Requirement [10 CFR 51.45(b)(4)]

> The environmental report shall . . . discuss . . . the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity . . . . [10 CFR 51.45(b)(4)]

6.5.2 Analysis

The balance between short-term use and long-term productivity of the environment at the site was established when PTN began operations in 1972 and has remained relatively constant since that time. No refurbishment activities are planned and no SLR-related activities have been identified that would alter the evaluation of the PTN FES for the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity of these resources (NRC 1972, Section VII). The period of extended operation will not alter the short-term uses of the environment from the uses previously evaluated in the PTN FES. The period of extended operation will postpone the availability of the site resources (land, air, water) for other uses. Denial of the application to subsequently renew the PTN OLs would lead to the shutdown of the plant and would alter the balance in a manner that depends on the subsequent uses of the site. For example, the environmental consequences of turning the site area occupied by PTN into a park or an industrial facility after decommissioning are quite different. However, extending PTN operations would not alter, but only postpone, the potential long-term uses of the site that are currently possible.

In summary, no SLR-related refurbishment activities have been identified that would alter the evaluation of the PTN FES for the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity of these resources.

7.0 ALTERNATIVES TO THE PROPOSED ACTION

7.1 No-Action Alternative

The proposed action as described in Section 2.1 is to renew the OLs for PTN, which would preserve the option for FPL to continue to operate PTN and provide reliable base-load power throughout the 20-year SLR period to meet future power generating needs. Therefore, the only other alternative under consideration by the NRC is the no-action alternative, which is its decision to not renew the PTN OL. If the PTN OLs are not renewed, the 1,632 MWe of base-load power would not be available to FPL's generating needs during the license renewal period for another 20 years. Because FPL is a regulated utility that must meet its customers' long-term power needs, the no-action alternative will result in replacement power sources for the loss of PTN generation.

In accordance with 10 CFR 51.53(b)(3), this ER will discuss a range of replacement power sources (no-action alternative) to the proposed action. A reasonable alternative as described by the NRC must be commercially viable on a utility scale and operational prior to the expiration of the reactor's OL, or expected to become commercially viable on a utility scale and operational prior to the expiration of the reactor's OL (NRC 2013a). The replacement power alternative generation must be equal to the base-load capacity and energy previously supplied by the nuclear plant.

The replacement power sources being considered are discussed in Section 7.2.1. Section 7.2.2 identifies alternatives that were evaluated and were not considered reasonable power sources for the replacement of PTN generation.

7.1.1 Decommissioning Impacts

The NRC definition of decommissioning as stated in 10 CFR 20.1003 is the safe removal of a nuclear facility from service and the reduction of residual radioactivity to a level that permits either of the following:

- Release of the property for unrestricted use and termination of the license.
- Release of the property under restricted conditions and termination of the license.

NRC-evaluated decommissioning options include the following:

- Immediate dismantling soon after the facility closes (DECON).
- Safe storage and monitoring of the facility for a period of time that allows the radioactivity to decay, and followed by dismantling and additional decontamination (SAFSTOR).

- Permanent entombment on the site in structurally sound material, such as concrete that is maintained and monitored (ENTOMB).

All of the decommissioning options must be completed within a 60-year period following permanent cessation of operations. Under the no-action alternative, FPL would continue operating PTN until the existing OL expires. Upon expiration of the OL, FPL would initiate decommissioning procedures in accordance with NRC requirements. The NRC GEIS (NRC 2013a) evaluated termination of operations and decommissioning environmental impacts for land use, visual resources, air quality, noise, geology and soils, hydrology, ecology, historic and cultural resources, socioeconomics, human health, environmental justice, and waste management. FPL considers the GEIS description of decommissioning impacts as representing the actions it will perform for the PTN decommissioning.

Decommissioning and its associated impacts are not considered evaluation criteria used to proceed with the proposed action or select the no-action alternative. The GEIS states the timing of the decommissioning does not change the environmental impacts associated with this activity. The NRC findings as described in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, state that delaying the decommissioning until after the renewal term would result in small environmental impacts. The primary criteria used to evaluate the proposed action and the no-action alternative are the power options available for replacement of the PTN generation.

Decommissioning activities would be initiated during the replacement generation operations and will be completed within 60 years of the plant shutdown.

7.2 Energy Alternatives That Meet System Generating Needs

In accordance with 10 CFR 51.53(c)(2), FPL considered a range of alternatives to replace generation if the PTN OLs are not renewed. FPL considered each of the replacement alternatives identified in the NRC GEIS for license renewal (NRC 2013a, Section 2.3). These alternatives were evaluated based on the following criteria using the screening process discussed in Section 2.6:

- Alternatives or combinations of alternatives evaluated in this ER would need to provide energy and capacity equivalent to PTN.
- Alternatives considered must maintain a balance between generation and electrical demand within the service area of Miami-Dade and Broward counties.
- Alternatives considered must be fully operational by 2032 considering development of the technology, permitting, construction of the facility, and connection to the grid.
- Alternatives must be electricity-generating sources that are technically feasible and commercially viable.

The power sources considered for replacement of the 1,632 MWe of PTN generation included both discrete sources such as NGCC, nuclear, and a combination alternative of NGCC and solar PV facilities. Alternatives that could not replace the PTN base-load power were considered unreasonable.

The following sections identify the power sources considered as reasonable (Section 7.2.1) and power sources considered as unreasonable (Section 7.2.2).

7.2.1 Energy Alternatives Considered as Reasonable

A reasonable alternative as described by the NRC must be commercially viable on a utility scale and operational prior to the expiration of the reactors' OLs, or expected to become commercially viable on a utility scale and operational prior to the expiration of the reactor's OL. The replacement power alternative generation must provide equivalent capacity and energy to that previously supplied by the nuclear plant. The alternative analysis identified the following power sources as meeting the NRC criteria for reasonableness for replacement of the PTN generation during the proposed SLR period:

- NGCC plant sited at the Turkey Point site.
- New nuclear proposed at Turkey Point site.
- Combination of NGCC plant and four solar PV facilities. The NGCC plant and one of the solar PV facilities would be sited near the Turkey Point site. Three solar PV facilities would be sited at offsite locations.

7.2.1.1 Natural Gas-Fired Generation

The NGCC plant option would be sited on the FPL Turkey Point site outside the footprint of PTN and outside the footprint for the proposed Turkey Point Units 6 and 7. The site would require approximately 75 acres, based on land use case studies (NETL 2010). This plant would consist of multiple combustion turbines, a heat recovery steam generator, and a steam turbine generator assembled in appropriate power-train configurations. Based on a capacity factor of 87 percent (EIA 2016a), the replacement NGCC plant would be designed with a generating capacity of approximately 1,726 MWe to provide the MWhs to replace the current 1,632 MWe of generation (approximate annual production of 13,154,016 MWhs) produced at PTN. FPL assumes the NGCC plant would utilize closed-cycle cooling with a mechanical draft cooling tower, with reclaimed water providing the source of the cooling water makeup. A new 100-mile natural gas pipeline would be required to provide fuel for the NGCC plant.

7.2.1.2 New Nuclear

The new nuclear alternative would consist of a facility sited at Turkey Point outside the footprint of PTN and outside the footprint for the proposed Turkey Point Units 6 and 7. The facility could provide the equivalent 1,632 MWe of generation (approximate annual production of 13,154,016 MWhs) produced at PTN. Based on a capacity factor of 90 percent (EIA 2016a), the replacement nuclear plant would have a generating capacity of approximately 1,668 MWe of power. The new nuclear facility would require 364 acres of land for the plant infrastructure.

7.2.1.3 Combination of Natural Gas-Fired Generation and Solar PV Facilities

This combination of NGCC and solar PV would provide the equivalent generation to replace the current 1,632 MWe of generation produced from PTN. The NGCC plant component of this alternative was selected based on the FPL focus on conversion to natural gas-fired plants to provide reliable base-load power in the FPL service area. Solar PV generation was added to this combination alternative because FPL is planning to add 2,086 MW of this generation source by 2023. (FPL 2017a) The NGCC plant would be sited at the FPL Turkey Point site outside the footprint of PTN and outside the footprint for the proposed Turkey Point Units 6 and 7. The NGCC plant would consist of multiple combustion turbines, a heat recovery steam generator, and a steam turbine generator assembled in appropriate power-train configurations. The NGCC plant capacity would be 1,636 MWe operating at an 87 percent capacity factor (EIA 2016a). The NGCC plant associated with the combination alternative would require approximately 70 acres for installation of plant infrastructure.

The solar PV component would be four 75-MWe facilities with an estimated 26 percent capacity factor given their intermittent generation (EIA 2016a). One of these solar facilities would be located on FPL-owned lands in the Turkey Point area, and three would be sited at offsite locations in Miami-Dade County and/or Broward County with access to the transmission grid. These facilities would each require approximately 450–500 acres for installation based on current siting of FPL solar facilities (FPL 2017e).

7.2.2 Energy Alternatives Not Considered as Reasonable

The full range of energy alternatives as described in the GEIS include power sources that will require development of new generation and power alternatives that will not, such as purchased power (NRC 2013a, Section 2.3). FPL considered all the alternatives described in the GEIS for replacement of the PTN generation. This section discusses the energy alternatives that were not considered reasonable for additional evaluation.

7.2.2.1 Alternatives Not Requiring New Generating Capacity

7.2.2.1.1 Purchased Power

Purchased power to replace the loss of PTN generation would likely be acquired from sources outside the FPL service area. The purchased power would be generated from fossil fuel sources or intermittent renewables. These generation sources result in environmental impacts that would occur in facilities currently generating power or at recently constructed facilities, such as NGCC facilities in the region.

Fossil generation or a mix of fossil and some solar generation would be sources for purchased power to replace the PTN generation. In 2016, FPL purchased firm capacity generation of 826 MWe from other power facilities (FPL 2017a). FPL also purchases additional non-firm power from cogeneration and small power facilities. If FPL decided to purchase power to replace the PTN generation, it would likely be required to contract with a utility that operates larger fossil-fuel generation facilities to make up for the deficit in power in their service area.

Purchasing power from facilities outside the FPL service area might require construction of a new transmission corridor that would result in environmental impacts. The siting of a new transmission line ROW would also require an extensive public involvement process. The length of a transmission line and a determination of whether an existing corridor can be used or a new corridor is required would be dependent on identifying a source for purchasing power. Once a source is determined, the transmission line siting process would analyze corridor alternatives. The environmental impacts, determined during the siting process, would likely range from moderate to large, depending on the area of land disturbance and proximity to residential development.

Purchased power would not meet the need of replacing PTN generation with reliable generation sited in Miami-Dade and Broward counties. The alternative evaluation process in this ER specifies that alternatives must provide generation sited in Miami-Dade and Broward counties to be considered as a replacement generation alternative.

Purchasing power from other power generators is not considered a reasonable no-action alternative because of the transmission constraints of importing power and the environmental impacts associated with the construction of a transmission line to convey power to the FPL service area. Also, this alternative may not provide reliable generation.

7.2.2.1.2 Plant Reactivation

In its 10-year plan, FPL evaluated existing fossil-fuel facilities in its portfolio and documented the closure of existing older technology gas-fired plants and the upgrades to newer NGCC facilities. The focus of FPL is the modernization of its gas-fired generation facilities and the integration of increased solar generation facilities into the utility portfolio. In addition, the 10-year plan focused on adding more reliable nuclear generation to the future generation mix. (FPL 2017a)

FPL has repowered the Cape Canaveral, Riviera Beach, and Port Everglades fossil fuel-fired steam generating units to new NGCC units. These plans were approved by the Florida Public Service Commission (FPSC) in September 2008. (FPL 2014a, Section 9.2.1.2) The downside to converting older plants to a new technology is the cost for adherence to new environmental regulations.

FPL reviews its existing fleet for cost-effective opportunities to modernize its fleet to meet demand and has modernized and repowered units to extend operations. FPL has not identified opportunities within its existing fleet that would provide replacement of the 1,632 MWe provided by PTN (FPL 2017a). Likewise, FPL also determined during its alternatives assessment required as part of its license application for Units 6 and 7 that repowering inactive units within the existing fleet would not be a reasonable alternative.

If the PTN OLs are not renewed, plant reactivation of existing fossil facilities would not be a reliable replacement power source for the loss of the 1,632 MWe of PTN generation. Even if substantial generating capacity scheduled for retirement is delayed, the delayed retirement would be needed to meet load growth. Therefore, reactivation of plants is not considered a reasonable alternative for replacing the loss of base-load power from PTN.

7.2.2.1.3 Conservation and Demand Side Management

DSM includes demand response that shifts electricity from a peak-use period to times of lower demand, and energy efficiency or conservation programs that reduce the amount of electricity required for existing activities and processes. A DSM alternative would be required to reduce the peak hour demand in FPL's service area by 1,360 MWe to be considered a reasonable discrete alternative.

Since 1978, FPL has implemented a successful DSM program that has resulted in a summer peak reduction of approximately 4,843 MW at the generator through 2016 (FPL 2017a). However, this amount of cost-effective DSM in this two-county area is not a reasonable assumption and is not considered a reasonable discrete alternative for replacement of the PTN generation.

7.2.2.2 Alternatives Requiring New Generation Capacity

7.2.2.2.1 Wind

The FPL service area is in a Class 2 wind power region with average wind speeds lower than 5.1 m/s at 10m (NREL 2012). This onshore wind resource is rated as marginal for the development of wind power. Offshore areas in the FPL service area are in a Class 3 wind power region with average wind speeds of 5.1 to 5.6 m/s. This offshore wind resource is suitable for wind power development.

Development of an offshore wind farm would result in impacts to marine wildlife and disruption to commercial and recreational use in the area being developed. Impacts to marine life would occur during the construction phase of the project through disruption of habitat for fish and other marine life. During operations, marine avian species could be impacted, especially during offshore migrations. Commercial use, such as fishing, may be disrupted, and future access to the area may be curtailed. Recreational boating and use of the site would also be impacted. Overall impacts resulting from the construction and operation of the offshore wind farm would likely be large.

Currently there are no wind farms present in Florida, and FPL's 10-year plan (FPL 2017a) did not address wind power development in the 2017–2026 planning period. As tower technology improves with taller towers and longer blades, wind power development may occur in Florida and other southeastern states. For wind power to be viable as a base-load energy source, energy storage would need to be considered in the planning process. The current energy storage technologies are costly, and no utility-scale energy storage facilities currently exist in the FPL service area. Therefore, energy storage is not currently being considered in this ER as a technology that would make wind energy a reliable source of generation.

The NRC concluded in the Turkey Point Units 6 and 7 EIS that wind power was not a reliable generation source in Florida because (1) the wind resource in Florida is not optimal for utility-scale generation; (2) the DOE/U.S. Energy Information Administration (EIA) projects no growth in wind energy in Florida; (3) the capacity factor of wind is low; and (4) the offshore area needed for wind turbines would be very large (NRC 2016a, Section 9.2.3.2).

Because of the large impacts associated with offshore wind power development and operations and wind having a low capacity factor, wind energy is not considered a reasonable alternative for replacement of PTN generation.

7.2.2.2.2 Hydropower

FPL did not address hydropower as a potential source of renewable energy in its 10-year plan. A study on Florida hydropower estimated 43 MW of hydropower generation in the state (DOE 1998). Therefore, because the potential to develop this resource in the state is small, hydropower is not considered a reasonable alternative.

7.2.2.2.3 Geothermal

Florida is rated as having a low potential for geothermal energy development (NREL 2009). Geothermal energy resources that can be developed for power generation are primarily located in the western United States. Geothermal power plants are currently generating power in Alaska, California, Hawaii, Idaho, Nevada, New Mexico, Oregon, and Utah (NREL 2014a). Because the potential to develop this energy resource in Florida is small, geothermal is not considered a reasonable alternative.

7.2.2.2.4 Fuel Cells

Fuel cells as a reliable generation alternative are not presently economically or technologically competitive with other alternatives. The EIA projects that fuel cells may cost $6,932 per installed kW (total overnight capital costs), which is higher than most generation technologies analyzed in this ER (EIA 2017a). This high cost is associated with the durability of fuel cells and the technology to convert natural gas to hydrogen.

FPL has been conducting some limited field trials for fuel cells to evaluate the technology for future use (FPL 2017a). The FPL 10-year plan describes FPL's approach to fuel cells as monitoring the technology to keep apprised of any breakthroughs that would allow this technology to be employed commercially. With no plans to bring this technology online in the FPL service area and the constraints associated with cost of the technology, fuel cells are not considered a reasonable alternative for replacement of PTN generation.

7.2.2.2.5 Ocean Wave and Current Energy

The potential for ocean energy in Florida has been estimated at 41 terawatt hours (TWH) along the outer shelf and 36 TWH along the inner shelf (EPRI 2011). The potential for ocean energy is high along Florida's eastern coast, but the technology is in its early stages of commercial development, and the current costs make it cost-prohibitive for large-scale development. Ocean energy would not be able to replace PTN generation. In addition, no federal market subsidies exist for this renewable source of energy. Based on the early stages of commercial development of the technology and the fact that no federal market initiatives are available, ocean wave and current energy is not considered a reasonable alternative for replacement of PTN generation.

7.2.2.2.6 Oil

Oil-fired generation has larger costs and greater environmental impacts than gas-fired generation. The FPL 10-year plan does not propose new oil generation. Recently, FPL upgraded two steam-generating units with enhanced air pollution control technology, so they could continue to burn heavy oil. Oil-fired generation emits large amounts of CO_2 and hazardous air pollutants (HAPs), making it undesirable for utilities looking to reduce air pollutants and comply with regulations.

Based on the greater environmental impacts and cleaner energy source policies and regulations, oil-fired generation is not a reasonable alternative.

7.2.2.2.7 Coal

FPL does not propose any new coal-fired generation in its 10-year plan. The 10-year plan focuses on new fossil fuel generation being fueled by natural gas. This emphasis on natural gas is based on its lower cost and its status as a cleaner fuel source. The existing and proposed environmental regulations are also a large consideration when reviewing new coal generation facilities. Coal generation emits GHG that are targeted for reduction in new regulations such as the Clean Power Plan.

The evaluation of coal-fired generation as a replacement for PTN generation also considered the FPSC denial of FPL's petition for determination of need for the proposed coal-fired Glades Power Plant Units 1 and 2 (FPL 2007). This FPSC denial of the proposed FPL coal-fired generation illustrates the difficulty in getting approvals for coal-fired generation. The costs associated with environmental compliance were a large consideration in the FPSC denial of the petition for determination of need for the proposed coal-fired units.

Environmental impacts associated with a new coal-fired unit would be large. In addition to air emissions being greater than continued use of PTN or a new NGCC plant, other impacts associated with a new plant would focus on infrastructure such as rail for transporting coal to southern Florida. The transportation of coal may require upgrading rail or potentially requiring a new rail line to bring the coal into the plant. The impacts associated with upgrading rail lines and building new capacity would potentially impact special status species such as the Florida panther and other sensitive species. Water crossings for bridges would also result in more impacts that may require fill being placed in jurisdictional waters of the U.S. Therefore, permitting the project through Section 404 could require extensive mitigation for loss of waters of the U.S. Other impacts associated with coal-fired generation would be disposal of coal ash and adhering to the required mitigation to prevent release of this material into waterways. Overall, the environmental impacts associated with the construction and operation of a new coal-fired plant would be large.

With no new coal generation proposed in the FPL 10-year plan, the large environmental impacts associated with new coal generation and the associated infrastructure to deliver coal, and environmental regulations increasingly targeting GHG emissions in coal generation facilities, coal-fired generation is not a reasonable alternative to replace PTN generation.

7.2.2.2.8 Coal-Fired Integrated Gasification Combined Cycle

Coal-fired integrated gas-fired combined cycle (IGCC) is a gasification process that produces synthetic natural gas from coal to use as fuel in the combined cycle process. In this process, heat pressure and steam pyrolyze coal to produce syngas. The syngas is processed to remove contaminants and is then used in a combined cycle plant to produce electricity. CO_2 can be removed from the syngas prior to its use as fuel in the plant. IGCC plants would remove a larger quantity of criteria pollutants than coal units (NETL 2017).

IGCC technologies may be increasingly utilized in the future as carbon capture and sequestration is developed to remove CO_2 from fossil fuel use. Because CO_2 is removed from the syngas before it is used as fuel, carbon capture and sequestration technology would be more economical to employ with IGCC than with standard coal-fired generation where carbon would be removed after combustion.

Currently, IGCC technologies have been installed on a very limited scale. Cost is cited as the major limiting factor in IGCC implementation, as the capital costs are higher as compared to other power sources (NETL 2017). Therefore, IGCC is not considered a reasonable alternative.

7.2.2.2.9 Solar (Includes Energy Storage)

Solar PV and concentrated solar power (CSP) are the two main types of solar technology used in electric power generation. Solar PV systems consist of interconnected PV cells that convert sunlight into electricity. CSP systems utilize mirrors to reflect and concentrate sunlight onto receivers to convert solar energy into thermal energy that in turn produces electricity. Solar generation is intermittent by nature, and the generation can fluctuate from hour to hour. This type of generation volatility on a large scale can create distribution and/or transmission instability.

Due to the amount of solar generating capacity needed to replace the PTN base-load generation and the lower efficiencies in producing electricity from solar power versus nuclear power, the amount of land required to install solar generation is larger than other alternatives being considered in this ER. The National Renewable Energy Laboratory (NREL) has estimated that current land use required for PV installations ranges from 1.6 to 5.8 acres/gigawatt hours per year (GWh/yr), with a generation-weighted average of 3.1 acres/GWh/yr. CSP installations are estimated to average 2.7 acres/GWh/yr. (NREL 2013) Therefore, depending on the location of the solar facilities, the land use disturbances could result in moderate to large impacts on resources such as wildlife habitats, vegetation, land use, and aesthetics impacts.

For solar power to be viable as a discrete source of large amounts of energy that is reliably available at the system peak hours, energy storage might need to be considered in the planning process. The current energy storage technologies are costly, and no utility-scale energy storage facilities currently exist in the FPL service area. Therefore, energy storage is not considered in this ER as a technology that would make discrete solar energy facilities a reliable source of generation.

Because a discrete solar generation alternative is not a source of large amounts of energy that is reliably available at the system peak hours, and because of the potential environmental impacts associated with the large land disturbances for this scale of solar power installation, this alternative, by itself, was not considered a reasonable alternative for the replacement of the PTN generation.

7.2.2.2.10 Wood Waste

Generating power from wood waste depends on being close to a large supply of wood waste from lumber or other wood product production. Wood waste plants require large land areas for fuel storage and processing, and they involve combustion equipment that would require air emissions control technology.

No data exist on the amount of forest residue available in Miami-Dade and Broward counties. Counties in central Florida have less than 5,000 dry tons of forest residue available for use as wood waste biomass power plants. (NREL 2014b) Therefore, no wood waste resource is available for use in the counties identified for siting a replacement generation source. If a wood waste resource were available for power plant development, replacing the PTN baseload generation with this energy source would require the installation of several plants.

Since no wood waste sources are located in close proximity to Miami-Dade and Broward counties, development of wood waste-fired plants is not considered a reasonable alternative for replacement of PTN generation.

7.2.2.2.11 Municipal Solid Waste

Using MSW as a fuel source is dependent on being close to large metropolitan areas that generate large quantities of this waste. MSW consists of materials such as food waste, landscape materials, paper products, plastics, metals, and other materials. As of 2015, 71 waste-to-energy plants are operating in the United States (EIA 2016b). MSW plants are primarily used as an alternative to manage waste, with electricity generation a benefit of this waste management. Miami-Dade and Broward counties currently have three existing MSW energy facilities.

Air emission impacts associated with the operation of an MSW plant are like those resulting from the operation of a coal-fired plant. Since MSW plants would be smaller than a fossil fuel generation plant, several MSW plants would be required to replace PTN generation. Therefore, land use impacts would be moderate to large under this alternative.

Since environmental impacts to land use, air quality, transportation and other resources are substantial under this alternative and several MSW plants would be required to replace the Units 3 and 4 base-load generation, MSW-fired plants are not considered a reasonable alternative for replacement of PTN generation.

7.2.2.2.12 Other Biomass-Derived Fuels

This section discusses biomass fuels other than wood and MSW. These sources of potential fuel for power generation include crop residue, methane from animal facilities, wastewater treatment facilities, and crops grown for use as fuel. Based on NREL data, Miami-Dade and Broward counties have less than 20,000 tons per year of energy crop residue available for biomass fuels (NREL 2014b). This amount of available crop biomass is not enough to sustain the number of crop-residue-fueled power plants necessary to replace PTN generation. The intermittent supply of this biomass also makes it an unreliable energy source.

Based on the limited supply of this fuel available in the counties where these plants would be sited, and the large number of plants required to provide the equivalent PTN generation, crop-residue-fueled plants are not considered a reasonable alternative for replacement of PTN generation.

7.2.3 Environmental Impacts of Alternatives

The alternatives considered as reasonable replacement power sources are discussed in this section. Three alternatives that can provide the equivalent of 1,632 MWe of generation to replace the PTN base-load power are being considered as reasonable alternatives. This section presents the potential environmental impacts that may occur if these alternatives were developed.

7.2.3.1 Natural Gas-Fired Generation

As identified in Section 7.2.1, an NGCC plant is being considered as a reasonable power alternative. This plant would consist of multiple combustion turbines, a heat recovery steam generator, and a steam turbine generator. Based on a capacity factor of 87 percent (EIA 2016a), the NGCC plant will be designed to a 1,726 MWe generating capacity to provide the equivalent MWH provided by 1,632 MWe of PTN base-load generation.

7.2.3.1.1 Land Use and Visual Resources

Land Use

The NGCC plant would be sited on approximately 75 acres based on case studies of natural gas plants and associated pipelines (NETL 2010). The NGCC plant would be located on the Turkey Point site and be constructed on previously undisturbed land. Therefore, the NGCC site would likely be sited in wetland and native vegetation areas which would require fill material to stabilize the soils for construction. The proposed location of the NGCC plant is west of Canal L-31E and slightly north of the transmission line that runs west of the canal.

The NGCC plant natural gas pipeline would require a new approximately 100-mile natural gas pipeline corridor to be installed just east of the Everglades National Park. Where possible, this pipeline route would use existing utility corridors to minimize land-use impacts associated with the installation of the pipeline. However, since this would be a new pipeline corridor, it would likely require vegetation clearing, which would change the land use within the pipeline footprint. If any shrubs or woody vegetation are cleared in the corridor, this vegetation would be replaced with native grass and herbaceous plants for reclamation of the cleared pipeline corridor. Land-use impacts associated with the new natural gas pipeline would be large.

FPL assumes the existing PTN transmission line system is adequate for the 1,726-MWe NGCC plant.

Because the NGCC plant alternative would be built on undisturbed land at the Turkey Point site and would potentially require vegetation clearing, construction-related impacts on land use under the NGCC plant alternative are assumed to be moderate.

In addition to onsite land requirements, offsite land is typically required for natural gas wells and collection systems during operations. However, no new gas wells are assumed to be needed because there is currently an abundant natural gas supply in the United States and FPL has recently increased its ability to source natural gas for utility usage. On February 2, 2016, the Federal Energy Regulatory Commission approved a new FPL natural gas pipeline system to increase its supply of natural gas for power plants (FPL 2017a). With an increased supply of natural gas available in the region, FPL assumes the current and proposed regional natural gas supply would be sufficient for the operation of the NGCC plant alternative at Turkey Point.

No operations-related impacts to land use will occur under the NGCC plant alternative.

Because the existing PTN facility is an industrial site, the construction and operation of the NGCC plant would not change the land use in the surrounding area. The pipeline impacts would be large because of the length of the corridor and the potential installation of the pipeline into previously undisturbed land. Overall, land use impacts associated with the construction and operation of the NGCC plant would be large. The impacts are primarily associated with the potential clearing of native vegetation and the conversion from a natural vegetation community to an industrial land use.

Visual Resources

During the construction phase of the project, the NGCC plant site would be cleared of trees and other vegetation. This portion of the Turkey Point site is currently undeveloped, and the potential conversion of mangrove forest and wetland areas to industrial use would be visually noticed in the flat coastal topography. However, Turkey Point already has five operating plants, so the construction activity associated with the NGCC plant would be similar in scope to the existing industrial character of the site. Therefore, construction visibility impacts under the NGCC plant alternative would be small.

During operations, the tallest structures at the NGCC plant would be the mechanical draft cooling towers and exhaust stacks. The facility would be visible, but not out of context with PTN and fossil generation plants at Turkey Point. Therefore, with the general use of Turkey Point being power generation, the addition of the NGCC plant will not significantly alter the viewshed on the Turkey Point site. Visibility-related impacts associated with the operation of the NGCC plant would be small.

7.2.3.1.2 Air Quality

Air quality impacts associated with the construction of the NGCC plant alternative would result in the release of various criteria pollutants such as CO, NO_x, sulfur oxides (SO_x), PM, and volatile organic compounds (VOCs). These criteria pollutants would be released from the use of construction vehicles and equipment. VOC releases would also result from the onsite storage and dispensing of vehicle and equipment fuels. Some GHGs would also be emitted from the use of construction equipment and vehicles during the construction of the plant. Onsite activities such as clearing and grubbing would also generate fugitive dust. The air impacts associated with the construction of the NGCC plant alternative would be short in duration, as gas-fired power plants are generally constructed rather quickly. The air impacts during construction would be minimized by the implementation of a fugitive dust control plan and adherence to mitigation practices, such as limiting the idling of vehicles and construction equipment. Therefore, construction-related impacts on air quality under the NGCC plant alternative would be small.

The operational NGCC plant would be equipped with air pollution controls to ensure compliance with air quality regulations. The facility would consume 89.6 billion ft^3 of natural gas annually. Emission estimates for the NGCC plant, based on EPA emission factors, are shown in Table 7.2-1. More recent FPL operational experience and projected emissions for FPL planning purposes indicate that emissions of a replacement NGCC could be expected to be less than those provided in Table 7.2-1, with the exception of CO_2.

The NGCC plant would qualify as a new major source of criterial pollutants and would be subject to the CAA PSD of air quality review. Therefore, the plant would need to comply with the new source performance standard for NGCC plants set forth in 40 CFR Part 60 Subpart KKKK and 40 CFR Part 60 Subpart TTTT. The plant would also qualify as a major source because of its potential to emit greater than 100 tons/year of criteria pollutants. The plant would be required to obtain a Title V operating permit.

The NGCC plant would be subject to the national emission standards for HAPs for stationary combustion turbines as stipulated in 40 CFR 63, if the plant exceeded 1,000 hours per year of oil use and became a major source of HAPs (having the potential to emit 10 tons/year or more of any single HAP or 25 tons/year or more of any combination of HAPs [40 CFR 63.6085(b)]).

A new NGCC plant would also have to comply with Title IV of the CAA [42 U.S.C. 7651] reduction requirements for SO_2 and NO_x, which are the main precursors of acid rain and the major cause of reduced visibility. A new NGCC plant would be a major source of criteria pollutants and GHGs. Compliance with existing air quality regulations would ensure air quality impacts are minimized. Therefore, the operations-related impacts on air quality under the NGCC plant alternative would be moderate relative to a nuclear unit.

7.2.3.1.3 Noise

Construction-related noise impacts would include the operation of vehicles, earthmoving equipment, and other equipment such as generators and compressors used in the construction of the facility. Startup testing would also include steam blows for a limited time. The NGCC plant alternative would be located on the Turkey Point site, which is a remote coastal location with limited noise receptors. Therefore, construction-related noise impacts would be small.

Noise impacts associated with plant operations would include noise from cooling towers, transformers, turbines, pumps, compressors, exhaust stack, combustion inlet filter house, condenser fans, and high-pressure steam piping. FPL does not expect noise impacts from the operation of the NGCC plant to be greater than those associated with PTN. Therefore, operations-related noise impacts associated with the NGCC plant alternative would be small.

7.2.3.1.4 Geology and Soils

Construction-related impacts to geology would be minimal, as the excavation associated with plant construction should not damage geologic formations at the site. In addition, materials such as stone, gravel, and other material used in the construction of the plant and associated infrastructure will be obtained from regional sources. Commercial stone and gravel sources typically sell material from local quarries. No non-native stone and gravel would be introduced to the site. Therefore, construction-related impacts to geology would be small.

Construction-related impacts to soil would occur during land clearing and the construction of the plant. In addition, the construction of a new natural gas pipeline corridor to connect to the plant would disturb soil temporarily until installation and reclamation of the new pipeline corridor is complete. The exposure of these soils during clearing and grubbing will increase the risk of erosion during and after precipitation events. In addition, fill material (including soils) will need to be used for the NGCC site and will be sourced from local mines and quarries in the region. Soils excavated and removed during clearing and construction will be stockpiled onsite for use as backfill after construction is completed. Topsoil will be separated and stockpiled for use in areas where revegetation will be required at the site. Because the ground disturbance will exceed one acre, FPL would obtain an FDEP generic permit for stormwater discharge from large and small construction activities (62-621.300(40)(a)). This is a general permit for construction activities that would require preparation of a stormwater pollution prevention plan (SWPPP) that identifies BMPs that would be installed to minimize erosion and sediment resulting from stormwater runoff. The SWPPP must be prepared prior to the initiation of ground-disturbing activities at the site. Overall, with the installation and implementation of BMPs, construction-related impacts to soils would be small.

Land disturbance activities initiated during the operation of the NGCC plant would comply with applicable FDEP regulations for stormwater permitting. Once the plant is in operation, stormwater runoff is assumed to be collected and discharged directly to the cooling canals as is currently practiced at the Turkey Point site. No stormwater discharges to surface water would occur during operation of the NGCC plant. This system of collecting and discharging plant stormwater is currently practiced at Turkey Point. Therefore, soil impacts related to the operation of the plant would be small.

No geological impacts are expected during the operation of the plant.

7.2.3.1.5 Hydrology (Surface Water and Groundwater)

Surface Water

The construction-related impacts to surface water include those related to construction of the NGCC plant and infrastructure that would alter surface drainage features. An additional 75 acres of land at the Turkey Point site would be altered from clearing of vegetation and the placement of fill for the construction of the NGCC plant, and this could alter features that convey runoff from the site. Surface water impacts resulting from construction would be minimized by implementation of BMPs as identified in the SWPPP. The BMPs would minimize and eliminate sediment and accidental releases of construction oils/chemicals into Biscayne Bay and wetlands adjacent to the site.

Overall, the NGCC plant construction-related impacts on surface water and water quality would be small.

A 100-mile pipeline corridor would be required for the NGCC plant alternative that connects to the NGCC plant. This pipeline corridor would cross rivers, streams, and wetlands on the Turkey Point site. Where this pipeline crosses wetlands or water bodies, the impacts associated with aquatic and wetland crossings would be temporary and small. Typically, wetland and aquatic impacts would be eliminated or minimized by installing the pipeline under these features via horizontal directional drilling. If permitting is required for installation of the pipeline, it would be a USACE Section 404 permit. This permit would identify BMPs and other mitigation to minimize impacts to waterways and wetlands. Impacts associated with the construction and installation of a new natural gas pipeline would be moderate to large.

The NGCC plant alternative would use reclaimed water for cooling water makeup for the cooling tower and discharge blowdown to the CCS. Overall, the discharge volume for the NGCC plant would be less than the PTN discharge volume. As addressed in Section 7.2.3.1.4, stormwater collected during plant operations would be routed through catch basins and discharged to the cooling canals. No discharges to surface water would occur from plant operations.

Operations-related surface water impacts under the NGCC plant alternative would be small.

Groundwater

FPL assumes water used for construction purposes such as dust suppression, equipment washing, sanitary systems, and potable water will be trucked in by the construction contractor. Excavations for facility foundations may intrude into groundwater zones, and dewatering may be required. Dewatering the Biscayne Aquifer during construction of the plant would be a small impact because the aquifer would be recharged by nearby surface waters such as the cooling canals, Biscayne Bay, and L-31E Canal (NRC 2016a, Section 4.2.2.2).

If the groundwater extracted from construction is to be discharged to surface water, an FDEP generic permit for discharge of groundwater from dewatering operations (62-621.300(2)a Florida Administrative Code [FAC]) would be required. This permit specifies certain mitigation practices that must be utilized before the discharge of groundwater to Florida surface waters. Construction-related impacts to groundwater could also occur from spills not properly mitigated that transport through soil to the groundwater, and runoff containing contaminants generated from construction activities. These types of impacts associated with construction would be mitigated with adherence to the SWPPP. Therefore, construction-related impacts on groundwater use and quality under the NGCC plant alternative would be small.

Operations-related groundwater impacts under the NGCC plant alternative would be negligible because stormwater would be conveyed through catch basins and discharged to cooling canals. In addition, waste management and spill mitigation would minimize the spread of contaminants through the soils to groundwater. Therefore, operations-related impacts on groundwater use and quality under the NGCC plant alternative would be small.

7.2.3.1.6 Ecological Resources (Terrestrial and Aquatic)

Terrestrial Resources

Terrestrial ecology impacts resulting from the construction of the NGCC plant would primarily result from the loss of 75 acres of wetland and coastal plain habitats. The proposed NGCC plant location may require filling of wetland habitat. This undeveloped habitat does act as a buffer from the industrial character of the site, with a total of five operating facilities currently at Turkey Point. Therefore, impacts to wildlife would occur if the NGCC plant alternative is constructed at Turkey Point. Construction of the new natural gas pipeline would also result in temporary and permanent impacts to terrestrial habitat along the proposed corridor. Before clearing and construction of the pipeline would be initiated, the corridor would be sited to be installed in an existing corridor and avoid sensitive terrestrial resources habitats. Therefore, impacts associated with the pipeline would be limited because the corridor would be revegetated with native grasses and herbaceous plant species after the installation has been completed. The pipeline impact on terrestrial ecological resources would be moderate.

With the clearing of 75 acres of vegetation, the construction of the NGCC plant alternative would result in further fragmentation of natural habitats on the Turkey Point site. Wildlife using the NGCC site would disperse to adjoining habitat during the construction activity. In addition, wildlife using the habitat adjacent to the NGCC site may disperse because of noise associated with construction activities. After completion of the NGCC plant, undeveloped land would be revegetated with native and non-native plant species. The SWPPP plan would ensure sediment and precipitation runoff are minimized during construction via implementation of BMPs. Because the construction of the NGCC plant would result in the approximate loss of 75 acres of vegetated habitat, the impacts would be moderate.

Impacts on terrestrial resources from operation of the NGCC plant would be greater than the continued operation of PTN because the plant would convert natural habitat to industrialized use. Shadowing and fogging associated with the NGCC plant cooling tower could also damage vegetation near the plant. Noise from the cooling tower could impact wildlife residing near the plant, causing wildlife to disperse to habitats further from the plant. The cooling tower could also result in avian collisions, especially during periods of migration that coincide with reduced visibility. Overall, the operation of the NGCC plant would result in small impacts to terrestrial resources.

Aquatic Resources

Impacts on aquatic resources during construction would be minimal because surface water discharges would be limited through the utilization of BMPs. The BMPs would also eliminate or minimize potential spills and releases associated with the construction of the NGCC plant. If wetland habitat is temporarily or permanently impacted during construction of the NGCC plant, a USACE permit would likely be required. This permit would stipulate mitigation practices that would need to be implemented for construction of the plant. Installation of the pipeline may also require a USACE Section 404 permit because the corridor alignment would likely cross wetlands and aquatic sites. The conditions associated with the 404 permit would also stipulate mitigation practices to be implemented at the wetland and water body crossings. Because the NGCC plant construction and pipeline installation may result in impacts wetland habitats, the impacts to aquatic resources would be moderate.

During operations, the NGCC plant alternative would not use surface water or groundwater. Therefore, operations-related impacts on aquatic ecological resources under the NGCC plant alternative would be small.

Special Status Species

Special status species addressed in this section include federally and state-listed species. The NGCC plant alternative would not likely require ESA Section 7 consultation because a federal agency would not be responsible for licensing the plant. However, Section 7 could be triggered if a USACE Section 404 permit is required which would occur if the plant infrastructure (including pipeline) is placed in "waters of the U.S." In this scenario, the USACE would be the lead federal agency responsible for the Section 7 consultation with USFWS. If either the plant or pipeline do not trigger a federal permit, federally listed species would still be protected under the ESA.

Additional federally listed marine species are provided protection through NOAA. This list includes many of the species listed by the USFWS, but also includes seven coral species listed as threatened along the Florida Atlantic coast. Sections 3.7.1.1 and 3.7.8 describe these species and address whether habitat for these species is present on or near PTN.

State-listed threatened species are designated by the FFWCC (Rules 68A-27.003 and 68A-27.005). These species are not provided regulatory protection from this designation. A list of the threatened species that may occur on or near PTN is included in Section 3.7.8.

A total of 52 federally listed or proposed for listing species occur in Miami-Dade County. In addition, the PTN site is located within American crocodile critical habitat. If wetland habitat used by the crocodile is filled for construction of the NGCC plant, this activity would require consultation with the USFWS. Additional federally listed species, such as the West Indian manatee, are known to frequent the waters around PTN. Section 3.7.8.1 addresses federally listed species in Miami-Dade County and describes whether they have been present within or adjacent to the PTN site. Impacts to federally listed species from construction of the NGCC plant would be moderate if American crocodile or other federally listed species habitat would be impacted from the activity. If federally listed species or their habitat is not impacted from construction activity, the impact would be small.

The natural gas pipeline required for the NGCC plant may temporarily impact federally or state-listed species habitat if it crosses habitat used by threatened or endangered species. However, the pipeline siting studies would identify federal and state-listed species habitat within and adjacent to the corridor alignments being considered. The preferred pipeline alignment would avoid these special status species habitats. If impacts were to occur to federally listed species habitat during pipeline installation, consultation with USFWS through either Section 7 or Section 10 would be required. Overall, impacts to federally listed species during installation of the pipeline would be small because special status species habitat would be avoided.

State-listed species, as described in Section 3.7.8.2, may be present within habitat on or adjacent to the NGCC plant site. The state-listed wildlife species would likely disperse to adjacent habitat during construction activity. However, if state-listed plant species habitat is present within these sites, a plant survey would be initiated before clearing to determine their presence or absence. If present, the plants would likely be relocated or avoided during construction. Therefore, impacts to state-listed species from construction of the NGCC plant alternative would be small.

Operations of the NGCC plant would likely not impact federally or state-listed species because these species would not be located within the site after development. Impacts to aquatic and avian species from maintenance activities would be mitigated by adherence to seasonal restrictions that prevent activities which disturb avian and reptile nesting. Therefore, impacts to federally and state-listed species from NGCC plant operations would be small.

7.2.3.1.7 Historic and Cultural Resources

The NGCC plant alternative would be sited on Turkey Point site. The cultural resource surveys conducted for the proposed nuclear Units 6 and 7 did not observe any historic or archaeological resources within the APE (NRC 2016a, Section 2.7.3). In addition, cultural resource surveys for PTN do not report any historic or cultural resources within the APE. These surveys show a low potential for cultural and historic resources on the PTN site. However, the proposed location of the NGCC plant would require a pedestrian cultural resources survey prior to site clearing to determine if historic or archaeological sites are present. The new pipeline corridor would also require a pedestrian survey to determine the presence of cultural and historic resources. If sites are documented along the pipeline corridor, they would be avoided during installation of the pipeline. In addition, if a USACE Section 404 permit is required for the project (including NGCC plant and pipeline), a potential NHPA Section 106 consultation with the Florida DHR would be required if cultural resources are impacted by proposed activities.

Operation of the NGCC plant would not result in impacts to cultural resources. The cultural resources survey conducted before construction would identify any sites and they would be avoided during NGCC plant operations.

As cultural resources, both historic and archaeological, would be avoided or protected during the NGCC plant construction and operations, no adverse effects to these resources are expected.

7.2.3.1.8 Socioeconomics (Including Transportation)

Socioeconomic Issues other than Transportation

The jobs created to complete the construction of NGCC plant and natural gas pipeline would be temporary jobs. It is expected some of the workers associated with the construction activity may relocate to the area temporarily during the construction of the plant and associated infrastructure. However, most of these workers would return to their permanent places of residence at the completion of the construction. Therefore, any boost to the local economies would be short-term, and socioeconomic impacts related to the construction of the plant would be small.

The number of workers required to operate the NGCC plant would be less than those currently employed at PTN. Workers employed at the NGCC plant would live primarily in Miami-Dade County. These workers would contribute to the local economies via housing, living expenses, taxes, and other revenue contributions. Jobs associated with the operation of the NGCC plant would be long-term and thus contribute long-term socioeconomic impacts.

This alternative would result in the loss of jobs at PTN and would translate to a reduction in local economic activity. The reduction of jobs at PTN would likely occur gradually as FPL transitions from reactor operations to decommissioning. This long-term reduction in PTN employment, along with the short-term NGCC plant construction job boost, may minimize the impacts to the local socioeconomic conditions from the PTN closure. Because PTN does employ a large number in the county, some loss of tax revenue may be recognized in towns near PTN. However, Miami-Dade County has a large population and tax base to buffer the loss of employment at PTN. The overall socioeconomic impacts resulting from the operation of the NGCC plant would be small.

Transportation

Construction of the NGCC plant would increase vehicle traffic on the roads that access the Turkey Point. The principal road access to Turkey Point is SW 344th Street. Some of the construction equipment may be shipped by barge, but it is expected to be primarily transported via the existing road system. This increase in traffic on SW 344th Street would translate into slower speeds and possible staggering of material shipments to reduce the potential for congestion. However, the increase in traffic could exceed local roadway capacity during peak times given the existing PTN would be operational during the construction phase for the NGCC plant. Mitigation measures such as staggered work shifts would be used as needed to alleviate road congestion. Construction-related traffic impacts would be moderate because of the increased use of the road during this phase of the project.

Traffic impacts associated with the operation of the NGCC plant would be minimal. Some increase on SW 344th Street traffic may occur as PTN is being decommissioned and the NGCC plant operations are being initiated. Overall, as the NGCC plant operations would require fewer workers, operations-related transportation impacts would be small.

7.2.3.1.9 Human Health

Human health impacts associated with the construction of the NGCC plant alternative and natural gas pipeline would be related primarily to potential accidents and injuries that may occur from the accidents. Worker safety would be addressed by adherence to OSHA worker protection and other initiatives such as contractor safety meetings. The radiological human health impact on construction workers working near PTN would be small due to compliance with NRC regulations and adherence to ALARA principles. The NRC reviewed radiation exposure to plant workers in its license renewal GEIS and found the impacts to be SMALL (NRC 2013a, Table 2.1-1). Construction activities should not have any impact on residents because the site is remote and the activity would be confined to the Turkey Point site. Therefore, construction-related impacts on human health under the NGCC plant alternative would be small.

Operations-related impacts resulting from the operation of the NGCC plant would primarily be from air pollutant emissions. The NGCC plant will emit criteria air pollutants (Table 7.2-1). Some pollutants, such as NO_x, contribute to ozone formation that can potentially create health problems. These criteria pollutants are regulated and the best available control technology, such as selective catalytic reduction for NO_x control, will be installed in the plant to limit criteria air pollutant releases. Therefore, human health impacts from the NGCC plant air pollutant emissions would be small. Human health impacts from plant operations would also be avoided and minimized by adherence to safety standards. Overall, the operations-related impacts on human health under the NGCC plant alternative would be small.

7.2.3.1.10 Environmental Justice

Section 3.11.2 presents the minority and low-income population in the region surrounding the PTN site. The NRC determined the construction of Units 6 and 7 would not have a disproportionate impact on minority and low-income populations in their study area (NRC 2016a, Section 4.5.4). Based on this determination, FPL assumes the NGCC plant alternative would also not have a disproportionate impact on minority and low-income population in the project area.

Potential impacts to minority populations from the construction of the NGCC plant would primarily be associated with socioeconomic effects. Housing and apartment rentals could increase in cost, thus impacting low-income populations in the form of increased cost for housing. Overall, the construction impacts will result in no disproportionately high and adverse impacts to minority and low-income populations.

No disproportionately high and adverse impacts to minority or low-income populations are expected to occur during the NGCC plant alternative operations.

7.2.3.1.11 Waste Management

The construction of the NGCC plant would create sanitary and industrial waste. These wastes will be properly managed onsite and disposed of at an approved offsite treatment or disposal facility. Overall, waste impacts resulting from construction of the NGCC plant would be small.

Operation of the NGCC plant alternative would result in waste being created from spent catalytic reduction catalysts used to control nitrous oxide (N_2O) emissions. This waste stream is considered hazardous and would be disposed of at a facility that handles hazardous materials. Other waste generated at the site would be characterized as hazardous or non-hazardous. These wastes would be disposed of at permitted offsite facilities. Recycling and waste minimization programs would also be implemented to minimize waste streams at the plant. Therefore, waste management impacts expected during operation of the NGCC plant would be small.

7.2.3.2 New Nuclear Generation

As discussed in Section 7.2.1.2, a new nuclear facility at Turkey Point is considered a reasonable power alternative. This facility would be sized as 1,668 MWe to replace the equivalent PTN MWh generation. FPL assumes the following: (1) new nuclear would utilize closed-cycle cooling with a mechanical draft cooling tower; (2) cooling water makeup would be reclaimed water from the MDWASD; and (3) the existing transmission system is adequate with the addition of infrastructure for interconnection.

7.2.3.2.1 Land Use and Visual Resources

Land Use

The new nuclear alternative would occupy approximately 364 acres of land on the Turkey Point site outside the footprint of PTN and outside the footprint of the proposed Turkey Point Units 6 and 7. The area considered for the new nuclear plant alternative consists of undeveloped lands west of Canal L-31E and slightly south of the transmission line that runs west of the canal. This area is undeveloped, consisting primarily of wetlands and native vegetation. Building the plant in this location would require fill material be placed in an area of native soils and vegetation. Because extensive wetland acreage would be impacted, a USACE Section 404 permit would likely be required for the project. In addition, FPL would also be responsible for wetland mitigation to compensate for wetland loss.

The conversion of undeveloped wetlands and native coastal vegetation communities to industrial use would change the land use in this area of the Turkey Point site. This conversion from undeveloped lands to industrial use would increase the existing industrial footprint at the Turkey Point site. Therefore, the land use impacts associated with the construction of the new nuclear alternative would be moderate.

Once the new nuclear facility is operational, the impacts associated with the operation of the facility would be small as the site would have been converted to an industrial facility and be compatible with other land uses on the Turkey Point site.

Visual Resources

The addition of the new nuclear alternative would increase the industrial footprint of the Turkey Point site. Therefore, the site would become more visible with the cooling tower infrastructure. However, the site does have an existing industrial footprint, so increasing the industrial acreage would not change the context of the site. Therefore, the impacts to visual resources during construction of the new nuclear plant would be small.

Visual impacts associated with the operation of the new nuclear facility alternative would be similar to the visual impacts from the existing units; therefore, operations-related impacts on visual resources would be small.

7.2.3.2.2 Air Quality

Construction of the new nuclear alternative would result in temporary impacts to air quality. These impacts would be primarily from fugitive dust generated from clearing and grubbing. In addition, emissions from equipment and vehicles would contain air pollutants such as CO, NO_x, SO_x, particulate matter, VOCs, and GHGs. These vehicle and equipment air emissions would be intermittent and variable depending on the level of activity. Fugitive dust emissions would be mitigated via use of watering to reduce dust. Other mitigation could include carpooling to reduce the number of vehicles transporting workers to the site. Overall, air emissions from construction activities would be temporary and limited in duration. Therefore, construction-related impacts on air quality under the new nuclear plant would be small.

Air emissions during the new nuclear operations phase would be considered a minor source of air emissions and subject to conditions outlined in an FDEP air permit. Particulate emissions from the cooling towers would also be subject to the FDEP permit conditions. The NRC evaluated the impacts from cooling tower particulate emissions in the GEIS and considered the impacts to be SMALL (NRC 2013a, Table 2.1.1). Therefore, operations-related impacts under the new nuclear plant alternative would be small.

GHG emissions associated with nuclear power are lower than those from fossil-fuel based energy sources. Nuclear power life-cycle GHG emissions are within the same order of magnitude as renewable energy sources (NRC 2013a, Section 4.12.3). The new nuclear plant alternative would greatly reduce GHG emissions compared to those emitted from a fossil-fuel plant.

7.2.3.2.3 Noise

Sources of noise during construction would include heavy equipment, compressors, hydraulic equipment, dump trucks, and other construction equipment. These noise sources would be intermittent and last for the duration of the construction activities. The NRC estimated the highest noise levels for construction of Turkey Point Units 6 and 7 would be between 70 and 90 dBA, but could reach as high as 102 dBA for short periods of time (NRC 2016a, Section 4.8.2). FPL assumes the construction noise levels associated with the new nuclear alternative would be similar. Because construction noise levels are expected to be intermittent and brief in duration, the noise impacts associated with construction of the new nuclear facility would be small.

Noise associated with the operation of the new nuclear facility would result from sources such as cooling towers, motors, generators, and heavy trucks. Most of the anticipated operations-related noise would be associated with the cooling towers. Overall, noise levels associated with the new nuclear facility would be like those occurring at the other five operating units on the Turkey Point site. Therefore, operations-related noise impacts under the new nuclear facility alternative would be small.

7.2.3.2.4 Geology and Soils

Construction-related impacts to geology would be minimal, as materials such as stone and gravel used for construction of roads and buildings would be obtained from suppliers who use locally sourced materials. Clearing and grubbing associated with the construction of the new nuclear alternative would expose soils and make them susceptible to erosion and stormwater runoff. Because ground disturbance would be greater than one acre, an FDEP generic permit for stormwater discharge from small and large construction activities would be required. This permit requires the project applicant prepare an SWPPP that identifies BMPs that would be used to prevent and minimize erosion and runoff. Once construction activity is completed, exposed soils will be revegetated and monitored until reclamation is complete. Construction impacts to geology and soils would be small because of the use of BMPs during the construction phase of the project.

Operations-related geology and soil impacts would be minimized by conveyance of stormwater to catch basins that would discharge to the cooling canals. Therefore, operations-related impacts to geology and soils would be small.

7.2.3.2.5 Hydrology (Surface Water and Groundwater)

Surface Water

Construction of the new nuclear facility could result in stormwater runoff to wetlands and other water bodies such as Biscayne Bay. These construction impacts would be minimized by use of BMPs to prevent erosion and pollutants from entering the waterways. The BMPs identified in the SWPPP would be used prior to clearing and grubbing, and would remain in place after construction until the site is stabilized and revegetated.

Construction activities could result in spills and leaks from construction equipment and fuel tanks. The SWPPP would require the use of BMPs and waste management practices to prevent accidental spills and capture spills before they can reach surface water.

No surface water will be used during the construction of the new nuclear facility. Overall, the construction-related impacts to surface water are small.

Operational impacts to surface water are expected to be small. No surface water will be used for the new nuclear facility operations. In addition, no discharges to surface water from the new nuclear facility alternative will occur. Therefore, operations-related impacts on surface water use and quality under the new nuclear facility alternative would be small.

Groundwater

Excavations during construction of the new nuclear facility may intrude on the Biscayne Aquifer and require dewatering. As described in Section 7.2.3.1.5, the NRC concluded that groundwater dewatering for the proposed construction of Turkey Point Units 6 and 7 would be small because of recharge from nearby surface waters. An FDEP generic permit for discharge of groundwater from dewatering operations would be required if groundwater were to be discharged to surface water. BMPs identified in the SWPPP would also mitigate any construction-related accidental spills that would contaminate soils and potentially migrate to groundwater. Groundwater impacts associated with construction of the new nuclear plant would be small because of the small removal of groundwater during construction and the use of BMPs to mitigate accidental spills.

The new nuclear facility would have approved waste management, spill prevention practices, and stormwater BMPs in place to prevent and minimize any surface sources of contamination that could migrate into groundwater resources. Therefore, operations-related impacts to groundwater use and quality under the new nuclear alternative would be small.

7.2.3.2.6 Ecological Resources (Terrestrial and Aquatic)

Terrestrial Resources

Terrestrial ecology impacts from construction of the new nuclear facility would primarily occur from land disturbance. Some wildlife mortality, especially small mammal and reptile, is expected during construction of the facility. However, the mortality is not expected to reduce wildlife populations on the Turkey Point site. Wildlife would disperse to undisturbed adjacent habitats when construction is initiated. Because Turkey Point has five existing operating facilities, it is assumed wildlife is acclimated to noise, and the additional construction noise should not disrupt wildlife using habitats adjacent to the new nuclear facility site.

A large portion of the proposed new nuclear facility site is wetlands. It is likely that fill will be placed in site wetlands, and this would require a USACE Section 404 permit that stipulates implementation of mitigation practices and BMPs to protect waters potentially impacted by construction activity. Temporarily disturbed portions of the site would be revegetated with native and non-invasive flora species appropriate for the site. As discussed in Section 7.2.3.2.1, wetland mitigation would be required for the permanent loss of wetlands. Construction-related new nuclear facility impacts to terrestrial resources are moderate due to the potential loss of wetland habitats at the Turkey Point site.

Operation of the cooling towers would cause some deposition of dissolved solids on surrounding vegetation and soils. Operational noise from the cooling towers could also impact terrestrial wildlife, although the site has an existing background noise level that most wildlife should be acclimated to. Overall, operations-related impacts on terrestrial resources under the new nuclear alternative would be limited to the Turkey Point site and would be small.

Aquatic Resources

Construction-related impacts to aquatic species would be primarily from land clearing and construction activities that could discharge sediment into Biscayne Bay and other waterways. These sediment releases would be prevented or minimized by installation of BMPs identified in the SWPPP and the USACE Section 404 permit. With the adherence to FDEP and USACE permit conditions and the associated BMPs, the construction impacts to aquatic resources under the new nuclear facility alternative would be small to moderate.

Aquatic life impacts resulting from the new nuclear facility operations would be small because no surface water would be used for the facility. This would result in no intake or discharge of water from the facility to surface waters. Therefore, operations-related impacts on aquatic resources under the new nuclear facility alternative would be small.

Special Status Species

The NRC would remain the licensing agency under this alternative, and thus would be responsible for initiating consultation with the USFWS and NMFS if federally listed species or their habitat is present and impacted by the construction of the new nuclear facility alternative.

A total of 52 federally listed or proposed for listing wildlife and plant species are potentially present in Miami-Dade County. NOAA is also responsible for threatened marine species in coastal waters. Seven coral species are listed as threatened along the Florida Atlantic coast. In addition, a large portion of the PTN site is located within American crocodile critical habitat. Critical habitat for the West Indian manatee is also present at the south end of the PTN site, in and adjacent to Card Sound. If any project construction activities impact federally listed species and their habitat, Section 7 consultation under the ESA would be initiated. Impacts to the habitat of federally listed species would primarily occur from the loss and disturbance of habitat from the construction of the new nuclear facility. If any federally listed species habitat is impacted from the construction of the new nuclear alternative, it would be a moderate impact. However, FPL would avoid and minimize impacts to federally listed species' habitat during the siting process for the new nuclear facility. If the facility can be sited outside of federally listed species' habitat, the construction impacts to these species would be small.

State-listed threatened species and their habitats may also be impacted by the construction of the new nuclear facility alternative. These impacts would occur through loss of habitat and disturbance to habitats present at the site. Overall, the impacts to state-listed wildlife and plant species would be small.

Operations-related impacts to special status species would be minor, as any disturbance to special status species would occur during the construction phase of the project. Once the new nuclear facility is operational, no impacts to special status species would be expected. Therefore, operations-related impacts to special status species under the new nuclear facility alternative would be small.

7.2.3.2.7 Historic and Cultural Resources

As addressed in Section 7.2.3.1.7, the proposed Turkey Point Units 6 and 7 cultural resource assessment did not document historic or cultural resources within the APE for the facility. Additionally, as addressed in Section 3.8.3, the Florida DHR has no record of the presence of any historic or archaeological resources on the PTN site. Before constructing the new nuclear facility, a cultural resources survey would be completed to document any historic and archaeological resources. If historic or archaeological resources are present within the study area, FPL would avoid construction activities in these areas. The NRC would be responsible for any Section 106 consultation with the Florida DHR if archaeological or historic resources would be potentially impacted by construction activities. If all historic and archaeological resources are avoided before construction is initiated, the installation of the new nuclear facility would have no effect on historic and cultural resources.

Thus, the operation of the new nuclear facility alternative would have no effect on historic and archaeological resources.

7.2.3.2.8 Socioeconomics

Socioeconomic Issues other than Transportation

The construction and operation of the new nuclear alternative would create construction and plant operations employment. The construction employment would provide a stimulus to the local economy for the time the plant is being constructed. Plant operations would provide a long-term benefit to the local economy, especially in communities close to Turkey Point that would benefit from the increased employment and need for goods and services.

The NRC has estimated that construction of the proposed Turkey Point Units 6 and 7 would create up to 3,950 construction jobs over the 10-year period of pre-construction and construction of the plant (NRC 2016a, Section 4.4.2). This number of workers would provide an economic stimulus to the local economy as the demand for housing and goods would increase. Over a 10-year period, this stimulus to the local economy would be considered long-term in duration. The number of construction workers required for new nuclear alternative would be similar to those projected for Turkey Point Units 6 and 7. Therefore, the overall construction-related socioeconomic impacts under the new nuclear alternative would be small.

The NRC estimated 806 full-time employees for operation of Turkey Point Units 6 and 7 (NRC 2016a, Section 5.4.3). The new nuclear facility alternative operations would create a similar number of full-time workers. This number of new employees in the region would contribute to increased demand for housing and goods and would increase local tax revenue in Miami-Dade County. The increase in employment from operation of the nuclear facility would provide a long-term boost to the region's economy. Therefore, the operations-related impacts to socioeconomic issues under the new nuclear alternative would be small.

Transportation

Transportation impacts resulting from construction of the new nuclear facility alternative would be moderate in the surrounding area. The employment of more than 3,000 construction workers combined with the existing PTN workers would bring additional vehicles to the local road network. Increased vehicle use of roads during peak traffic times in the morning and evening would increase traffic on roads that could result in congestion on roadways. If traffic becomes an issue, the work shifts during construction would be staggered, which could minimize some of the road use during peak traffic hours. Overall, construction-related traffic impacts under the new nuclear alternative would be moderate.

Traffic impacts would be reduced after construction of the new nuclear facility alternative is completed. Transportation impacts from the approximately 800 full-time workers may result in some minor traffic delays. In addition, some decommissioning activities at PTN would occur during the operations period of the new nuclear facility, which would result in commuting and truck traffic and could result in a noticeable but not destabilizing increase in traffic on area roads. Therefore, operations-related transportation impacts under the new nuclear alternative would be small to moderate.

7.2.3.2.9 Human Health

Impacts on human health from construction of the new nuclear facility alternative would be similar to those associated with a large industrial facility construction project. Compliance with OSHA worker protection rules would prevent safety-related accidents. The radiological human health impact on construction workers due to the proximity to PTN would be small due to compliance with NRC regulations and adherence to ALARA principles. The NRC reviewed the human health and environmental impacts from radiological emissions and waste in its license renewal GEIS and found the impacts to be small (NRC 2013a, Table 2.1.1). Therefore, the construction-related impacts on human health under the new nuclear alternative would be small.

The human health effects from operation of the new nuclear facility alternative would be similar to those of the existing PTN. Therefore, the operations-related impacts on human health under the new nuclear alternative would be small.

7.2.3.2.10 Environmental Justice

As described in Section 7.2.3.1.10, the NRC concluded that construction of Turkey Point Units 6 and 7 would not have a disproportionate impact on minority and low-income populations in their study area. Based on this determination, FPL assumes the new nuclear facility alternative would similarly not have a disproportionate impact on minority and low-income populations in the region. Therefore, the construction-related impacts would not result in disproportionately high and adverse impacts to minority and low-income populations.

No operations-related impacts to minority or low-income populations would occur under the new nuclear facility. Plant operations would not result in conditions that create human health or environmental impacts for minority or low-income populations in the region. Therefore, operations-related impacts would not result in disproportionately high and adverse impacts to minority and low-income populations.

7.2.3.2.11 Waste Management

The construction of the new nuclear facility alternative would create sanitary and industrial waste. These wastes would be properly managed onsite and disposed of at an approved offsite treatment or disposal facility. Overall, waste impacts resulting from construction of the new nuclear facility alternative would be small.

During operations, the new nuclear facility would generate hazardous, non-hazardous, spent nuclear fuel, and radioactive waste. The non-hazardous and hazardous wastes would be managed in compliance with state regulations and disposed of in permitted facilities. FPL has internal recycling and waste minimization programs that would reduce waste volumes. Spent nuclear fuel would be managed onsite in accordance with NRC and state regulations. This waste would be disposed of in permitted facilities. The NRC reviewed the impacts from nonradioactive and radioactive waste in the GEIS and determined the impacts to be SMALL (NRC 2013a, Table 2.1-1). Therefore, the impacts from nonradioactive and radioactive waste generated by the new nuclear facility alternative would be small.

7.2.3.3 Combination of Alternatives

The combination of alternatives would include the construction and operation of an NGCC plant and four solar facilities. This combination of alternatives to provide the equivalent PTN MWh would be the following:

- A 1,636-MWe NGCC plant operating at an 87 percent capacity factor (EIA 2016a).
- Four 75-MWe solar PV facilities operating at a 26 percent capacity factor (EIA 2016a).

As discussed in Section 7.2.1.3, the NGCC plant would be sited on the Turkey Point property. The site would occupy approximately 70 acres.

Each solar facility would require approximately 450–500 acres for installation of the infrastructure. A site selection process would be utilized to select locations with sufficient infrastructure and to avoid sensitive resources such as cultural resources, wetlands, and threatened and endangered species habitat. Only one of the solar PV facilities would be located on FPL-owned property near the PTN site because the required acreage for infrastructure would impact large wetland areas and potential sensitive species habitat. In the site selection process, FPL would screen sites located in Miami-Dade and Broward counties that have been previously disturbed from industrial and other development.

The environmental impacts associated with the combination alternatives are described below.

7.2.3.3.1 Land Use and Visual Resources

Land Use

The impact on land use due to construction and operation of the NGCC plant and associated pipeline connection would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.1.

Four solar PV sites would each require approximately 450–500 acres of land to install the infrastructure. Utility-scale solar facilities require relatively large areas of land to generate electricity. Solar may impact existing land use and is especially incompatible with agriculture. One of the solar facilities would be installed on FPL-owned lands near PTN. This facility would likely impact wetlands and result in the conversion of undisturbed natural habitat to industrial use. The other three unidentified sites would be located on previously disturbed land close to existing transmission lines. To minimize impacts, preferred sites would be previously disturbed lands with an industrial and commercial footprint or lands that were once agricultural but have been taken out of production. Because of the large land area requirements, solar impacts on land use would be moderate.

Overall land use impacts from the construction and operation of the combination alternative would be large, due to the impact of the NGCC plant.

Visual Resources

Aesthetic impacts from the construction and operation of the NGCC plant and pipeline component of the combination alternative would be essentially the same as those described for the discrete NGCC alternative in Section 7.2.3.1.1.

The solar facilities would require large land areas that would tend to change the visual context of the landscape. The solar facility constructed on the Turkey Point site would increase the industrialization of the site and transform a larger area to industrial use. The other three sites would be located on previously disturbed industrial, commercial, or agricultural lands. At these sites, the solar facility would be visually noticeable. Depending on whether the land was industrial, commercial, or agricultural, the visual impact would range from small to moderate.

7.2.3.3.2 Air Quality

The impact on air quality due to construction and operation of the NGCC plant would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.2.

Construction activities associated with the solar PV installation would generate fugitive dust. Mitigation would be implemented via wetting of cleared areas and dirt roads to minimize the fugitive dust. Construction equipment and vehicles would also emit exhaust emissions. These emissions would be temporary, and mitigation such as curtailing the idling of vehicles would be implemented. The solar facility construction air quality impacts would be small.

Operational air quality impacts associated with the NGCC plant component of the combination alternative would be slightly less than the discrete NGCC plant alternative shown in Table 7.2-1. The NGCC plant would be subject to FDEP air quality regulations and permitting. A new NGCC plant would be a major source of criteria pollutants and GHGs. Therefore, the air quality impacts related to the NGCC plant component of the combination alternative would be moderate.

The solar facilities component of the combination alternative would not result in any emissions that would impact air quality.

7.2.3.3.3 Noise

The construction and operation of the NGCC plant component of the combination alternative would have noise impacts similar to those described in the discrete NGCC plant alternative discussed in Section 7.2.3.1.3.

Construction of the solar facilities would also have noise impacts similar to those described in the discrete NGCC plant alternative discussed in Section 7.2.3.1.3.

Overall construction and operations-related noise impacts associated with the combination alternative would be small.

7.2.3.3.4 Geology and Soils

The impact on geology and soils due to the construction and operation of the NGCC plant and pipeline component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.4.

Construction impacts to geology and soils resulting from the construction of the solar PV facilities would be primarily associated with impacts to soils from clearing and grubbing. Because the ground disturbance would be greater than one acre, an FDEP generic permit for stormwater discharge from large and small construction activities would be required. The SWPPP required by this permit would identify BMPs to minimize and eliminate stormwater runoff, which creates erosion and sediment pollution. Geological impacts would be minor, as gravel and stone used in the construction of roads and infrastructure would be sourced from local businesses selling materials from local quarries.

During operations, the solar PV facilities would be required to comply with FDEP regulations for stormwater runoff. If stormwater is an issue at any of these facilities, BMPs would be used to minimize the impact of erosion and runoff from these sites. No impacts to geology are anticipated from operating these facilities.

The construction and operational impacts on geology and soils associated with the solar PV facilities would be small.

7.2.3.3.5 Hydrology (Surface Water and Groundwater)

Surface Water

The impact on surface water use and quality due to constructing and operating the NGCC plant component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.5.

Water use associated with construction of the solar PV facilities will primarily be associated with dust suppression, equipment washing, sanitary systems, and potable water that will be trucked in by the construction contractor. Water quality impacts would result from erosion and runoff associated with the construction of the solar facility. Adherence to BMPs identified in the SWPPP would minimize the erosion and runoff associated with the clearing and grubbing. Construction of a solar facility near the Turkey Point site would clear vegetated land that would be prone to erosion. Clearing and grubbing at this site would have the potential to release sediment into Biscayne Bay and its tributaries. These impacts would be mitigated by adherence to measures outlined in an FDEP construction stormwater permit. Water used during the construction of the solar PV facilities would be trucked in from a location close to the proposed facilities.

No surface water use or water quality impacts are associated with the operations of the solar PV facilities.

The overall construction and operations-related impacts to surface water associated with the NGCC plant and solar PV facilities would be small.

Groundwater

The impact on groundwater use and quality due to constructing and operating the NGCC plant and pipeline component of the combination alternative would be similar to that associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.5.

No groundwater use or quality issues are associated with the construction and operation of the solar PV facilities.

The impacts to groundwater from the combination alternative would generally be small based on the potential to use some groundwater during the operation of the plants.

7.2.3.3.6 Ecological Resources (Terrestrial and Aquatic)

Terrestrial Resources

The impact on terrestrial resources due to the construction and operation of the NGCC plant and pipeline component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.6.

Terrestrial ecology impacts associated with the construction of the solar PV facilities would primarily occur from the clearing and grubbing of vegetation. Each facility would require 450–500 acres of land for installation of the infrastructure. This development would occur at four sites. The site located on FPL-owned lands near PTN would require the clearance of native vegetation, which would negatively impact terrestrial wildlife. Site use by wildlife would decline after installation of the solar facility. Wildlife adjacent to the facility would also disperse during construction but would return to habitat after installation of the facility is completed. A USACE Section 404 permit would likely be required if the site is located on wetlands. This permit would require mitigation for wetland loss that would entail replacement of the permanently impacted wetlands. Siting of the three plants in Miami-Dade and Broward counties would be at previously disturbed sites, which would minimize disturbance of vegetation and wildlife habitat. The impacts associated with the construction of the solar PV facility would range from small to moderate depending on the site locations and the level of habitat disturbance. The solar facility on the FPL-owned site would likely result in moderate impacts to terrestrial ecological resources, while sites located on previously disturbed sites would likely result in small impacts to terrestrial ecology.

No operational impacts to terrestrial ecological resources would result from the operation of the solar PV facilities. Once the plants are operational, the vegetation would have been cleared and wildlife would have dispersed from the site. Therefore, solar PV facility operations impacts to terrestrial ecological resources would be small.

Aquatic

The impact on aquatic resources due to the construction and operation of the NGCC plant and pipeline component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.6.

Impacts to aquatic resources during construction of the solar PV facilities would be minimal because of the adherence to mitigation and BMPs stipulated in the FDEP construction stormwater permit and the SWPPP. These practices would prevent and minimize discharges of sediment and other pollutants to surface water. Solar PV construction impacts to aquatic resources would be small because of the mitigation requirements. Operation of the solar PV facilities would not impact aquatic resources.

Special Status Species

The impact on special status species due to the construction and operation of the NGCC plant and pipeline component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.6.

The solar PV facilities component of the combination alternative would have a location on FPL-owned lands near the PTN site that may be in critical habitat for the American crocodile. FPL has crocodile mitigation procedures in place that would be adhered to while construction of the solar PV facility is ongoing. In addition, the solar PV site near PTN would be surveyed prior to construction to determine if federally or state-listed wildlife and plant species are present at the site. If listed plants or wildlife are present at the site, the site may be moved or reconfigured to avoid impacting the plant or wildlife habitat. The construction of the solar PV facility at this site would result in moderate impacts to special status species. The other three solar PV facilities would be located on previously disturbed sites. These sites would be screened to determine if special status wildlife or plant species and their habitats are present. Sites with habitat for special status species would be avoided. Therefore, the construction impacts associated with these three solar PV facilities would be small.

The solar PV facilities operations-related impacts to special status species would be small because these species would likely avoid the facilities once the sites are operational.

7.2.3.3.7 Historic and Cultural Resources

The impact on historic and cultural resources due to the construction and operation of the NGCC plant and pipeline component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.7.

In the solar PV facility site selection process, each site under consideration would be screened for the presence of historic and cultural resources. Those sites that contain historic and cultural resources would not be considered for development. In addition, prior to construction, a cultural resources survey would be completed to determine the presence or absence of historic and cultural resources. If sites are present, they would be avoided during the construction of the solar PV facilities. Therefore, solar PV construction-related impacts would result in no effect to cultural resources.

Because cultural resources, both historic and archaeological, would be avoided or protected during the operation of the solar PV facilities, no effect to these resources is expected.

7.2.3.3.8 Socioeconomics

Socioeconomic Issues other than Transportation

The construction and operation of the NGCC plant and pipeline component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.8.

The construction of the solar PV facilities would create fewer construction and operations jobs than the NGCC plant. Employment created during the installation of the solar facilities would be temporary. It is expected that some of the workers associated with the installation of the solar facilities would temporarily relocate or commute to the site for the project. It is not expected that any of the construction workers that migrate in from outside the region would permanently relocate to the region. Therefore, any socioeconomic effect from migrating workers would be temporary. The construction of the solar PV facilities would have a small socioeconomic impact.

The operation of the solar PV facilities requires very few workers, and typically the facilities would not have full-time workers onsite. Therefore, the solar PV facilities would not generate long-term employment that would boost the regional economy. Therefore, the operations of the solar PV facilities would have a small socioeconomic impact.

Transportation

Transportation impacts during the construction and operation of the NGCC plant would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.8.

Transportation impacts during construction of the solar PV facilities would be associated with commuting workers and trucks transporting construction materials and equipment to the work site. These activities would temporarily increase the amount of traffic on the local roads. The increase in vehicle traffic would peak during morning and at times when materials and equipment would be transported to the work site. Overall transportation impacts related to the construction of the solar PV facilities would range from small to moderate.

Traffic impacts associated with the operation of the solar PV facilities would not be quantifiable. Once the facilities are in operation, employees would not be required to work at the sites every day. Therefore, operations-related transportation impacts under the solar PV facility component of the combination alternative would be small.

7.2.3.3.9 Human Health

Impacts on human health from construction and operation of the NGCC plant and pipeline component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.9.

During construction of the solar PV facilities, worker safety would be addressed by following the OSHA worker protection standards. Impacts from construction on the public would be minimal because the construction contractor would limit access to the construction site. The solar facility sited near PTN would be constructed near an existing nuclear facility. The radiological human health impact on construction workers working at this facility would be small because of compliance with NRC regulations and adherence to ALARA principles. The NRC reviewed the human health and environmental impacts from radiological emissions and waste in the license renewal GEIS and found the impacts to be SMALL (NRC 2013a, Table 2.1-1).

Construction-related human health impacts associated with the solar PV facilities would be small.

No operations-related impacts to human health are expected under the solar PV facility component of the combination alternative.

Overall, human health impacts during operation of the solar PV facilities would be small.

The overall human health impacts associated with the construction and operation of the components of the combination alternative would range from small to moderate.

7.2.3.3.10 Environmental Justice

Environmental justice impacts from construction and operation of the NGCC plant and pipeline component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.10.

Potential impacts on minority and low-income populations from the construction of the solar PV facilities would consist primarily of environmental and socioeconomic effects (e.g., noise, dust, traffic, employment, and housing impacts). Minority and low-income populations residing along site access roads would be directly affected by increased vehicle and truck traffic. However, this would be a temporary effect and would not cause a long-term impact to individuals along these routes. The solar PV facilities would cause an increased demand for housing during construction. This may cause rental rates to increase and result in some housing shortages. However, the solar PV facilities construction would be short in duration and would not require the number of workers needed for a nuclear facility or NGCC plant. Therefore, these construction impacts would not result in disproportionately high and adverse impacts to minority and low-income populations.

The operations-related impacts associated with solar PV facilities would be negligible. Therefore, the solar PV facilities operations-related impacts would not result in disproportionately high and adverse impacts to minority and low-income populations.

Overall, the construction and operations associated with the solar PV facilities would not result in disproportionately high and adverse impacts to minority and low-income populations.

7.2.3.3.11 Waste Management

Impacts on waste management from construction and operation of the NGCC plant and pipeline component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.11.

The construction of the solar PV facilities would create sanitary and industrial waste, although it would be a smaller quantity as compared to the NGCC plant. This waste will be recycled, disposed of onsite, or shipped to an offsite waste disposal facility. All of the waste would be handled in accordance with appropriate FDEP regulations.

Overall, the waste management impacts from construction and operation of the combination alternative would be small.

Table 7.2-1
Air Emissions from the NGCC Plant Alternative

Emission	Discrete Alternative (annual amount)	Combination Alternative (annual amount)
Gas consumption	89.6 billion $feet^3$[(a)]	84.9 billion $feet^3$[(a)]
Sulfur dioxide	158 tons[(b)]	149 tons[(b)]
NO_x[(c)]	603 tons[(c)]	571 tons[(c)]
CO	1,390 tons[(c)]	1,320 tons[(c)]
Particulate matter	306 tons[(c)]	290 tons[(c)]
N_2O	139 tons[(c)]	132 tons[(c)]
VOCs	97 tons[(c)]	92 tons[(c)]
CO_2	5.10 million tons[(c)]	4.84 million tons[(c)]

a. Formulas and sources:
   Annual gas consumption (ft^3) = Plant size in MW × heat rate × 1,000 × (1/ fuel heating average value) × hours in a year
   Heat rate = 6,133 Btu/kWh (FPL 2017a, pg. 110)
   Fuel heating average value = 1,035 Btu/ft^3 (EIA 2017b)
b. Formulas and sources:
   Annual emissions (tons) = (emission factor) × (annual MMBtu)/2000
   Emission factor for processed natural gas (lbs/MMBtu): CO_2 – 110; NO_x – 0.13; CO – 0.03; PM – 0.0066; SO_2 – 0.0034; VOC – 0.0021; N_2O – 0.003; (EPA 2000, Tables 3.1-1 and 3.1-2a)
   Annual MMBtu = (annual gas consumption × fuel heating average value)/1,000,000
c. Assumes 90 percent reduction in emissions due to operation of air pollution control equipment (selective catalytic reduction).

Note: More recent FPL operational experience and projected emissions for FPL planning purposes indicate that emissions of a replacement NGCC could be expected to be less than those presented above with the exception of CO_2, which could be approximately 8 percent greater.

7.3 Alternatives for Reducing Adverse Impacts

7.3.1 Alternatives Considered

As noted in 10 CFR 51.53(c)(3)(iii), "The report must contain a consideration of alternatives for reducing adverse impacts, as required by 51.45(c), for all Category 2 license renewal issues in Appendix B to subpart A of this part." A review of the environmental impacts associated with the Category 2 issues in Chapter 4 identified no significant adverse effects that would require consideration of additional alternatives. Therefore, FPL concludes that the impacts associated with renewal of the PTN OL would not require consideration of alternatives for reducing adverse impacts as specified in the NRC Regulatory Guide 4.2, Revision 1 (NRC 2013b, Section 7.2). This determination assumes the existing mitigation measures discussed in Chapter 4 adequately minimize and avoid the environmental impacts associated with operating PTN.

7.3.2 Environmental Impacts of Alternatives for Reducing Adverse Impacts

No additional alternatives were considered by FPL to reduce impacts, because as determined in Chapter 4, the continued operation of PTN does not result in significant adverse effects to the environment.

8.0 COMPARISON OF THE ENVIRONMENTAL IMPACT OF SUBSEQUENT LICENSE RENEWAL WITH THE ALTERNATIVES

> To the extent practicable, the environmental impacts of the proposal and the alternatives should be presented in comparative form . . . . [10 CFR 51.45(b)(3)]

The proposed action is renewal of the PTN OLs, which would preserve the option to continue to operate PTN to provide reliable base-load power and meet FPL's future system generating needs throughout the proposed 20-year SLR period. Chapter 4 analyzes environmental impacts of the proposed action. The proposed action is compared to the no-action alternative, which includes both the termination of operations and decommissioning of PTN and replacement of its base-load generating capacity. The termination of operations and decommissioning impacts were discussed in the GEIS (NRC 2013a), Section 14.2.2, and decommissioning impacts were analyzed in the GEIS on decommissioning, NUREG-0586, Supplement 1 (NRC 2002b). The energy alternatives are described and their impacts analyzed in Chapter 7.

Table 8.0-1 summarizes the environmental impacts of the proposed action and the alternatives deemed reasonable, for comparison purposes. Table 8.0-2 provides a more detailed comparison. The environmental impacts compared in Tables 8.0-1 and 8.0-2 are Category 1 and 2 issues that apply to the proposed action or issues that the GEIS identified as major considerations in an alternatives analysis.

As shown in Tables 8.0-1 and 8.0-2, there are no reasonable alternatives superior to that of the continued operation of PTN, providing approximately 1,632 MWe of reliable base-load power generation. The continued operation of PTN would create significantly less environmental impact than the construction and operation of new alternative generating capacity. In addition, the continued operation of PTN will have a small positive economic impact on Miami-Dade County through tax revenues paid by FPL for PTN. Continued employment of plant workers will continue to provide economic benefits to the communities surrounding the station.

Table 8.0-1
Environmental Impacts Comparison Summary (Sheet 1 of 3)

Impact Area[(a)]	Proposed Action	No-Action Alternative			
		Termination of Operations and Decommissioning	NGCC Plant Alternative	New Nuclear Plant Alternative	Combination of Alternatives
Land Use	SMALL	SMALL	LARGE	MODERATE (construction) SMALL (operations)	LARGE
Visual Resources	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE
Air Quality	SMALL	SMALL	SMALL (construction) MODERATE (operations)	SMALL	SMALL (construction) MODERATE (operations)
Noise	SMALL	SMALL	SMALL	SMALL	SMALL
Geology and Soils	SMALL	SMALL	SMALL	SMALL	SMALL
Surface Water	Not Applicable	SMALL	SMALL (construction) MODERATE to LARGE (pipeline construction) SMALL (operations)	SMALL	SMALL (construction) MODERATE to LARGE (pipeline construction) SMALL (operations)
Groundwater	SMALL	SMALL	SMALL	SMALL	SMALL

Table 8.0-1
Environmental Impacts Comparison Summary (Sheet 2 of 3)

Impact Area[a]	Proposed Action	No-Action Alternative			
		Termination of Operations and Decommissioning	NGCC Plant Alternative	New Nuclear Plant Alternative	Combination of Alternatives
Terrestrial	SMALL	SMALL	MODERATE (construction) SMALL (operations)	MODERATE (construction) SMALL (operations)	MODERATE (construction) SMALL (operations)
Aquatic	SMALL	SMALL	MODERATE (construction) SMALL (operations)	SMALL to MODERATE (construction) SMALL (operations)	SMALL
Special Status Species	NO EFFECT	[b]	SMALL to MODERATE (construction) SMALL (operations)	SMALL to MODERATE (construction) SMALL (operations)	SMALL to MODERATE (construction) SMALL (operations)
Historic and Cultural	NO ADVERSE EFFECT	NO ADVERSE EFFECT	NO ADVERSE EFFECT	NO ADVERSE EFFECT	NO ADVERSE EFFECT
Socioeconomics	SMALL	Termination: SMALL Decommissioning: SMALL	SMALL	SMALL	SMALL

Table 8.0-1
Environmental Impacts Comparison Summary (Sheet 3 of 3)

Impact Area[a]	Proposed Action	No-Action Alternative: Termination of Operations and Decommissioning	NGCC Plant Alternative	New Nuclear Plant Alternative	Combination of Alternatives
Transportation	SMALL	SMALL	MODERATE (construction) SMALL (operations)	MODERATE (construction) SMALL (operations)	SMALL to MODERATE (construction) SMALL (operations)
Human Health	SMALL	SMALL	SMALL	SMALL	SMALL
Environmental Justice	(c)	(b)	(c)	(c)	(c)
Waste Management	SMALL	SMALL	SMALL	SMALL	SMALL

a. As defined in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, Footnote 3:
SMALL: Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
MODERATE: Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
LARGE: Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

b. NUREG-0586 Supplement 1 (NRC 2002b), the decommissioning GEIS, identifies this resource area as requiring a site-specific analysis based on site conditions at the time of decommissioning, which for decommissioning PTN would at a minimum occur after the expiration of the current license term as well as the proposed decommissioning method and activities. The magnitude of impacts could vary widely based on (1) site-specific conditions at the time of decommissioning; (2) for analysis of special status species, a consideration of the presence of the species or their habitats; and (3) for environmental justice analysis, the potential for disproportionate impacts from the impacts of decommissioning being experienced by minority or low-income populations as determined by the most recent USCB decennial census data and habitats when the alternative is implemented. Therefore, FPL cannot forecast a level of impact for this resource area.

c. This alternative would not have disproportionately high and adverse human health and environmental effects on minority and low-income populations in the vicinity of Turkey Point during construction or operations.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 1 of 16)

	NGCC Alternative	New Nuclear Alternative	Combination Alternative
Summary of Alternative	Multiple combustion turbines assembled in appropriate power train configurations for a total of 1,726 net MWe. (Section 7.2.1.1)	One unit nuclear plant for a total of 1,668 net MWe. (Section 7.2.1.2)	One 1,636 MWe NGCC plant at 87 percent capacity factor. Four 75 MWe solar PV at 26 percent capacity.
Location	At existing FPL PTN property.	At existing FPL Turkey Point property.	NGCC and one solar PV unit at existing FPL PTN property. Three solar PV units at off site locations with access to transmission grid.
Cooling System	Closed-cycle cooling with mechanical draft cooling towers supplied by reclaimed water; existing infrastructure is assumed adequate.	Same cooling sources as PTN; some infrastructure upgrades may be required.	NGCC: Closed-cycle cooling with mechanical draft cooling towers; some infrastructure upgrades may be required. Solar PV: No cooling system required.
Land Requirements	75 acres on existing FPL Turkey Point property; no additional gas fields required. (Section 7.2.3.1.1)	364 acres for the plant infrastructure.	70 acres for the NGCC plant on existing FPL PTN property. 450–500 acres for each solar PV plant.
Workforce	Short term increase during peak construction; smaller workforce during operations.	Up to 3,950 during pre-construction and construction; 806 during operations. (Section 7.2.3.2.8)	Short-term increase during peak construction; smaller workforce during operations.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 2 of 16)

Land Use	
Proposed action	SMALL: Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, for the following: • Onsite land use. • Offsite land use.
Termination of operations and decommissioning	SMALL: Temporary onsite land use changes during decommissioning are anticipated to be comparable to changes that occur during construction and operations and would not require additional land. Temporary changes in onsite land use would not change the fundamental use of the reactor site. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative	LARGE: Plant to be constructed on FPL Turkey Point land not previously disturbed; new gas pipeline required to support NGCC. During operations, the site would have been converted to an industrial facility.
New nuclear plant alternative	MODERATE (construction), SMALL (operation): Plant to be constructed on FPL Turkey Point land not previously disturbed; area is undeveloped, consisting primarily of wetlands and native vegetation; during operations, the site would have been converted to an industrial facility.
Combination of alternatives	LARGE (NGCC), MODERATE (Solar PV): NGCC plant and one solar PV plant to be constructed on FPL Turkey Point land not previously disturbed; existing gas pipeline assumed adequate to support NGCC plant operations with addition of a short spur pipeline; off-site solar PV plants require large areas of land, impact can be lessened during site selection by building on previously disturbed land.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 3 of 16)

Visual Resources	
Proposed action	SMALL: Adopting by reference the Category 1 issue finding for aesthetic impacts in 10 CFR Part 51, Subpart A, Appendix B, Table B-1.
Termination of operations and decommissioning	SMALL: Terminating nuclear power plant operations would not change the visual appearance of the nuclear power plant until demolition of structures. Decommissioning activities would be localized and reduced with implementation of BMPs. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative	SMALL: Construction and operations activities would appear similar to other ongoing onsite activities because the FPL property is already aesthetically altered by the presence of existing power plants.
New nuclear plant alternative	SMALL: Construction and operations activities would appear similar to other ongoing onsite activities because the FPL property is already aesthetically altered by the presence of existing power plants.
Combination of alternatives	SMALL (NGCC) to MODERATE (solar PV): NGCC plant and pipeline construction activities and NGCC plant operations would appear similar to other ongoing onsite activities because the FPL property is already aesthetically altered by the presence of existing power plants; solar PV plant impacts can be lessened during site selection by building on previously disturbed commercial or industrial land, dependent on previous land use.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 4 of 16)

Air Quality	
Proposed action	SMALL: Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, for the following: • Air quality impacts (all plants). • Air quality effects of transmission lines.
Termination of operations and decommissioning	SMALL: After termination of operations, air emissions from the nuclear power plant would continue, but at greatly reduced levels. The most likely impact of decommissioning on air quality is degradation by fugitive dust. Use of BMPs, such as seeding and wetting, can be used to minimize fugitive dust. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative	SMALL (construction); MODERATE (operations): Construction impacts would be temporary; emission estimates during the operations period are as follows[a]: SO_2 = 158 tons per year NO_x = 603 tons per year CO = 1,390 tons per year PM_x = 306 tons per year N_2O = 139 tons per year VOCs = 97 tons per year CO_2 = 5.10 million tons per year
New nuclear plant alternative	SMALL: Construction impacts would be temporary; operations impacts would be minor, with emissions being maintained within federal and state regulatory limits.
Combination of alternatives	SMALL (construction); MODERATE (operations): Construction impacts would be temporary; emission estimates during the operations period are as follows: *NGCC Plant*[a] SO_2 = 149 tons per year NO_x = 571 tons per year CO = 1,330 tons per year PM_x = 290 tons per year N_2O = 132 tons per year VOCs = 92 tons per year CO_2 = 4.84 million tons per year *Solar PV Plants* The solar alternative components would not result in air emissions.

a. More recent FPL operational experience and projected emissions for FPL planning purposes indicate that emissions of a replacement NGCC could be expected to be less than those presented above with the exception of CO_2, which could be approximately 8 percent greater (Table 7.2-1).

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 5 of 16)

Noise	
Proposed action	SMALL: Adopting by reference the Category 1 issue finding for noise impacts in 10 CFR Part 51, Subpart A, Appendix B, Table B-1.
Termination of operations and decommissioning	SMALL: During decommissioning, noise would generally be far enough away from sensitive receptors outside the plant boundaries that the noise would be attenuated to nearly ambient levels and would be scarcely noticeable offsite. Noise abatement procedures could also be used during decommissioning in order to reduce noise. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative	SMALL: Noise impacts from construction activities would be intermittent and last only through the duration of construction; noise impacts during operations would be like those occurring at the other power generation units at Turkey Point.
New nuclear plant alternative	SMALL: Noise impacts from construction activities would be intermittent and last only through the duration of construction; noise impacts during operations would be like those occurring at the other five power generation units at Turkey Point.
Combination of alternatives	SMALL: Noise impacts from construction activities of the NGCC and solar PV plants would be intermittent and last only through the duration of construction; noise impacts during operations would be like those occurring at the other power generation units at Turkey Point.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 6 of 16)

Geology and Soils	
Proposed action	SMALL: Adopting by reference the Category 1 issue finding for geology and soils in 10 CFR Part 51, Subpart A, Appendix B, Table B-1.
Termination of operations and decommissioning	SMALL: Termination of nuclear plant operations is not expected to impact geology and soils. Erosion problems could be mitigated by using BMPs during decommissioning. Site geologic resources would not be affected by decommissioning. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative	SMALL: Construction activities would be localized and minimized with implementation of BMPs; land disturbance activities during operations would be conducted in compliance with a stormwater permit and associated BMPs.
New nuclear plant alternative	SMALL: Construction activities would be localized and minimized with implementation of BMPs; land disturbance activities during operations would be conducted in compliance with a stormwater permit and associated BMPs.
Combination of alternatives	SMALL: Construction activities would be localized and minimized with implementation of BMPs; land disturbance activities during operations would be conducted in compliance with a stormwater permit and associated BMPs.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 7 of 16)

Surface Water	
Proposed action	No impact. Issue is not applicable because FPL utilizes a closed-cycle cooling system for condenser cooling purposes and does not withdraw makeup water from a river.
Termination of operations and decommissioning	SMALL: The NRC concluded that the impacts on water use and water quality from decommissioning would be SMALL for all plants. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative	SMALL (construction); MODERATE to LARGE (pipeline construction); SMALL (operation): Construction impacts would be minimized through implementation of BMPs; a new gas pipeline crossing rivers, streams and wetlands is required to support NGCC operations; the use of reclaimed water for cooling; cooling water blowdown and stormwater discharges to the existing CCS results in no discharges to surface water during operations.
New nuclear plant alternative	SMALL: Construction impacts would be minimized through implementation of BMPs; no surface water will be used during the construction or operation of the new nuclear facility. In addition, no discharges will occur to surface water from the new nuclear facility.
Combination of alternatives	SMALL (construction); MODERATE to LARGE (pipeline construction); SMALL (operation): *NGCC Plant* NGCC component same as for NGCC plant alternative above. *Solar PV Plants* Solar PV plant construction impacts would be minimized through implementation of BMPs. No surface water or water quality impacts are associated with the solar PV plants operation.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 8a of 16)

Groundwater	
Proposed action	SMALL: Adopting by reference the Category 1 issue finding for groundwater contamination and use (non-cooling system impacts), groundwater quality degradation resulting from water withdrawals, and groundwater quality degradation (plants with cooling ponds in salt marshes) in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. SMALL[(a)] [Groundwater use conflicts (plants that withdraw more than 100 gallons per minute)]: The Turkey Point facility is permitted to withdraw a total of 43.06 mgd from the from the Floridan Aquifer and Biscayne Aquifer recovery system for CCS salinity reduction, Unit 5 cooling water, Units 1 through 5 process water, and capture of hypersaline water in the Biscayne Aquifer. It is not anticipated that groundwater withdrawal increases above permitted quantities will be required during the license period; therefore, FPL concludes that impacts from groundwater withdrawals are SMALL and do not warrant additional mitigation measures. SMALL[(a)] [Groundwater quality degradation (plants with cooling ponds at inland sites)]: As discussed in Section 2.2.3, PTN utilizes a closed loop cooling system with the CCS for condenser cooling. Section 2.2.3.2 describes the CCS as composed of cooling canals that receive tidal inflow and outflow from the saline aquifer beneath Biscayne Bay. As shown in Section 3.1, Turkey Point's location is coastal rather than inland. Given that this issue is specific to inland sites and the cooling canals groundwater interface is to a marine aquifer, this issue is not applicable and further analysis is not required. SMALL[(a)] (Radionuclides released to groundwater): Tritium has been measured but no plant-related gamma isotopes or hard-to-detect radionuclides have been detected since initiation of the groundwater monitoring program (prior to 2011).
Termination of operations and decommissioning	SMALL: Decommissioning activities include some that may affect groundwater quality through the infiltration of water used for various purposes (e.g., cooling of cutting equipment, decontamination spray, and dust suppression). BMPs are expected to be employed as appropriate to collect and manage these waters. Groundwater chemistry may change as rainwater infiltrates through rubble. The increased pH could promote the subsurface transport of radionuclides and metals. However, this effect is expected to occur only over a short distance as a function of the buffering capacity of soil. Offsite transport of groundwater contaminants is not expected. (NRC 2013a, Section 4.12.2.1)

a. Category 2 issue requiring site-specific evaluation.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 8b of 16)

Groundwater	
NGCC plant alternative	SMALL: During construction and operations, potable water would be supplied by a local water supply; dewatering activities, if necessary, would be a small impact due to recharge; any required discharge to surface water would be regulated by an FDEP permit; BMPs would minimize impacts to groundwater quality as a result of stormwater runoff during construction and operation.
New nuclear plant alternative	SMALL: During construction and operations, potable water would be supplied by a local water supply; dewatering activities, if necessary, would be a small impact due to recharge; any required discharge to surface water would be regulated by an FDEP permit; BMPs would minimize impacts to groundwater quality as a result of stormwater runoff during construction and operation.
Combination of alternatives	SMALL: During construction and operations of the NGCC plant, dewatering activities, if necessary, would be a small impact for the NCGG due to recharge; any required discharge to surface water would be regulated by an FDEP permit; BMPs would minimize impacts to groundwater quality caused by stormwater runoff during construction and operation. No groundwater use or quality issues are associated with the construction and operation of the solar PV component.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 9a of 16)

Terrestrial	
Proposed action	SMALL: Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, for the following: • Exposure of terrestrial organisms to radionuclides. • Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds). • Bird collisions with plant structures and transmission lines. • Transmission line ROW management impacts on terrestrial resources. • Electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock). SMALL[(a)] (Effects on terrestrial resources—non-cooling system impacts): No refurbishment or other license renewal-related construction activities have been identified; adequate management programs and regulatory controls in place to protect onsite important terrestrial ecosystems.
Termination of operations and decommissioning	SMALL: The termination of nuclear power plant operations would reduce some impacts and eliminate others. Impacts from systems that continue operating to support other units (i.e., where the license term for each unit does not end at the same time) on the plant site may continue to affect terrestrial biota, but at a reduced level of impact. Areas disturbed or used to support decommissioning are within the operational areas of the site and are also within the protected area. Please note that this area is not the same as the environmentally protected lands described in Section 4.12. Decommissioning activities conducted within the operational areas are not expected to have a detectable impact on important terrestrial resources. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative	MODERATE (construction), SMALL (operations): Construction results in loss of 75 acres of wetland and coastal plain habitats and construction of new natural gas pipeline; NGCC plant has higher air emissions than a nuclear plant; operation of the cooling towers would cause some deposition of dissolved solids on surrounding vegetation; shadowing and fogging could also damage vegetation in close proximity to the plant; noise from the cooling tower could also impact wildlife species; the cooling towers could also result in avian collisions.

a. Category 2 issue requiring site-specific evaluation.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 9b of 16)

Terrestrial	
New nuclear plant alternative	MODERATE (construction), SMALL (operations): Because a large portion of the proposed new nuclear facility site is wetlands, wetland mitigation would be required; operation of the cooling towers would cause some deposition of dissolved solids on surrounding vegetation; shadowing and fogging could also damage vegetation in close proximity to the plant; noise from the cooling tower could also impact wildlife species; the cooling towers could also result in avian collisions.
Combination of alternatives	MODERATE (onsite NGCC and solar PV construction), SMALL (offsite solar PV construction), SMALL (operations): NGCC component same as for NGCC plant alternative above; NGCC plant and one solar PV plant to be constructed on FPL Turkey Point land not previously disturbed; onsite solar PV plant impact can be lessened by building on previously disturbed commercial or industrial land. For offsite solar PV plants, impact can be lessened during site selection by building on previously disturbed land.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 10a of 16)

Aquatic	
Proposed action	SMALL: Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, for the following: • Infrequently reported thermal impacts (all plants). • Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication. • Effects of nonradiological contaminants on aquatic organisms. • Exposure of aquatic organisms to radionuclides. • Effects of dredging on aquatic organisms. • Effects on aquatic resources (non-cooling system impacts). • Impacts of transmission line ROW management on aquatic resources. • Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses. SMALL[(a)](Impingement and Entrainment of Aquatic Organisms [Plants with Once-Through Cooling Systems or Cooling Ponds]): The closed-loop, recirculating Turkey Point CCS neither withdraws nor discharges surface water to any surface water of the United States or the State of Florida. Therefore, impacts from impingement of aquatic organisms are limited to aquatic organisms in the cooling canals, and there are no impacts from impingement on aquatic organisms of Biscayne Bay, Card Sound, or other waters. Therefore, the potential impacts are SMALL and mitigation measures are not warranted. SMALL[(a)] (Thermal impacts on aquatic organisms—plants with once-through cooling systems or cooling ponds): PTN withdraws water from the CCS, which is not classified as waters of the U.S. by the EPA. Therefore, the provisions of Section 316(a) of the CWA do not apply. Ongoing field studies indicate that thermal dynamics in the CCS to not influence Biscayne Bay or Card Sound. Therefore, impacts are anticipated to be SMALL and mitigation measures are not warranted.

a. Category 2 issue requiring site-specific evaluation.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 10b of 16)

Aquatic	
Termination of operations and decommissioning	SMALL: The termination of nuclear power plant operations would reduce some impacts and eliminate others. Impacts from systems that continue operating to support other units (i.e., where the license term for each unit does not end at the same time) on the plant site may continue to affect aquatic biota, but at a reduced level of impact. Some aquatic organisms may have become established in the cooling canal mixing zone because of the warmer winter environment, and these organisms may be adversely affected as the water temperature cools and the original conditions are restored within the body of water. The NRC concluded that for facilities at which the decommissioning activities would be limited to existing operational areas, the potential impacts on aquatic resources would be SMALL. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative	MODERATE (construction); SMALL (operations): Implementation of BMPs would minimize impacts on aquatic ecosystems during construction; impacts to wetlands would be governed under a USACE Section 404 permit. During operations, the NGCC plant would not use groundwater or surface water.
New nuclear plant alternative	SMALL to MODERATE (construction); SMALL (operations): Implementation of BMPs would minimize impacts on aquatic ecosystems during construction; impacts to wetlands would be governed under a USACE Section 404 permit. During operations, the new nuclear facility would not use surface water.
Combination of alternatives	SMALL: Implementation of BMPs would minimize impacts on aquatic ecosystems during NGCC and solar PV plant construction; during operations, less cooling water would be withdrawn; discharges would be governed under an NPDES permit; no impacts would result from the solar PV component operations.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 11a of 16)

Special Status Species	
Proposed action	NO EFFECT: No refurbishment or other license renewal-related construction activities have been identified. The continued operation of the site would have no adverse effects to any federally or state-listed species.
Termination of operations and decommissioning	Site Specific: The termination of nuclear power plant operations would reduce some impacts and eliminate others. Impacts from systems that continue operating to support other units (i.e., where the license term for each unit does not end at the same time) on the plant site may continue to affect aquatic biota, but at a reduced level of impact. As the water temperature in the CCS cools due to termination of operations and the original conditions are restored within the body of water, the potential impact of the cooler temperatures may require a site-specific review. (NRC 2013a, Section 4.12.2.1) The magnitude of impacts could vary widely based on site specific conditions at the time of decommissioning and the presence or absence of special status species and habitats when the alternative is implemented. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative	SMALL to MODERATE (construction); SMALL (operation): A total of 52 federally listed or proposed for listing species occur in Miami-Dade County. In addition, the Turkey Point facility is located within American crocodile critical habitat. Additional federally listed species, such as the manatee, are known to frequent the waters around Turkey Point. Impacts to federally listed species from construction of the NGCC plant would be MODERATE if American crocodile or other federally listed species habitat would be impacted from the activity, SMALL if not impacted. Operations of the NGCC plant would likely not impact federally or state-listed species because these species would not be located within the site after development.
New nuclear plant alternative	SMALL to MODERATE (construction); SMALL (operation): A total of 52 federally listed or proposed for listing species occur in Miami-Dade County. In addition, the Turkey Point facility is located within American crocodile critical habitat. Additional federally listed species, such as the manatee, are known to frequent the waters around Turkey Point. Impacts to federally listed species from construction of the NGCC plant would be MODERATE if American crocodile or other federally listed species habitat would be impacted from the activity, SMALL if not impacted. Operations of the new nuclear facility would likely not impact federally or state-listed species because these species would not be located within the site after development.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 11b of 16)

Special Status Species	
Combination of alternatives	SMALL to MODERATE (NGCC and onsite solar PV construction); SMALL (off-site construction); SMALL (operation): NGCC component and the onsite solar PV plant would be the same as for NGCC plant alternative above; for offsite solar PV plants, the site selection process that would be used to select sites for the solar facilities would have criteria to avoid locations whose development would impact special status species.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 12a of 16)

Historic and Cultural Resources	
Proposed action	NO ADVERSE EFFECT: No license renewal-related refurbishment or construction activities identified; administrative controls ensure protection of cultural resources in the event of excavation activities.
Termination of operations and decommissioning	NO ADVERSE EFFECT: The termination of nuclear plant operations would not affect historic or cultural resources. The NRC conducted an analysis of the potential effects of decommissioning on historic and archaeological (cultural) resources and found that the potential onsite impacts at sites where the disturbance of lands would not go beyond the operational areas would be SMALL. (NRC 2013a, Section 4.12.2.1) The termination of nuclear plant operations would not affect historic or cultural resources; FPL anticipates that decommissioning activities will be in accordance with the GEIS description of decommissioning impacts and would implement administrative controls to ensure protection of cultural resources during decommissioning activities.
NGCC plant alternative	NO ADVERSE EFFECT: There are no records of the presence of any historic or archaeological resources at Turkey Point. The proposed location of the NGCC plant would require a pedestrian cultural resource survey prior to clearing to determine if historic or archaeological sites are present. In addition, if a USACE Section 404 permit is required for the project (including NGCC plant and pipeline), potential NHPA Section 106 consultation with the Florida DHR would be required if cultural resources are impacted by the proposed activities. Because cultural resources, both historic and archaeological, would be avoided or protected during the NGCC plant construction and operations, no adverse impacts are expected.
New nuclear plant alternative	NO ADVERSE EFFECT: There are no records of the presence of any historic or archaeological resources at Turkey Point. The proposed location of the NGCC plant would require a pedestrian cultural resource survey prior to clearing to determine if historic or archaeological sites are present. In addition, if a USACE Section 404 permit is required for the project (including NGCC plant and pipeline), potential NHPA Section 106 consultation with the Florida DHR would be required if cultural resources are impacted by the proposed activities. Because cultural resources, both historic and archaeological, would be avoided or protected during the new nuclear facility construction and operations, no adverse impacts are expected.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 12b of 16)

Historic and Cultural Resources	
Combination of alternatives	NO ADVERSE EFFECT: *NGCC Plant* NGCC component same as for NGCC plant alternative above. *Solar PV Plants* Historic and archaeological resources would be assessed and impacts avoided during the site selection process.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 13a of 16)

Socioeconomics	
Proposed action	SMALL: Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, for the following: • Employment and income, recreation and tourism • Tax revenues • Community services and education • Population and housing • Transportation
Termination of operations and decommissioning	When a nuclear power plant is closed and decommissioned, most of the important socioeconomic impacts will be associated with the plant closure rather than with the decommissioning process (NRC 2002b, Section 4.3.12). SMALL: Terminating nuclear plant operations would have a noticeable impact on socioeconomic conditions in the region around the nuclear power plant. There would be immediate socioeconomic impacts from the loss of jobs. The impacts from the loss or reduction of tax revenue due to the termination of plant operations on community and public education services could range from SMALL to LARGE. (NRC 2013a, Section 4.12.2.1) The tax payments attributable to Units 3 and 4 are a small percentage of the overall tax revenues of Miami-Dade County (Section 3.9.5), and the plant workforce is a small percentage of the workforce population of Miami-Dade County of 1.68 million (Section 3.9.1). Therefore, the loss of jobs and tax revenue from termination of operations would have a small impact on Miami-Dade County. SMALL: Decommissioning itself has no impact on the tax base and no detectable impact on the demand for public services. The impacts of decommissioning on socioeconomics are neither detectable nor destabilizing; therefore, the impacts on socioeconomics are SMALL. (NRC 2002b, Sections 4.3.12.3 and 4.3.12.4)
NGCC plant alternative	SMALL (beneficial) (construction); MODERATE (construction traffic); SMALL (operations); SMALL (operations traffic): The jobs created to complete the construction of the NGCC plant and natural gas connection pipeline would be temporary. This alternative would result in the loss of jobs at Turkey Point, which would translate to a reduction in local economic activity. The increase in traffic would be short-term and noticeable, and could exceed local roadway capacity during peak times given that existing units would remain operational during the construction time period. Traffic impacts associated with the operation of the NGCC plant will be minimal.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 13b of 16)

Socioeconomics	
New nuclear plant alternative	SMALL (beneficial): The construction employment would be short-term and would provide a stimulus to the local economy. Plant operations employment would be long-term and would provide additional stimulus to the local economy. MODERATE (construction traffic): This increase in traffic would increase traffic on the roads and congestion would be noticed by commuters. Increased use of the roads during construction could create some safety and maintenance issues. SMALL (operations traffic): Transportation impacts from the approximate 800 full-time workers may result in some minor traffic delays, equipment and materials deliveries slightly increased, and a minor increase in maintenance truck traffic.
Combination of alternatives	SMALL (beneficial) (construction); MODERATE (construction traffic); SMALL (operations); SMALL (operations traffic): NGCC component same as for NGCC plant alternative above. The jobs created to complete the construction of the solar PV plant would be less than those needed for the NGCC plant and temporary. Traffic impacts associated with the construction of the solar PV plants would be less than the NGCC plant. Very few employees are required for maintenance and operation of the solar PV plants.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 14 of 16)

Human Health	
Proposed action	SMALL: Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, for the following: • Radiation exposures to the public. • Radiation exposures to plant workers. • Human health impact from chemicals. • Microbiological hazards to plant workers. • Physical occupational hazards. SMALL[a] [Microbiological hazards to the public (plants with cooling ponds or canals or cooling towers that discharge to a river)]: Impacts from microbiological (thermophilic) organisms are not likely to occur due to the harsh conditions of the cooling canal environment (Section 4.9.1.4). No mitigation is warranted. SMALL[a] (Electric shock hazards): All in-scope transmission lines are located entirely within FPL property. No induced shock hazards would exist for the general public due to restricted site access. Additionally, Turkey Point transmission lines meet the NESC requirements, and no mitigation is warranted.
Termination of operations and decommissioning	SMALL: The human health impacts from physical, chemical, and microbiological hazards during the termination of plant operations and decommissioning would be SMALL for all plants. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative	SMALL: Compliance with OSHA worker protection rules would control impacts on workers at acceptable levels during construction and operations; air emissions would be subject to regulatory standards that are protective of human health.
New nuclear plant alternative	SMALL: Compliance with OSHA worker protection rules would control impacts on workers at acceptable levels during construction; human health impacts during operation would be similar to PTN. The radiological human health impact would be SMALL due to compliance with NRC regulations and adherence to ALARA principals.
Combination of alternatives	SMALL: Compliance with OSHA worker protection rules would control impacts on workers at acceptable levels during NGCC plant construction and operations; air emissions would be subject to regulatory standards that are protective of human health; impacts from solar PV component would be similar with no expected operational impacts.

a. Category 2 issue requiring site-specific evaluation.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 15 of 16)

Environmental Justice	
Proposed action	There are no known pathways by which disproportionately high and adverse impacts could be imposed on minority or low-income populations from the proposed action.
Termination of operations and decommissioning	Termination of power plant operations and the resulting loss of jobs, income, and tax revenue could have a disproportionate effect on minority and low-income populations (NRC 2013a, Section 4.12.2). Site Specific: The determination of whether the minority or low-income populations are disproportionately highly and adversely impacted by facility decommissioning activities needs to be made on a site-by-site basis because their presence and their socioeconomic circumstances will be site specific (NRC 2002b, Section 4.3.13.3).
NGCC plant alternative	Impacts during construction would be temporary and likely would result in no impacts to minority and low-income populations. There are no known pathways by which disproportionately high and adverse impacts could be imposed on minority or low-income populations from the operation of an NGCC plant alternative.
New nuclear plant alternative	NRC concluded that construction of nuclear Units 6 and 7 would not have a disproportionate impact on minority and low-income populations in their study area. Based on this determination, FPL assumes the new nuclear facility alternative would not have a disproportionate impact on minority and low-income populations in the region.
Combination of alternatives	Impacts during NGCC and solar PV plant construction would be temporary and likely would result in no impacts to minority and low-income populations. There are no known pathways by which disproportionately high and adverse impacts could be imposed on minority or low-income populations from the operation of the combination of energy alternatives.

Table 8.0-2
Environmental Impacts Comparison Detail (Sheet 16 of 16)

Waste Management	
Proposed action	SMALL: Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, for the following: • Low-level waste storage and disposal. • Onsite storage of spent nuclear fuel. • Offsite radiological impacts of spent nuclear fuel and high-level waste disposal. • Mixed-waste storage and disposal. • Nonradioactive waste storage and disposal.
Termination of operations and decommissioning	SMALL: After termination of nuclear plant operations, there would be a period before the beginning of decommissioning when the reactor would be placed in a cold shutdown condition and maintained. The quantities of waste generated would be smaller than the quantities generated during either operations or decommissioning. The impacts associated with the management of LLW, hazardous waste, mixed waste, and nonradioactive and nonhazardous waste during operations and decommissioning would be SMALL. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative	SMALL: Construction-related wastes would be properly characterized and disposed of at permitted offsite facilities; spent catalytic reduction catalysts would make up the majority of the waste during operations; operations-related wastes would be managed and recycled or disposed of at permitted offsite facilities.
New nuclear plant alternative	SMALL: Construction-related wastes would be properly characterized and disposed of at permitted offsite facilities; during operations, nonhazardous, hazardous, and radioactive wastes would be managed in compliance with federal and state regulations and disposed of in permitted facilities.
Combination of alternatives	SMALL: NGCC component same as for NGCC plant alternative above. Construction of the solar PV component of the combination alternative would create sanitary and industrial waste, although it will be in smaller quantities as compared to the NGCC plant. All waste generated at the solar PV plants would be recycled or disposed of at an offsite waste disposal facility.

9.0 STATUS OF COMPLIANCE

The ER shall list all federal permits, licenses, approvals, and other entitlements which must be obtained in connection with the proposed action and shall describe the status of compliance with these requirements. The ER shall also include a discussion of the status of compliance with applicable environmental quality standards and requirements including, but not limited to, applicable zoning and land-use regulations, and thermal and other water pollution limitations or requirements which have been imposed by federal, state, regional, and local agencies having responsibility for environmental protection. [10 CFR 51.45(d)]

9.1 PTN Authorizations

Table 9.1-1 provides a summary of authorizations held by PTN for current plant operations. Authorizations in this context include any permits, licenses, approvals, or other entitlements that would continue to be in place, as appropriate, throughout the period of extended operation given their respective renewal schedules. Table 9.1-2 lists additional environmental authorizations and consultations related to the renewal of the PTN site. FPL routinely interacts with stakeholders and will notify the appropriate state and local agencies to inform them of the proposed action.

Table 9.1-1
Environmental Authorizations for Current PTN Operations (Sheet 1 of 7)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
CILLRWC	Omnibus Low-Level Radioactive Waste Interstate Compact Consent Act (1980; amended in 1985)	Authorization to export waste	None	Updated annually	Export of LLRW outside the region.
EPA & FDEP	Clean Water Act Section 401 [33 USC 1341]	Certification of state water quality standards	PA 03-45E	Final conditions of certification issued 3/29/2016	Discharges during license renewal term.
FAA	14 CFR Part 77 – Safe, Efficient Use, and Preservation of Navigable Airspace	FAA obstruction permit for Units 3 and 4	2009-ASO-4096-OE and 2009-ASO-4094-OE	N/A; pre-construction coordination	FAA obstruction permit for Units 3 and 4.
NRC	10 CFR 72	General license for storage of spent fuel at power reactor sites	General permit	N/A	Storage of power reactor spent fuel and other associated radioactive materials in an ISFSI.
NRC	Atomic Energy Act 10 CFR 50	Licensing of nuclear power plant	DPR-31	7/19/2032	Operation of Unit 3.
NRC	Atomic Energy Act 10 CFR 50	Licensing of nuclear power plant	DPR-41	4/10/2033	Operation of Unit 4.
US District Court	Clean Water Act	Consent decree	70-328-CA	N/A	IWW Construction, Operation, and Maintenance.

Table 9.1-1
Environmental Authorizations for Current PTN Operations (Sheet 2 of 7)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
USDOT	40 CFR 107 Subpart G	Registration	060911 551 091T	None	Hazardous materials shipments.
USACE & FDEP	Clean Water Act of 1976	Section 401/404 permit	Pending	Permit pending	Discharge of dredge and fill materials into waters of the U.S. (Turtle Point and Barge Terminal).
USACE & FDEP	Clean Water Act Section 401 [33 USC 1341]	Certification of State Water Quality Standards	FL0001562 (Section I.E. 15)	Under agency review	Discharges during license renewal term
USACE & FDEP	Resource Conservation and Recovery Act (RCRA) 42 USC 6901	Hazardous waste generator number	FLR000192922	N/A	Small Quantity Hazardous Waste Generator
USFWS	16 USC 1539(a)(1)(A) 50 CFR Parts 13, 17	Endangered species permit to take American crocodile during monitoring	TE092945-2	4/20/2018	Provides authorization to take (capture, examine, weigh, sex, collect tissue samples, mark, radio-tag, radio-track, relocate, release) endangered American crocodile individuals during population monitoring.

Table 9.1-1
Environmental Authorizations for Current PTN Operations (Sheet 3 of 7)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
USFWS	16 USC 703-712	Migratory bird special purpose utility permit	MB697722-0	3/31/2018	Authorizes utilities to collect, transport and temporarily possess migratory birds found dead on utility property, structures, and ROWs for avian mortality monitoring or disposal purposes.
USFWS	Biological Opinion	Effects of operation on the on the endangered American crocodile	41420-2006-FA-0478; 41420-2006-F-0125	Perpetual	Plan to minimize the potential adverse effects of ongoing operations of PTN to the American crocodile.
State of Florida Authorizations					
FDEP Siting Board	FS 403.501-.518	Power plant site certification	PA 03-45E	Final conditions of certification issued 3/29/2016	Construction and operation of a power plant with more than 75 MW of steam generated power and associated facilities.
SFWMD	Fifth Supplemental Agreement	Power plant site certification	N/A	N/A	Implementation of new monitoring plan that includes groundwater, surface water, and ecological monitoring in and around the Turkey Point CCS.

Table 9.1-1
Environmental Authorizations for Current PTN Operations (Sheet 4 of 7)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
FDEP	403.087, FS and FAC 62-4, 62-520, 62-522, 62-528, 62-550, 62-600, 62-601	Operation of Class V, Group 3 domestic wastewater injection (gravity flow) well	0127512-006-UO	Issued 8/14/2012	Operation of IW-1.
FDEP	FAC 62-213	Title V operations permit	025003-021-AV	12/31/2018 Final conditions of certification issued 3/29/ 2016.	Operation of facilities that generate air emissions.
FDEP	FAC Chapters 62-600, 62-601, 62-602, 62-620, 62-640 and 62-699 and Florida Statute Chapter 403	Operation of domestic wastewater treatment facility	FLA013612-003-DW3P	Under agency review	Operation of PTN wastewater treatment facility.
FDEP	Rule 62-620.610(11) FAC; Rule 62-620.340 FAC; Rule 62-620.610(14) FAC	Domestic wastewater	FLA013612 002-DW3P	Under agency review	Discharges during license renewal term.
FDEP	Florida Statutes Chapter 376	Annual storage tank registration	Facility ID: 8622249 Placard No.: 110600	Annual renewal	Operation of above-ground storage tanks.

Table 9.1-1
Environmental Authorizations for Current PTN Operations (Sheet 5 of 7)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
FDEP	Florida Statutes Chapter 377	Annual storage tank registration	Facility ID: 8622251 Placard No.: 110599	Annual renewal	Operation of above-ground storage tanks.
FDEP	Rule 62-620.610(11) FAC; Rule 62-620.340 FAC; Rule 62-620.610(14) FAC	Domestic wastewater annual operating permit	0127512-002-UO	Final conditions of certification issued 3/29/2016	Operation of a domestic wastewater injection well.
FFWCC	FAC 68A-9.002, 68A-27.004	Migratory bird nest removal	LSNR-11-00026C	Annual renewal	Authorization to remove and replace inactive nests of migratory birds.
FFWCC	FAC 68A-9.002, 68A-27.005	Scientific collection permit	LSNR-11-00021B	4/20/18	Scientific collection.
Florida Forest Service	Turkey Point Monitoring Plan (effective 10/12/2009)	Burn permit	1373489	No expiration	Authorization for open fires.
Other States' Authorizations					
Utah Department of Environmental Quality Division of Radiation Control	R313-26 of the Utah Radiation Control Rules	Revision of existing general site access permit		Annual authorization	Transport of radioactive materials into the State of Utah.

Table 9.1-1
Environmental Authorizations for Current PTN Operations (Sheet 6 of 7)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
Tennessee Department of Environment and Conservation Division of Radiological Health	TDEC Rule 1200-2-10.32	Revision of existing Tennessee radioactive waste license for delivery		Annual authorization	Transport of radioactive waste into the State of Tennessee.
Local Authorizations					
MDC DERM	Section 24-18(A)17 Code of Miami-Dade County	Stratospheric ozone protection annual operations permit	APCF-001747-2017/2018	Annual renewal	Use of refrigerants R-12, R-22, R-502 for Robinair Recovery Units, Models 25200, 25200A, 25200B.
MDC DERM	40 CFR 403; Section 24-42.4 Code of Miami-Dade County	Domestic wastewater annual operating permit	DWO-000010-2017/2018	April 14, 2018 Annual renewal	Stabilization treatment facility.
MDC DERM	41 CFR 403; Section 24-42.4 Code of Miami-Dade County	Industrial waste annual operations permit	IW-000003-2017/2018	Annual renewal	Onsite disposal of Class III industrial solid waste consisting of earth and earth-like products, concrete, rock, bricks, and land clearing debris.
MDC DERM	42 CFR 403; Section 24-42.4 Code of Miami-Dade County	IW5 permit (or waiver)	IW-000016-2017/2018	Annual renewal	Hazardous materials or hazardous waste-, large user or generator.

Table 9.1-1
Environmental Authorizations for Current PTN Operations (Sheet 7 of 7)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
MDC DERM	43 CFR 403; Section 24-42.4 Code of Miami-Dade County	Operation of pollution control facility permit	IW5-006229-2017/2018	Annual renewal	Operation of fleet vehicle maintenance facility that generates waste oil, coolant, and used batteries with a solvent wash tank and served by septic tank.
MDC DERM	Chapter 24, Code of Miami-Dade County	Research permit on MDC DERM environmentally endangered lands	2011	6/17/2017	Authorization to conduct ecological monitoring on county-owned environmentally endangered lands.

CFR: Code of Federal Regulations
CILLRWC: Central Interstate Low-Level Radioactive Waste Commission
DOE: U.S. Department of Energy
FAA: Federal Aviation Administration
FAC: Florida Administrative Code
FDEP: Florida Department of Environmental Protection
FFWCC: Florida Fish and Wildlife Conservation Commission
FWS: U.S. Fish and Wildlife Service
MDC DERM: Miami-Dade County Department of Environmental Resources Management
NPS: National Park Service
NRC: U.S. Nuclear Regulatory Commission
SFWMD: South Florida Water Management District
USACE: U.S. Army Corps of Engineers
USDOT: U.S. Department of Transportation

Table 9.1-2
Environmental Authorizations and Consultations for PTN License Renewal

Agency	Authority	Requirement	Remarks
U.S. Nuclear Regulatory Commission	Atomic Energy Act [42 USC 2011 et seq.]	License renewal	Applicant for federal license must submit an ER in support of license renewal application.
U.S. Fish and Wildlife Service	Endangered Species Act Section 7 [16 USC 1636]	Consultation	Requires federal agency issuing a license to consult with the USFWS, and NMFS if applicable, regarding federally protected species.
National Marine Fisheries Service	Endangered Species Act Section 7 [16 USC 1636]	Consultation	Requires federal agency issuing a license to consult with the USFWS, and NMFS if applicable, regarding federally protected species.
Florida Department of State Historic Preservation Office	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
Miccosukee Tribe of Indians of Florida	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
Poarch Band of Creek Indians	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
Seminole Tribe of Florida	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
The Choctaw Nation of Oklahoma	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
Muscogee (Creek) Nation	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
Seminole Nation of Oklahoma	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.

9.2 Status of Compliance

Turkey Point has established control measures in place to ensure compliance with the authorizations listed in Table 9.1-1, including monitoring, reporting, and operating within specified limits. Turkey Point environmental compliance coordinators are responsible for monitoring and ensuring that the site complies with its environmental permits and applicable regulations. Monitoring and sampling results associated with environmental programs are submitted to appropriate agencies, as specified in the permits and/or governing regulations.

9.2.1 Site Certification

The Florida PPSA, ss. 403.501-.518, F.S., is the state's centralized process for licensing large power plants. One license, a certification, replaces many of the local and state permits. Local governments and state agencies within whose jurisdiction the power plant is to be built participate in the process. However, additional state and local permits may be required that do not fall under the umbrella of site certification. Certification addresses permitting, land use and zoning, and property interests. A certification grants approval for the location of the power plant and its associated facilities such as a natural gas pipeline supplying the plant's fuel, rail lines for bringing coal to the site, and roadways and electrical transmission lines carrying power to the electrical grid, among others (FDEP 2017g).

Turkey Point Units 3 through 5 are licensed under the Florida PPSA, Chapter 403, Part II, F.S. Those units operate in accordance with the conditions of certification in their license, PA 03-45E. The Florida PPSA process provides a certification that encompasses many licenses and permits needed for affected Florida state, regional, and local agencies. It also includes any regulatory activity applicable under these agencies' regulations for PTN. COC X requires FPL to execute a fifth supplemental agreement with the SFWMD and to revise FPL's monitoring obligations, which resulted in the Turkey Point groundwater, surface water, and ecological monitoring plan, as amended (2009 monitoring plan) incorporated as Exhibit A to the fifth supplemental agreement between the SFWMD and FPL entered on October 16, 2009 (FDEP 2016b). On March 29, 2017, the State of Florida approved an amendment to the final conditions of certification to FPL authorizing the average daily withdrawal of the 28.06 MGD from the upper production zones of the Floridan Aquifer (FDEP 2016a). The final conditions of certification issued are binding and subject to the requirements listed in the Florida PPSA.

9.3 Notices of Violation

In April 2013, the SFWMD sent a letter to FPL indicating that the district had completed its technical analysis of data associated with implementation of the comprehensive pre-uprate monitoring report. The letter also provided notice to FPL to begin consultation with the SFWMD to identify measures to mitigate, abate, or remediate the movement of CCS saline water. Following the issuance of this letter, FPL began active consultation with the FDEP, SFWMD, and MDC DERM. The result of that consultation was an AO issued by the FDEP in December 2014 directing FPL to develop a salinity management plan to lower salinity in the CCS, among other requirements. (FDEP 2014b)

The AO was challenged by several parties, including MDC DERM. On October 2, 2015, MDC DERM issued an NOV to FPL for alleged violations of county water quality standards and criteria in groundwater. At the time the NOV was issued, FPL was working with MDC DERM to address its challenge to the AO. On October 7, 2015, MDC DERM entered into a CA (2015 CA) with FPL, which acknowledged FPL's plans to reduce salinity in the CCS, and required FPL to implement actions to intercept, capture, contain, and retract hypersaline groundwater west and north of the Turkey Point CCS boundary. It also required FPL to conduct additional monitoring and reporting. As a result, MDC DERM dropped its challenge to the AO. (MDC 2015)

The 2015 CA addresses MDC DERM’s October 2015 NOV and defines actions that FPL must take. The principal specific objectives of the 2015 CA are for FPL: (1) to demonstrate a statistically valid reduction in salt mass and volumetric extent of the hypersaline water in groundwater west and north of FPL’s property without creating adverse environmental impacts and (2) to reduce the rate of and arrest migration of hypersaline groundwater. Frequent meetings and correspondence between FPL and MDC DERM document the continued implementation of the CA. (MDC 2015)

The 2015 CA acknowledged the abatement activities that FPL was undertaking to lower the salinity of the CCS, thus reducing the movement of hypersaline water into the groundwater. The 2015 CA also recognized that factors beyond FPL’s control may influence movement of groundwater in the surficial aquifer, and FPL must take into account such factors when developing and implementing remedial actions to minimize the timeframe for achieving compliance with the 2015 CA. FPL is moving forward with the implementation of the activities required by the 2015 CA. The 2015 CA also required FPL to consider alternative water sources to reduce chloride concentration, including, e.g., reclaimed water from Miami-Dade County. (MDC 2015)

The remaining challenges to the AO led to an administrative hearing in which the administrative law judge issued a recommended order to rescind or modify the AO. In response to that recommended order, the FDEP modified and issued the AO as a final AO on April 21, 2016. (FPL 2017c)

On April 25, 2016, the FDEP issued an NOV (the FDEP NOV) regarding the hypersaline groundwater to the west of the CCS and a warning letter identifying concerns related to water quality in deep artificial channels in four specific areas immediately adjacent to the east and south of the CCS. The FDEP NOV directed FPL to enter into consultations to develop a CO to develop corrective actions to reduce the CCS contribution to the hypersaline plume and to reduce the size of the hypersaline plume. On June 20, 2016, a CO (2016 CO) was executed between FPL and the FDEP. The 2016 CO and FPL’s compliance with its requirements incorporate the issues and requirements identified in the final AO, as well as the FDEP NOV and the warning letter. As such, the 2016 CO supersedes all requirements of the final AO and rescinds the AO. (FDEP 2016b)

The primary objectives of the 2016 CO are to: (1) cease discharges from the CCS that impair the reasonable and beneficial use of the adjacent G-II groundwaters west of the CCS; (2) prevent releases of groundwater from the CCS to surface waters connected to Biscayne Bay that result in exceedances of surface water quality standards in Biscayne Bay by undertaking restoration projects at Turtle Point and Barge Basin; and (3) provide mitigation to address impacts due to historic operation of the CCS. To meet the first objective, the CO requires FPL to achieve an average annual salinity of 34 PSU by the end of the fourth year of freshening activities. If FPL is unable to meet this target, it must submit a plan to FDEP within 30 days with additional measures that it will implement to meet the target. FPL is moving forward with the implementation of the activities required by the 2016 CO activities including continued implementation of the nutrient management plan and thermal efficiency plan; complete construction of the RWS (Section 3.6.3.2.1) and commence full operation; initiate construction of Barge Basin and Turtle Point Canal restoration projects; and prepare and submit the annual monitoring reports. (FDEP 2016b)

On August 15, 2016, MDC DERM and FPL executed an addendum to the October 2015 CA (2016 CAA). The 2016 CAA requires FPL to take action to address MDC DERM's alleged violations of water quality standards and cleanup target levels relating to the exceedance of ammonia in deep remnant canals adjacent to the Turkey Point CCS. The 2016 CAA required FPL to prepare and submit a SAP to MDC DERM to allow for the identification of source(s) of the ammonia exceedances and the delineation of the vertical and horizontal extent of the subject ammonia exceedances in surface water. Additionally, the SAP was required to adequately address the ammonia exceedances to the surface waters surrounding the facility, including but not limited to, waters tidally connected to Biscayne Bay. (MDC 2016a)

Following MDC DERM approval, and FPL's implementation of the SAP, the 2016 CAA required FPL to prepare and submit a SAR addressing the requirements of the approved SAP, and further submit to MDC DERM a corrective action plan consisting of an environmental restoration plan to correct the exceedances of ammonia; details of proposed process modifications or changes in operational systems to manage and control the source(s) of ammonia to prevent future ammonia exceedances; and physical, structural, or hydraulic modifications to the area of the CCS to eliminate contributions of CCS water to surface water, including a timetable for implementation and completion of the corrective action plan. (MDC 2016a)

There have been no other federal (i.e., agencies other than the NRC), state, or local regulatory NOVs issued to the facility since the last license renewal.

9.4 Remediation Activities

Cooling Canal System

The actions FPL has taken over the last few years have resulted in improved conditions within the CCS. Most notably, FPL has observed improvements in thermal efficiency of the CCS as a direct result of sediment management activities. FPL has also been able to better control water salinity concentrations and algae that can result from significant drought conditions. (FPL 2017c)

Since operations of the underground injection well testing phase of the RWS began on September 28, 2016, as of June 30, 2017, approximately 3.7 BG of hypersaline groundwater from beneath the CCS have been extracted and disposed of in the naturally saline Boulder Zone formation located 3,200 feet below the surface. This amounts to approximately 890,000 tons of salts removed from the Biscayne Aquifer beneath the CCS. Construction of the ten RWS extraction wells began in June 2017 and the wells are expected to begin operations in early 2018. Groundwater models of the RWS indicate the westward migration of the hypersaline plume will be stopped in three years of operation, with retraction of the hypersaline plume north and west of the CCS beginning in 5 years. Retraction of the plume back to the FPL site boundary is projected in 10 years. (FPL 2017c)

As noted above, the extracted groundwater is disposed of in a deep injection well in the Boulder Zone under FDEP Permit No. 293962-002-UC. The FDEP has permitted FPL and others to discharge treated sewage and other wastes through injection wells into the Boulder Zone. The Boulder Zone is located in the Lower Floridan Aquifer and is overlaid by a confining layer that prevents upward migration of the water (see Section 3.6.2 for detailed description of the aquifers underlying PTN). The competency of the middle confining layer at the Turkey Point site was recently evaluated and confirmed by the NRC staff as part of the PTN Units 6 and 7 licensing proceeding (ASLB 2017; NRC 2016a, Section 5.2.13; NRC 2016d, Section 11.2.4).

FPL has determined that Upper Floridan Aquifer water wells are the best choice of water supply for meeting its CCS freshening objective. Operation of the 14 MGD Upper Floridan Aquifer freshening well system began on November 28, 2016. The brackish water from the Floridan wells (2.5 PSU compared to bay salinity at 34 PSU) is being used to help reduce the CCS salinity to an average annual level of 34 PSU, essentially equivalent to the salinity of the bay. The addition of this water was instrumental in minimizing the increase in salinity that ordinarily occurs during the dry season. Continued operation of the freshening wells during the wet season will further reduce CCS salinities, achieving progress towards the overall goal of 34 PSU. (FPL 2017c)

Deep Canal Ammonia

The SAP was submitted to the MDC DERM on September 14, 2016 and approved for implementation on December 21, 2016. The SAR was submitted on March 17, 2017 and concluded that the CCS is not the source of the measured elevated ammonia samples collected at some of the adjacent remnant canals connected to Biscayne Bay. (FPL 2017d)

The data collected during the SAR investigation indicate the presence of elevated ammonia values in excess of MDC DERM surface water standards is not the result of point or non-point source contamination attributable to the Turkey Point site. Rather, the report concluded the occurrence of elevated ammonia is the result of the conversion of organic nitrogen sourced from organic wetland soils, decomposition of wetland and aquatic plant material, atmospheric nitrogen fixation, and natural microbial processes in anoxic, stagnant surface and groundwater environments similar to numerous other such occurrences documented along the coastal Biscayne Bay region. Therefore, FPL concludes that additional assessment work associated with the 2016 CAA is not warranted based on the SAP results. There is no evidence of any sources of ammonia being caused by FPL that warrant a corrective action plan by FPL. (FPL 2017d)

9.5 Federal, State, and Local Regulatory Standards: Discussion of Compliance

This section contains information regarding environmental programs identified in the 2013 GEIS that may or may not be applicable to the site, and current status of compliance with each program.

9.5.1 Atomic Energy Act

9.5.1.1 Radioactive Waste

As discussed in Section 2.2.6, PTN utilizes liquid, gaseous, and solid radioactive waste-management systems to collect and treat radioactive materials produced from the plants' generation. As a generator of both LLRW and spent fuel, PTN is subject to and complies with provisions and requirements of the Low-Level Radioactive Waste Policy Amendment Act of 1985 and the Nuclear Waste Policy Act of 1982, as subsequently amended.

PTN also complies with permits issued by (1) the Central Interstate Low-Level Radioactive Waste Commission for exporting radioactive waste outside the region; (2) the Mississippi Emergency Management Agency for transportation of radioactive material into, within, or through the state of Mississippi; and (3) the Tennessee Department of Environment and Conservation for shipping radioactive material to a licensed disposal/processing facility within the state of Tennessee.

9.5.2 Clean Air Act

9.5.2.1 Air Permit

PTN has a permit to operate backup diesel generators, diesel generator engines, and one diesel pump (FDEP 2014a).

Operation of these air emission sources is maintained within the emissions, opacity, fuel sulfur content, and fuel usage (as applicable) limits established in the station air permit issued by the FDEP. As required by the air permit, reports are submitted annually and semiannually to the FDEP. Due to its co-location with the Turkey Point Fossil Plant, PTN is considered a Title V major emission source. PTN is in compliance with this permit.

9.5.2.2 Chemical Accident Prevention Provisions [40 CFR Part 68]

PTN is not required to have a risk management plan under 40 CFR Part 68 because the amount of regulated chemicals present on site does not exceed the threshold quantities specified in 40 CFR 68.130 (FDEP 2014a).

9.5.2.3 Stratospheric Ozone [40 CFR 82]

Under Title VI of the CAA, the EPA is responsible for several programs that protect the stratospheric ozone layer. Regulations promulgated by the EPA to protect the ozone layer are contained in 40 CFR Part 82. Refrigeration appliances and motor vehicle air conditioners are regulated under Sections 608 and 609 of the CAA, respectively. A number of service practices, refrigerant reclamation, technician certification, and other requirements are covered by these programs. PTN is in compliance with Section 608 of the CAA as amended in 1990 and the implementing regulations codified in these regulations. The program to manage stationary refrigeration appliances at PTN is described in the FPL administrative procedure "Title VI: Stratospheric Ozone Protection" (PTN 2017c).

Because motor vehicle air conditioners are not serviced on site, Section 609 of the CAA is not applicable.

9.5.2.4 Stratospheric Ozone [Section 24-18(A)17 of the Miami-Dade County Code]

Section 24-18(A)17 of the Miami-Dade County Code requires that a stratospheric ozone protection permit be obtained to ensure that individuals meet and maintain the required training and certification and that they utilize the required recovery and recycling equipment and approved practices to prevent venting of ozone-depleting compounds (ODCs) to the environment. A permit is required to:

- Purchase, sell, offer to sale, let, or allow the distribution of regulated ODCs as defined in 24-5 of Chapter 24, the Environmental Code of Miami-Dade County. Regulated ODCs include, but are not limited to, Freon (R-12 and R-22), halon, and various other compounds defined by the EPA as having ozone-depleting potential.

- Perform installation, evacuation, recharge, repair, salvage, and maintenance services on any appliance or system containing regulated ODCs. Examples of these appliances or systems include, but are not limited to, mobile (automotive and freight) and stationary (wall and central) air-conditioning units, refrigerators, freezers, and fire extinguishing systems.

- Handle, recover, or recycle regulated ODCs from any appliance or system.

PTN operates under MDC DERM stratospheric ozone protection permit number APCF-001747 (Table 9.1-1). PTN is in compliance under Section 24-18(A)17 of the Miami-Dade County Code and maintains fleet procedures to ensure compliance (PTN 2017c).

9.5.3 Clean Water Act

9.5.3.1 Section 10/404 Permitting

PTN is currently seeking authorization through the FDEP and USACE for fill activities in the Barge Basin and Turtle Point. The canal was previously dredged to approximately -20 to -28 feet NAVD88 during the original construction of the plant to allow once-through cooling water from Units 1 and 2 to be discharged to the bay. The construction of the CCS replaced the need for the original cooling water discharge. Cooling water is no longer discharged, and the remnant canal has been plugged. The remnant canal and the adjacent area of scour are proposed to be backfilled to improve water quality in Biscayne Bay (FPL 2016d). PTN will comply with all regulatory requirements imposed by the FDEP and USACE as they relate to performing activities in federal jurisdictional waters.

9.5.3.2 Water Quality (401) Certification

Federal CWA Section 401 requires that applicants for a federal license to conduct an activity that might result in a discharge into navigable waters provide the licensing agency with a certification from the state that the discharge will comply with applicable CWA requirements (33 USC 1341). FPL is applying to the NRC for a license (i.e., license renewal) to continue PTN operations. PTN discharges to the CCS, which is not considered waters of the U.S.

FPL received confirmation of 401 certification in a letter from the FDEP to the USACE dated March 9, 2012 (FDEP 2012). The operating agreement between the FDEP and participating agencies identifies the final order issued as part of the PPSA as the 401 certification for the authorized power plant. Therefore, PTN has fulfilled the regulatory requirement to provide certification by the state.

9.5.3.3 NPDES Permit

FPL operates the CCS (IWW facility) under NPDES/IWW permit number FL0001562. This permit is issued pursuant to the federal NPDES program and Florida IWW permitting program. The permit authorizes wastewater discharges from the generating units through two internal outfalls into the CCS. The permit does not authorize direct discharges to surface waters of the state. The permit authorizes discharges from the CCS into Class G-III groundwater, which is part of the surficial aquifer system. Condition IV.1 of the permit provides that discharges to groundwater shall not cause a violation of the minimum criteria for groundwater specified in Rules 62-520.400 FAC, 62-520.430 FAC, and 62-520.400 FAC provide that discharges to groundwater shall not impair the reasonable and beneficial use of adjacent waters, either ground or surface (FDEP 2005).

9.5.3.4 Stormwater Permit

Plant stormwater is recycled to the CCS (IWW facility), which is an FDEP-permitted wastewater treatment facility. PTN has no intake or direct discharge to surface waters and therefore is designated as a zero-discharge facility under the NPDES permit. The NPDES permit requires monitoring of water quality at the internal outfalls that handle facility wastewater. The state IWW/NPDES permit is incorporated into the conditions of certification (State of Florida 2016)

9.5.3.5 Sanitary Wastewaters

As previously discussed in Section 2.2.7, PTN is equipped with its own sewage treatment plant. Sanitary waste from showers, water closets, toilets, etc. is routed to county-approved onsite septic systems for the fossil and land management facilities. The nuclear units' domestic wastewater is routed to an onsite, county and state approved, contact stabilization sewage treatment plant. Sanitary wastewater from PTN is regulated by PTN's MDC DERM permit number DWO-00010-99 (DERM 2017).

FPL complies with monthly reporting requirements to the FDEP to ensure compliance with permit conditions.

9.5.3.6 Spill Prevention, Control, and Countermeasures

The EPA's Oil Pollution Prevention Rule became effective January 10, 1974, and was published under the authority of Section 311(j)(1)(C) of the Federal Water Pollution Control Act. The regulation has been published in 40 CFR Part 112, and facilities subject to the rule must prepare and implement an SPCC plan to prevent any discharge of oil into or upon navigable waters of the United States or adjoining shorelines. PTN is subject to this rule and has a written SPCC plan that identifies and describes the procedures, materials, equipment, and facilities that are utilized at the station to minimize the frequency and severity of oil spills to meet the requirements of this rule.

9.5.3.7 Reportable Spills [40 CFR Part 110]

PTN is subject to the reporting provisions of 40 CFR Part 110 as it relates to the discharge of oil in such quantities as may be harmful pursuant to Section 311(b)(4) of the Federal Water Pollution Control Act. Any discharges of oil in such quantities that may be harmful to the public health or welfare or the environment must be reported to the EPA's national response center. Based on a review of records over the previous 5 years (2012–2016), there have been no releases at PTN that have triggered this notification requirement.

9.5.3.8 Reportable Spills [FAC 62-780.110]

PTN is also subject to the reporting provisions of FAC 62-780.110, and under the conditions of certification Attachment 4. This reporting provision requires that any release of oil having the potential to significantly pollute surface or groundwaters and which are not confined to a building or similar structure reported to the FDEP, the coordinator of emergency services of the locality that could reasonably be expected to be impacted, and appropriate federal authorities. Based on a review of records over the previous 5 years (2011–2016), there have been no releases at PTN that have triggered this notification requirement .

9.5.3.9 Facility Response Plan

PTN is not subject to the facility response plan risk requirements described in 40 CFR 112.20 because the facility does not transfer oil over water to or from vessels and does not store oil in quantities greater than 1 million gallons.

9.5.4 Safe Drinking Water Act

9.5.4.1 Safe Drinking Water Act

As discussed in Section 2.2.3, potable water for PTN is obtained from the Miami-Dade Rex system, which is part of the county's public water supply system. This water is used for plant processes, potable water, and for the plant fire protection program.

A new replacement water treatment plant, which supplies pure water for steam-related use, was completed in 2017. The new plant has the ability to treat either potable water or Upper Floridan Aquifer well water (as does the Unit 5 treatment plant). Injection wells on the Turkey Point site are permitted through the FDEP and do not endanger drinking water sources. Compliance with these permits (Table 9.1-1) ensures compliance under the Safe Drinking Water Act.

9.5.5 Endangered Species Act

Potential impacts on federally and state-listed species were considered in FPL's review and analysis in Section 4.6.6, and it was concluded that none would likely be adversely affected as a result of SLR.

Section 7 of the ESA requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of species that are listed, or proposed for listing, as endangered or threatened. Depending on the action involved, the ESA requires consultation with the USFWS, and with the NMFS if marine or anadromous species could be affected. Although FPL has invited comment from the USFWS and NMFS (Attachment B), a more structured consultation process with these agencies may be initiated by the NRC per Section 7 of the ESA.

9.5.6 Migratory Bird Treaty Act

The MBTA makes it unlawful to pursue, hunt, take, capture, kill, or sell birds listed and grants protection to any bird parts including feathers, eggs, and nests. FPL maintains state and federal avian permits, included in Table 9.1-1.

9.5.7 Bald and Golden Eagle Protection Act

The BGPA prohibits the take, transport, sale, barter, trade, import and export, and possession of eagles, making it illegal for anyone to collect eagles and eagle parts, nests, or eggs without a USFWS permit. Bald eagles are known to use the Turkey Point site; therefore, consultation with the USFWS is conducted prior to new activities and maintenance activities to ensure compliance with the BGPA. There are currently no BGPA permitting requirements associated with PTN operations.

9.5.8 Magnuson-Stevens Fishery Conservation and Management Act

As discussed in Section 3.7.8.3, according to the 2009 EFH Final Amendment, potential EFH exists within the proposed project area for the following species:

- Adult and juvenile gray snapper (*Lutjanus griseus*)
- All life stages of dog snapper (*L. jocu*)
- Juvenile mutton snapper (*L. analis*)
- All life stages of bluestriped grunt (*Haemulon sciurus*)
- Adult white grunt (*H. plumieri*)

- Juvenile and adult spiny lobster (*Panulirus argus*)
- All life stages of pink shrimp (*Farfantepenaeus duorarum*)

FPL has invited comment from the NMFS. Attachment B includes a copy of FPL correspondence with the DNR regarding potential effects that PTN SLR might have on EFH and HAPCs.

9.5.9 Marine Mammal Protection Act

The Marine Mammal Protection Act prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the United States. There are currently no Marine Mammal Protection Act permitting requirements associated with PTN operations.

9.5.10 Coastal Zone Management Act

The federal Coastal Zone Management Act [16 USC 1451 et seq.] imposes requirements on applicants for a federal license to conduct an activity that could affect a state's coastal zone. The act requires the applicant to certify to the licensing agency that the proposed activity would be consistent with the state's federally approved coastal zone management program [16 USC 1456(c)(3)(A)]. NOAA has promulgated implementing regulations indicating that the requirement is applicable to renewal of federal licenses for activities not previously reviewed by the state [15 CFR 930.51(b)(1)]. The regulation requires the license applicant to provide its certification to the federal licensing agency and a copy to the applicable state agency [15 CFR 930.57(a)].

The NRC's Office of Nuclear Reactor Regulation has issued guidance to its staff regarding compliance with the act. This guidance acknowledges that Florida has an approved coastal zone management program (NRC 2013c). The entire state of Florida is designated as a coastal zone; therefore, Turkey Point is located within the Florida coastal zone.

FPL received confirmation of coastal zone certification in a letter dated March 9, 2012, from the FDEP to the USACE (FDEP 2012). The operating agreement between the FDEP and participating agencies identifies the final order issued as part of the PPSA as the CZMA consistency for the authorized power plant. Therefore, PTN has fulfilled the regulatory requirement to certify to the licensing agency that the proposed activity would be consistent with the state's federally approved coastal zone management program.

9.5.11 National Historic Preservation Act

Potential impacts on historic properties were considered in FPL review and analysis in Section 4.7.4.2, and it was concluded that no eligible historic properties are present on the Turkey Point site. As previously discussed in Section 3.8.6, administrative controls are in place for management of cultural resources ahead of any future ground-disturbing activities at the plant. These controls ensure that existing or potentially existing cultural resources are adequately protected, and assist PTN in meeting state and federal expectations.

Section 106 of the NHPA (16 USC 470 et seq.) requires federal agencies having the authority to license any undertaking, prior to issuing the license, to take into account the effect of the undertaking on historic properties and to afford the Advisory Council on Historic Preservation an opportunity to comment on the undertaking. Council regulations provide for establishing an agreement with any SHPO to substitute state review for council review (35 CFR 800.7). Although not required of an applicant by federal law or NRC regulation, FPL has invited comment from the Florida SHPO. Attachment C includes a copy of FPL correspondence with the Florida SHPO regarding potential effects that PTN SLR might have on historic or cultural resources. In accordance with Section 101(d)(2) of the NHPA (P.L. 102-575), FPL has chosen to initiate consultation with SHPO-identified tribal historic preservation officers (THPOs), designated representatives of tribes with no THPO, and with Indian tribes that may attach religious and cultural significance to historic properties within Florida.

9.5.12 Resource Conservation and Recovery Act

9.5.12.1 Nonradioactive Wastes

As a generator of hazardous and nonhazardous wastes, PTN is subject to and complies with RCRA and specific FDEP regulations contained in the site certification conditions of certification. PTN is classified as a small quantity generator of hazardous wastes (EPA 2017d). As a generator of hazardous wastes, PTN also maintains a hazardous waste generator identification number (Table 9.1-1). PTN has not received any violations for hazardous waste management in the past 5 years based on a review of its compliance history (EPA 2017d).

For most hazardous waste records, the regulations require that records be retained for at least 3 years from the date the hazardous waste, for which the record pertains, is last shipped offsite. It is an FPL fleet procedure to maintain most records for 3 years in accordance with the FPL non-radiological environmental protection program administrative guidance.

9.5.12.2 Reportable Spills [40 CFR Part 262]

PTN is subject to the reporting provisions of 40 CFR 262.34(d)(5)(iv)(C) as it relates to a fire, explosion, or other release of hazardous waste which could threaten human health outside the facility boundary or when the facility has knowledge that a spill has reached surface water. Any such events must be reported to the EPA's national response center.

Based on a review of records over the previous 5 years (2012–2016), there have been no releases at PTN that have triggered this notification requirement (EPA 2017e).

9.5.12.3 Mixed Wastes

Radioactive materials are regulated by the NRC under the AEA of 1954, and hazardous wastes are regulated by the EPA under the RCRA of 1976. Management of radioactive waste at PTN is discussed in Section 2.2.6. FPL has developed guidance documents for managing its hazardous waste streams, including mixed wastes. In addition, FPL inspects its waste management areas for compliance. FPL's management of its waste streams is in compliance with applicable regulatory standards and has not resulted in any NOVs for the 2012–2016 timeframe (EPA 2017e). FPL would continue to store and dispose of hazardous and nonhazardous waste in accordance with EPA and state regulations and dispose of the wastes in appropriately permitted treatment and disposal facilities during the SLR term. As indicated in the 2013 GEIS, PTN will continue existing systems and procedures to ensure proper storage and disposal.

9.5.12.4 Underground Storage Tanks [FAC 62-761]

FPL no longer utilizes underground storage tanks at Turkey Point. The six tanks previously utilized on the site have been removed (FDEP 2015).

9.5.12.5 Reportable Spills [§Site Certification]

FPL no longer utilizes underground storage tanks at Turkey Point; therefore, PTN is not subject to reporting requirements for the release of regulated substances from underground storage tanks.

9.5.13 Pollution Prevention Act

In accordance with RCRA Section 3002(b) and 40 CFR 262.27, a small or large quantity generator must certify that a waste minimization program is in place to reduce the volume and toxicity of the waste generated to the degree determined to be economically practical. As previously discussed in Section 4.11.5.4, PTN is meeting this requirement as procedural measures are in place to minimize hazardous waste generated to the maximum extent practical.

9.5.14 Federal Insecticide, Fungicide, and Rodenticide Act

Commercially approved herbicides may be used to maintain linear facilities connecting the collector yard to the switch yard. Maintenance must be performed in accordance with the SCA and any state and federal regulations concerning the use of herbicides. FPL must notify the FDEP Southeast District of the Department of Siting Coordination Office of the type of herbicides to be used at least 60 days prior to their first use (FDEP 2016a).

9.5.15 Toxic Substances Control Act

The Toxic Substances Control Act of 1976 regulates PCBs [40 CFR Part 761] and asbestos [40 CFR Part 763], both of which may be present at PTN. FPL procedure 0-ENV-601 provides guidance for asbestos removal to ensure compliance with state and federal regulations. PTN is in compliance with the PCB and asbestos regulations applicable to the facility.

9.5.16 Hazardous Materials Transportation Act

Because PTN ships offsite the hazardous materials regulated by the USDOT, the facility is subject to and complies with the applicable requirements of the Hazardous Materials Transportation Act described in 49 CFR, including the requirement to possess a current hazardous materials certificate of registration (Table 9.1-1).

9.5.17 Emergency Planning and Community Right-to-Know Act

9.5.17.1 Section 312 Reporting [40 CFR Part 370]

PTN is subject to and complies with Section 312 of the Emergency Planning and Community Right-to-Know Act, which requires the submission of an emergency and hazardous chemical inventory report (Tier II) to the local emergency planning commission, the state emergency response commission, and the local fire department. This report, which typically includes, but is not limited to, chemicals such as ammonium hydroxide, boric acid, CO_2, diesel fuel, electrohydraulic fluid, ethylene glycol, gasoline, hydrazine, hydrogen, lube oils, Nalco products, nitrogen, sodium hydroxide, and sulfuric acid, is submitted to these agencies annually.

9.5.17.2 Section 313 Reporting [40 CFR Part 372]

Because PTN is located on the same property as Turkey Point Units 1, 2, and 5, and the facilities are owned by the same entity, the facilities are designated as one "complex." By default, this subjects PTN to the Section 313 Toxic Release Inventory reporting requirements. Although reporting under this requirement may not be applicable in certain calendar years given, PTN is in compliance with the Section 313 Toxic Release Inventory reporting requirements.

9.5.18 Comprehensive Environmental Response, Compensation, and Liability Act

PTN is subject to the hazardous substance release and reporting provisions of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as subsequently amended. Any release of reportable quantities of listed hazardous substances to the environment requires a notification to the EPA's national response center, the FDEP, and subsequent written follow-up within 15 days of the release. Based on a review of records over the previous 5 years (2012–2016), no releases at PTN have triggered this notification requirement. PTN has not received any NOVs for hazardous waste management in the past 5 years based on a review of its compliance history (EPA 2017f).

9.5.19 Farmland Protection Policy Act

The FPPA only applies to federal programs. The term "federal program" under this act does not include federal permitting or licensing for activities on private or non-federal lands. Therefore, because license renewal is considered a federal licensing activity and PTN is located on non-federal lands, the FPPA is not applicable.

9.5.20 Federal Aviation Act

Coordination with the Federal Aviation Administration (FAA) is required when it becomes necessary to ensure that the highest structures associated with the project do not impair the safety of aviation. Submission of a letter of notification (with accompanying maps and project description) to the FAA would result in a written response from the FAA certifying that no hazard exists or recommending project changes and/or the installation of warning devices such as lighting. PTN was originally authorized under FAA permit numbers 2009-ASO-4093-OE and

2009-ASO-4094-OE. The Turkey Point property is currently authorized under FAA permit numbers 2015-ASO-11359-OE (Unit 6) and 2015-ASO-11360-OE (Unit 7) (Table 9.1-1). No license renewal-related construction activities have been identified; therefore, no new notifications to the FAA are required.

9.5.21 Occupational Safety and Health Act

OSHA governs the occupational safety and health of the construction workers and operations staff. PTN and its contractors comply with OSHA's substantive requirements, as these are incorporated in the sites occupational health and safety practices.

9.5.22 State Water Use Program

The SCA for PTN authorized the average daily withdrawal of 28.06 mgd from the upper production zones of the Floridan Aquifer. Pursuant to section 373.236(4), F.S., every 10 years from the date of certification issuance, PTN must submit a water use compliance report for review and approval by SFWMD (FDEP 2016a). PTN is in compliance with this reporting requirement.

9.5.23 Miami-Dade County Zoning Requirements

PTN is located in unincorporated Miami-Dade County, Florida. Miami-Dade County has adopted a CDMP to meet the requirements of the Local Government Comprehensive Planning and Land Development Regulation Act, Chapter 163, Part II, F.S. The CDMP was last revised in October 2006 (FPL 2008).

PTN has a future land use category of "institutions, utilities, and communications," according to the Miami-Dade County CDMP map. The CDMP map illustrates the locations of major institutional uses, communication facilities, and utilities of metropolitan significance. The Miami-Dade County CDMP land use element allows a full range of institutions, communications, and utilities in the "institutions, utilities, and communications" future land use category. PTN, as well as Turkey Point Units 1, 2, and 5, are an allowed use under this land use designation (FPL 2008).

The Miami-Dade County Land Development Code (Code) has been adopted to implement the policies and objectives of the Miami-Dade CDMP and to regulate land development within the unincorporated portions of Miami-Dade County. The Code incorporates a zoning map that depicts the zoning categories of lands lying within unincorporated Miami-Dade County. PTN is zoned as "industrial unlimited manufacturing district" (IU-3). The IU-3 zoning district allows "atomic reactors" (i.e., nuclear reactors) as a permitted use in the Code. The SLR project is an allowed use in the IU-3 district and does not represent a change or adjustment to the existing use status of PTN. The Miami-Dade County Department of Planning and Zoning has concurred with that conclusion (FPL 2008). PTN is in compliance with all zoning requirements.

9.6 Environmental Reviews

FPL has procedural controls in place to ensure that environmentally sensitive areas at Turkey Point, if present, are adequately protected during site operations and project planning. These controls, which encompass nonradiological environmental resource areas such as land use, air quality, surface water and groundwater, terrestrial and aquatic ecology, historic and cultural resources, and waste management and pollution prevention consist of the following:

- Appropriate local, state, and/or federal permits are obtained or modified as necessary.
- BMPs are implemented to protect wetlands, natural heritage areas, and sensitive ecosystems.
- Appropriate agencies are consulted on matters involving federally and state-listed threatened, endangered, and protected species, and that BMPs are implemented to minimize impacts to these species.
- Appropriate agencies are consulted on matters involving cultural resources and to ensure BMPs are implemented to minimize impact to this resource.

In summary, FPL's administrative controls ensure that appropriate local, state, and/or federal permits are obtained or modified as necessary, that cultural resources and threatened and endangered species are protected if present, and that other regulatory issues are adequately addressed as necessary.

9.7 Alternatives

The discussion of alternatives in the ER shall include a discussion of whether alternatives will comply with such applicable environmental quality standard and requirements [10 CFR 51.45 (d)].

The natural gas combined cycle plant, new nuclear, and combination of natural gas combined cycle, and solar PV combination alternative discussed in Section 7.2.1 would be constructed and operated to comply with all applicable environmental quality standards and requirements.

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Attachment A

NRC NEPA Issues for License Renewal

NRC NEPA Issues for License Renewal of Nuclear Power Plants

Florida Power and Light (FPL) has prepared this environmental report in accordance with the requirements of NRC regulation 10 CFR 51.53. The NRC included in the regulation the list of 78 National Environmental Policy Act (NEPA) issues for license renewal of nuclear power plants that were identified in the 2013 GEIS (Appendix B to Subpart A of 10 CFR Part 51, Table B-1).

The following table lists the 78 issues from 10 CFR Part 51, Appendix B, Table B-1 and identifies the section in this environmental report in which FPL addresses each applicable issue.

Table A-1. Turkey Point Nuclear Plant Environmental Report Cross-Reference of License Renewal NEPA Issues

No.	Issue[a]	Category	ER Section	GEIS Cross Reference (Section/Page)[b]
	Land Use			
1	Onsite land use	1	4.1.1	4.2.1.1/4-6
2	Offsite land use	1	4.1.2	4.2.1.1/4-7
3	Offsite land use in transmission line rights-of-way[c]	1	4.1.3	4.2.1.1/4-6
	Visual Resources			
4	Aesthetic impacts	1	4.1.4	4.2.1.2/4-9
	Air Quality			
5	Air quality (all plants)	1	4.2.1	4.3.1.1/4-14
6	Air quality effects of transmission lines	1	4.2.2	4.3.1.1/4-14
	Noise			
7	Noise impacts	1	4.3	4.3.1.2/4-19
	Geologic Impacts			
8	Geology and soils	1	4.4	4.4/4-29
	Surface Water Resources			
9	Surface water use and quality (non-cooling system impacts)	1	4.0.1	4.5.1.1/4-30
10	Altered current patterns at intake and discharge structures[c]	1	4.0.1	4.5.1.1/4-36
11	Altered salinity gradients	1	4.0.1/5.2	4.5.1.1/4-36
12	Altered thermal stratification of lakes[c]	1	4.0.1	4.5.1.1/4-37
13	Scouring caused by discharged cooling water	1	4.0.1/5.2	4.5.1.1/4-38
14	Discharge of metals in cooling system effluent	1	4.0.1/5.2	4.5.1.1/4-38
15	Discharge of biocides, sanitary wastes, and minor chemical spills	1	4.0.1/5.2	4.5.1.1/4-39
16	Surface water use conflicts (plants with once-through cooling systems) [c]	1	4.0.1	4.5.1.1/4-40
17	Surface water use conflicts (plants with cooling ponds, or cooling towers using makeup water from a river)	2	4.5.1	4.5.1.1/4-41
18	Effects of dredging on surface water quality	1	4.0.1/5.2	4.5.1.1/4-42
19	Temperature effects on sediment transport capacity[c]	1	4.0.1	4.5.1.1/4-43
	Groundwater Resources			
20	Groundwater contamination and use (non-cooling system impacts)	1	4.0.1/5.2	4.5.1.2/4-45
21	Groundwater use conflicts (plants that withdraw <100 gpm)[c]	1	4.0.1	4.5.1.2/4-47

No.	Issue[a]	Category	ER Section	GEIS Cross Reference (Section/Page)[b]
22	Groundwater use conflicts (plants that withdraw >100 gpm)	2	4.5.3	4.5.1.2/4-48
23	Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river)	2	4.5.2	4.5.1.2/4-48
24	Groundwater quality degradation resulting from water withdrawals	1	4.0.1/5.2	4.5.1.2/4-49
25	Groundwater quality degradation (plants with cooling ponds in salt marshes)[c]	1	4.0.1/5.2	4.5.1.2/4-50
26	Groundwater quality degradation (plants with cooling ponds at inland sites)[c]	2	4.5.4	4.5.1.2/4-51
27	Radionuclides released to groundwater	2	4.5.5	4.5.1.2/4-51
	Terrestrial Resources			
28	Effects on terrestrial resources (non-cooling system impacts)	2	4.6.5	4.6.1.1/4-59
29	Exposure of terrestrial organism to radionuclides	1	4.0.1/5.2	4.6.1.1/4-61
30	Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds)	1	4.0.1/5.2	4.6.1.1/4-64
31	Cooling tower impacts on vegetation (plants with cooling towers)[c]	1	4.0.1	4.6.1.1/4-69
32	Bird collisions with plant structures and transmission lines	1	4.0.1/5.2	4.6.1.1/4-70
33	Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river)	2	4.6.4	4.6.1.1/4-75
34	Transmission line ROW management impacts on terrestrial resources	1	4.0.1/5.2	4.6.1.1/4-75
35	Electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	1	4.0.1/5.2	4.6.1.1/4-80
	Aquatic Resources			
36	Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	2	4.6.1	4.6.1.2/4-87
37	Impingement and entrainment of aquatic organisms (plants with cooling towers)[c]	1	4.0.1	4.6.1.2/4-92
38	Entrainment of phytoplankton and zooplankton (all plants)	1	4.0.1/5.2	4.6.1.2/4-93
39	Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds)	2	4.6.2	4.6.1.2/4-94

No.	Issue[a]	Category	ER Section	GEIS Cross Reference (Section/Page)[b]
40	Thermal impacts on aquatic organisms (plants with cooling towers)[c]	1	4.0.1	4.6.1.2/4-96
41	Infrequently reported thermal impacts (all plants)	1	4.0.1/5.2	4.6.1.2/4-97
42	Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication	1	4.0.1/5.2	4.6.1.2/4-100
43	Effects of non-radiological contaminants on aquatic organisms	1	4.0.1/5.2	4.6.1.2/4-103
44	Exposure of aquatic organisms to radionuclides	1	4.0.1/5.2	4.6.1.2/4-105
45	Effect of dredging on aquatic organisms	1	4.0.1/5.2	4.6.1.2/4-107
46	Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river)	2	4.6.3	4.6.1.2/4-109
47	Effects on aquatic resources (non-cooling system impacts)	1	4.0.1/5.2	4.6.1.2/4-110
48	Impacts of transmission line ROW management on aquatic resources	1	4.0.1/5.2	4.6.1.2/4-112
49	Losses from predation, parasitism, and disease among organisms exposed to sub-lethal stresses	1	4.0.1/5.2	4.6.1.2/4-110
	Special Status Species and Habitats			
50	Threatened, endangered, and protected species and essential fish habitat	2	4.6.6	4.6.1.3/4-115
	Historic and Cultural Resources			
51	Historic and cultural resources	2	4.7	4.7.1/4-122
	Socioeconomics			
52	Employment and income, recreation and tourism	1	4.8.1	4.8.1.1/4-127
53	Tax revenues	1	4.8.2	4.8.1.1/4-128
54	Community services and education	1	4.8.3	4.8.1.1/4-129
55	Population and housing	1	4.8.4	4.8.1.1/4-130
56	Transportation	1	4.8.5	4.8.1.1/4-131
	Human Health			
57	Radiation exposures to the public	1	4.0.1/5.2	4.9.1.1.1/4-140
58	Radiation exposures to plant workers	1	4.0.1/5.2	4.9.1.1.1/4-136
59	Human health impacts from chemicals	1	4.0.1/5.2	4.9.1.1.2/4-147
60	Microbiological hazards to the public (plants with cooling ponds or canals or cooling towers that discharge to a river)	2	4.9.1	4.9.1.1.3/4-149
61	Microbiological hazards to plant workers	1	4.0.1/5.2	4.9.1.1.3/4-149

No.	Issue[a]	Category	ER Section	GEIS Cross Reference (Section/Page)[b]
62	Chronic effects of electromagnetic fields	NA	4.0.3	4.9.1.1.4/4-150
63	Physical occupational hazards	1	4.0.1/5.2	4.9.1.1.5/4-156
64	Electric shock hazards	2	4.9.2	4.9.1.1.5/4-156
	Postulated Accidents			
65	Design-basis accidents	1	4.15.1/5.2	4.9.1.2/4-158
66	Severe accidents	2	4.15.2	4.9.1.2/4-158
	Environmental Justice			
67	Minority and low-income populations	2	4.10.1	4.10.1/4-167
	Waste Management			
68	Low-level waste storage and disposal	1	4.11.1	4.11.1.1/4-171
69	Onsite storage of spent nuclear fuel	1	4.11.2	4.11.1.2/4-172
70	Offsite radiological impacts of spent nuclear fuel and high-level waste disposal	1	4.11.3	4.11.1.3/4-175
71	Mixed waste storage and disposal	1	4.11.4	4.11.1.4/4-178
72	Non-radioactive waste storage and disposal	1	4.11.5	4.11.1.5/4-179
	Cumulative Impacts			
73	Cumulative impacts	2	4.12	4.13/4-243
	Uranium Fuel Cycle			
74	Offsite radiological impacts–individual impacts from other than the disposal of spent fuel and high-level waste	1[d]	4.13.1	4.12.1.1/4-193
75	Offsite radiological impacts–collective impacts from other than the disposal of spent fuel and high-level waste	1	4.13.2	4.12.1.1/4-194
76	Non-radiological Impacts of the uranium fuel cycle	1	4.13.3	4.12.1.1/4-194
77	Transportation	1	4.13.4	4.12.1.1/4-196
	Termination of Nuclear Power Plant Operations and Decommissioning			
78	Termination of plant operations and decommissioning	1	4.14	4.12.2.1/4-201

a. 10 CFR 51, Subpart A, Appendix A, Table B-1. (Issue numbers added to facilitate discussion.)

b. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437, Rev 1).

c. The issue is not applicable to PTN; it concerns a plant feature or operation that PTN does not have or utilize.

d. SECY-14-0072 (July 21, 2014).

NA = not applicable (the categorization and impact finding definitions do not apply to the issue).

NEPA = National Environmental Policy Act

Attachment B

Threatened and Endangered Species Consultation Letters

January 30, 2018

Ms. Roxanna Hinzman
Field Supervisor Ecological Services
U.S. Fish and Wildlife Service
South Florida Field Office
1339 20th Street
Vero Beach, FL 32960-35599

FPLFWS-17-0267

Dear Ms. Hinzman:

Florida Power & Light Company (FPL) has submitted an application to renew the operating license for its Turkey Point Nuclear Plant Units 3 and 4 (PTN) for another 20-years to meet future power generating needs. PTN has been an integral part of Miami-Dade County for nearly 45-years, producing clean, reliable and zero-emissions electricity that powers hundreds of thousands of homes and local businesses. FPL recently modernized PTN by replacing a substantial amount of key equipment including turbine rotors, pipes, valves, machinery, and digital control systems. This license renewal effort will not require any refurbishments, construction, or physical changes to PTN.

As part of the renewal process, the U.S. Nuclear Regulatory Commission (NRC) requires that the license renewal application include an environmental report (ER) that assesses the environmental impacts of continued operation. The ER discusses species listed or proposed for listing as threatened or endangered in accordance with the Endangered Species Act (ESA) and important plant and animal habitats. As part of the renewal process, the NRC may request an informal or formal consultation with your agency pursuant to Section 7 of the ESA. It is our intent by this letter to introduce you to the project and to make available any data you need to ensure an efficient and effective consultation process.

PTN is located on the southeastern coast of Florida in unincorporated southeastern Miami-Dade County, approximately 25-miles south of Miami. The site borders Biscayne Bay (Biscayne National Park) and Card Sound. PTN is within 2-miles of the Model Lands Basin, a South Florida Water Management District (SFWMD) conservation area. A portion of the Biscayne Bay Aquatic Preserve is located immediately east of the PTN site, and a separate portion of the preserve, along with the Florida Keys National Marine Sanctuary, is located adjacent to the south- southeastern site boundary. The PTN site is also located just east of the 13,000-acre Everglades Mitigation Bank, an FPL-owned and operated wetland restoration project.

PTN is supported by a system of cooling canals that occupy an area approximately 2-miles wide by 5-miles long. The PTN cooling canal system is not “waters of the U.S.” or “waters of the State.” FPL has monitored crocodile nesting and crocodile population at the PTN cooling canals since the late 1970’s. As the license renewal will not require refurbishments, construction, or physical changes the environmental report has concluded the continued operation of PTN will not change the effects on species listed as federally threatened, endangered, or candidates for listing. Species under your jurisdiction potentially occurring near the PTN site that are federally listed as threatened or endangered species are included in Attachment 1. Attachment 2 shows critical habitat areas within a 6-mile radius of PTN.

FPL appreciates your participation in the consultation process. If you have any comments or questions, please contact Jena Mier at (561) 691-2209 or via e-mail at Jena.Mier@fpl.com.

Sincerely,

Matthew J. Raffenberg

Matthew J. Raffenberg
Sr. Director of Environmental Licensing & Permitting

Attachment 1: Species Federally Listed as Threatened, Endangered, or Candidates for Listing in Miami-Dade County, Florida
Attachment 2: Critical Habitat Areas within 6-mile Radius of PTN

Attachment 1: Federally Listed as Threatened or Endangered or Candidates for Listing Species in Miami-Dade County, Florida in Miami-Dade County, Florida

Scientific Name	Common Name	Federal Status
Plants and Lichens		
Amorpha herbacea var. crenulata(1),(2)	Crenulate lead-plant	E
Argythamnia blodgettii(1),(2)	Blodgett's wild-mercury (Blodgett's silverbush)	T
Brickellia mosieri(1),(2)	Florida Brickell-bush	E
Chamaesyce deltoidea ssp. adhaerens(1)	Hairy deltoid spurge	E
Chamaesyce deltoidea ssp. deltoidea(1),(2)	Deltoid spurge	E
Chamaesyce deltoidea ssp. pinetorum(1),(2)	Pinelands spurge (pinelands sandmat)	C
Chamaesyce deltoidea ssp. serpyllum(1)	Wedge spurge	E
Chamaesyce garberi(1),(2)	Garber's spurge	T
Chromolaena frustrata [Eupatorium frustratum](2)	Cape Sable thoroughwort	E
Consolea [Opuntia] corallicola (2)	Florida semaphore cactus	E
Cucurbita okeechobeensis ssp. Okeechobeensis (2)	Okeechobee gourd	E
Dalea carthagenensis var. floridana(1),(2)	Florida prairie clover	C
Digitaria pauciflora(1),(2)	Few-flowered fingergrass	C
Galactia smallii(1),(2)	Small's milkpea	E
Halophila johnsonii(1)	Johnson's seagrass	T
Jacquemontia reclinata(1),(2)	Beach jacquemontia	E
Linum arenicola(1),(2)	Sand flax	E
Linum carteri var. carteri(1),(2)	Carter's small-flowered flax	E
Polygala smallii(1),(2)	Tiny polygala	E
Trichomanes punctatum ssp. floridanum(1),(2)	Florida bristle fern (Florida filmy fern)	E
Sideroxylon reclinatum ssp. austrofloridense(1),(2)	Everglades bully	C
Invertebrates		
Cicindelidia floridana(1)	Miami tiger beetle	PE
Anaea troglodyta floridalis(1),(2)	Florida leafwing	E
Cyclargus thomasi bethunebakeri(1),(2)	Miami blue butterfly	E
Papilio aristodemus ponceanus(1),(2)	Schaus' swallowtail	E
Strymon acis bartrami(1),(2)	Bartram's scrub-hairstreak	E
Orthalicus reses reses(1),(2)	Stock Island tree snail	T
Reptiles		
Alligator mississippiensis(1),(2)	American alligator	SAT
Caretta caretta(1),(2)	Loggerhead sea turtle	T
Chelonia mydas(1)	Green sea turtle	T
Crocodylus acutus(1),(2)	American crocodile	T

Scientific Name	Common Name	Federal Status
Dermochelys coriacea(1),(2)	Leatherback sea turtle	E
Drymarchon couperi(1),(2)	Eastern indigo snake	T
Eretmochelys imbricata(1),(2)	Hawksbill sea turtle	E
Gopherus polyphemus(1),(2)	Gopher tortoise	C
Lepidochlys kempii(3)	Kemp's Ridley sea turtle	E
Birds		
Ammodramus maritimus mirabilis(1),(2)	Cape Sable seaside sparrow	E
Caladris rufa (2)	Red knot	T
Charadrius melodus(1),(2)	Piping plover	T
Mycteria americana(1),(2)	Wood stork	T
Rostrhamus sociabilis(1),(2)	Snail kite	E
Polyborus plancus audubonii(2)	Audubon's crested caracara	T
Setophaga kirtlandii(2)	Kirtland's warbler	E
Vermivora bachmani (2)	Bachman's warbler	E
Mammals		
Eumops floridanus(1),(2)	Florida bonneted bat	E
Puma concolor coryi(1),(2)	Florida panther	E
Puma concolor (all sub species except coryi(2)	Puma	SAT
Trichechus manatus(1),(2)	West Indian manatee	T

E = Listed as endangered species at the federal level by the U. S. Fish and Wildlife Service.
T = Listed as threatened species at the federal level by the U. S. Fish and Wildlife Service.
C = Candidate species.
PE = Proposed to be listed as endangered.
PT = Proposed to be listed as threatened.
SAT = Treated as threatened due to similarity of appearance.

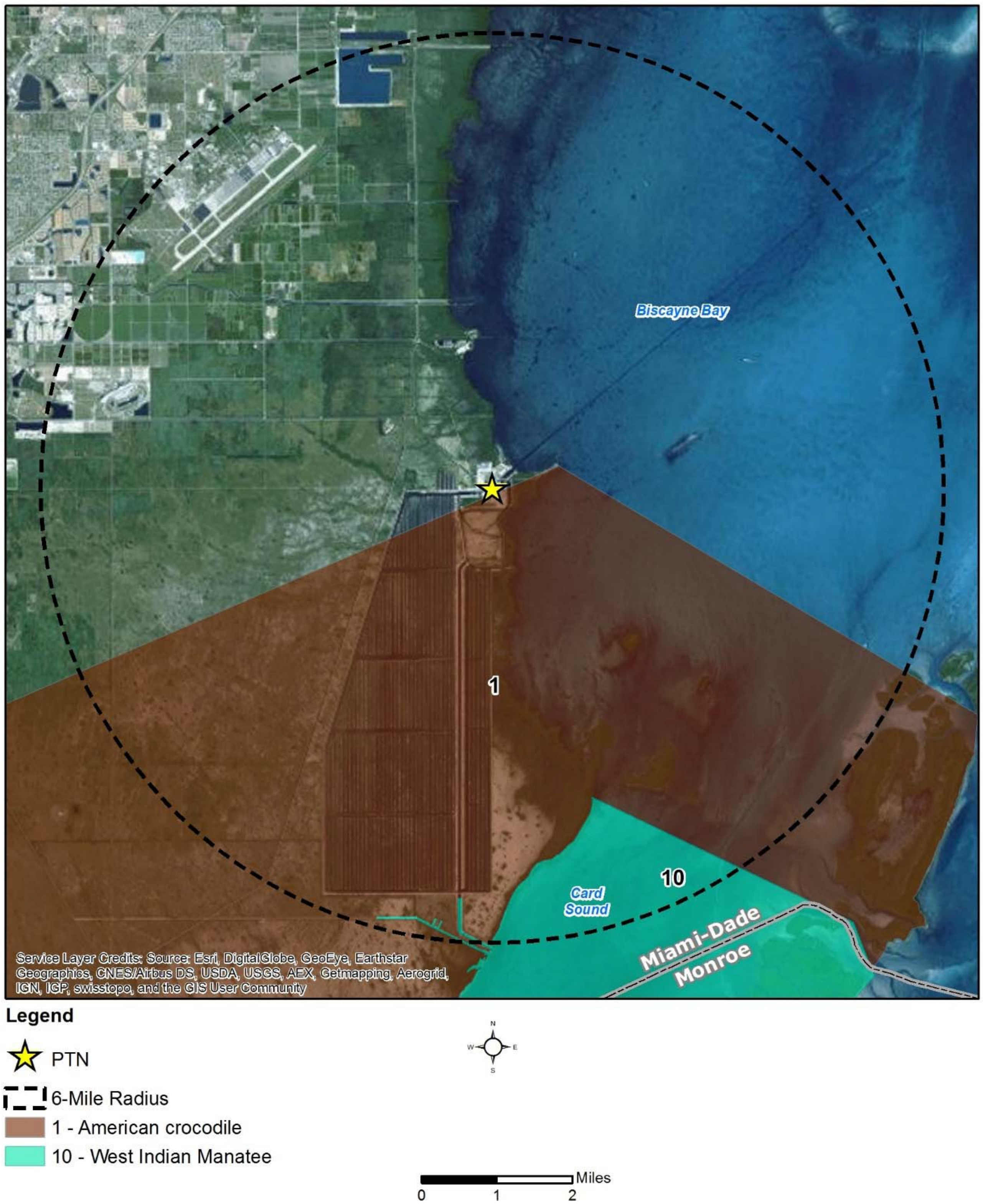
Sources: (1) USFWS 2017; (2) FNAI 2017; (3) NOAA 2017

FNAI (Florida's Natural Areas Inventory). 2017. FINAL tracking list, Miami-Dade County (last updated: February 2017). Retrieved from http://fnai.org. Accessed February 22, 2017.

NOAA (National Oceanic & Atmospheric Administration). 2017. Florida's Atlantic Coast Threatened and Endangered Species. Retrieved from http://sero.nmfs.noaa.gov/protected_resources/section_7/threatened_endangered/Documents/florida_atlantic.pdf. Accessed on April 12, 2017

USFWS (U.S. Fish & Wildlife Service). 2017. Species by County Report: Miami-Dade, Florida. Retrieved from https://ecos.fws.gov. Accessed on March 25, 2017.

Attachment 2: Critical Habitat Areas within 6-mile Radius of PTN



January 30, 2018

Mr. David Bernhart FPLNOA-17-0253
Assistant Regional Administrator
National Oceanic and Atmospheric Administration National Marine Fisheries Services
Southeast Regional Office Protected Resources Division
263 13th Avenue South
St. Petersburg, FL 33701-5505

Dear Mr. Bernhart:

Florida Power & Light Company (FPL) has submitted an application to renew the operating license for its Turkey Point Nuclear Plant Units 3 and 4 (PTN) for another 20-years to meet future power generating needs. PTN has been an integral part of Miami-Dade County for nearly 45-years, producing clean, reliable and zero-emissions electricity that powers hundreds of thousands of homes and local businesses. FPL recently modernized PTN by replacing a substantial amount of key equipment including turbine rotors, pipes, valves, machinery, and digital control systems. This license renewal effort will not require any refurbishments, construction, or physical changes to PTN.

As part of the renewal process, the U.S. Nuclear Regulatory Commission (NRC) requires that the license renewal application include an environmental report (ER) that assesses the environmental impacts of continued operation. The ER discusses species listed or proposed for listing as threatened or endangered in accordance with the Endangered Species Act (ESA) and important plant and animal habitats, including critical habitats as defined by the ESA and essential fish habitat as identified under the Magnuson-Stevens Fishery Conservation and Management Act. As part of the renewal process, the NRC may request an informal or formal consultation with your agency. It is our intent by this letter to introduce you to the project and to make available any data you need to ensure an efficient and effective consultation process.

PTN is located on the southeastern coast of Florida in unincorporated southeastern Miami-Dade County, approximately 25-miles south of Miami. The site borders Biscayne Bay (Biscayne National Park) and Card Sound. PTN is within 2-miles of the Model Lands Basin, a South Florida Water Management District (SFWMD) conservation area. A portion of the Biscayne Bay Aquatic Preserve is located immediately east of the PTN site, and a separate portion of the preserve, along with the Florida Keys National Marine Sanctuary, is located adjacent to the south- southeastern site boundary. The PTN site is also located just east of the 13,000 acre Everglades Mitigation Bank, an FPL-owned and operated wetland restoration project.

As the license renewal will not require refurbishments, construction, physical changes, or in-water work, the environmental report has concluded the continued operation of PTN has no effect on marine species federally listed as threatened, endangered, or candidates for listing. Species under your jurisdiction potentially occurring near the PTN site that are federally listed as threatened or endangered species are included in Attachment 1. Attachment 2 shows critical habitat areas within a 6-mile radius of PTN.

FPL appreciates your participation in the consultation process. If you have any comments or questions, please contact Jena Mier at 561-691-2209 or via e-mail at Jena.Mier@fpl.com.

Sincerely,

Matthew J. Raffenberg
Sr. Director of Environmental Licensing & Permitting

Attachment 1: Federally Listed as Threatened or Endangered Marine Species in Miami-Dade County, Florida
Attachment 2: Critical Habitat Areas within 6-mile Radius of PTN

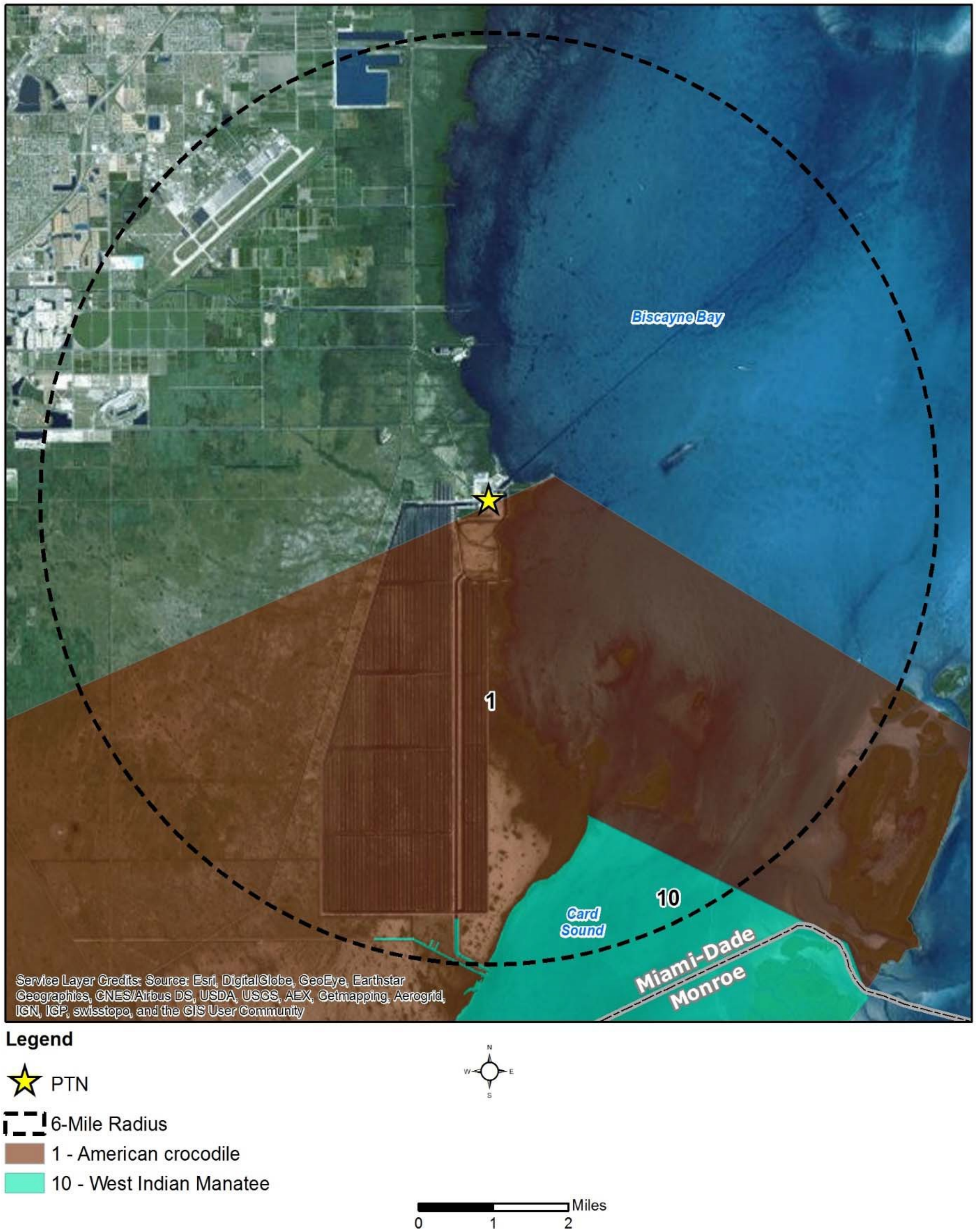
Attachment 1: Federally Listed as Threatened or Endangered or Candidates for Listing Marine Species in Miami-Dade County, Florida

Scientific Name	Common Name	Federal Status
Plants and Lichens		
Halophila johnsonii	Johnson's seagrass	T
Acropora cervicornis	Staghorn coral	T
Acropora palmata	Elkhorn coral	T
Dendrogyra cylindrus	Pillar coral	T
Mycetophyllia ferox	Rough cactus coral	T
Orbicella annularis	Lobed star coral	T
Orbicella faveolata	Mountainous star coral	T
Orbicella franksi	Boulder star coral	T
Fish		
Acipenser brevirostrum	Shortnose sturgeon	E
Epinephelus striatus	Nassau grouper	T
Pristis pectinata	Smalltooth sawfish	E
Reptiles		
Caretta caretta	Loggerhead sea turtle	T
Chelonia mydas	Green sea turtle	T
Dermochelys coriacea	Leatherback sea turtle	E
Eretmochelys imbricata	Hawksbill sea turtle	E
Lepidochlys kempii	Kemp's Ridley sea turtle	E

E = Listed as endangered species at the federal level by the U. S. Fish and Wildlife Service.

T = Listed as threatened species at the federal level by the U. S. Fish and Wildlife Service.

Attachment 2: PTN and Critical Habitat Areas within 6-mile Radius of PTN



Attachment C

Cultural Resource Consultation Letters

FPL

January 30, 2018

Dr. Timothy A. Parsons FPLDHR-17-0254
Division Director & State Historic Preservation Officer
Florida Department of State Divisions of Historical Resources
500 South Borough Street -4th Floor
Tallahassee, FL 32399-0250

Dear Dr. Parsons:

Florida Power & Light Company (FPL) has submitted an application to renew the operating license for its Turkey Point Nuclear Plant Units 3 and 4 (PTN) for another 20-years to meet future power generating needs. PTN has been an integral part of Miami-Dade County for nearly 45-years, producing clean, reliable and zero-emissions electricity that powers hundreds of thousands of homes and local businesses. FPL recently modernized PTN by replacing a substantial amount of key equipment including turbine rotors, pipes, valves, machinery, and digital control systems. This license renewal effort will not require any refurbishments, construction, or physical changes to PTN.

As part of the renewal process, the U.S. Nuclear Regulatory Commission (NRC) requires that the license renewal application include an environmental report (ER) that assesses the environmental impacts of continued operation. The ER discusses historic and cultural resources, including tribal cultural resources, near the PTN site. As part of the renewal process, the NRC may request an informal or formal consultation in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470), as implemented by 36 CFR 800 (Protection of Historic Properties). It is our intent by this letter to introduce you to the project and to make available to you any data you need to ensure an efficient and effective consultation process.

PTN is located on the southeastern coast of Florida in unincorporated southeastern Miami-Dade County, approximately 25-miles south of Miami. This location is situated in portions of Sections 27, 28, 29, 31, 32, 33, and 34, Township 57 South, Range 60 East. The site borders Biscayne Bay (Biscayne National Park) and Card Sound (Attachment 1). We have conducted a search of the Florida Master Site File records available in GIS and tabular format within 6-mile radius of PTN. The 6-mile radius also includes portions of the incorporated cities of Florida City and Homestead, and the unincorporated community of Homestead Base. Attachment 2 presents currently recorded cultural resources within a 6-mile radius of PTN.

Again, the license renewal effort will not require any refurbishments, construction, or physical changes to PTN. It is our intent by this letter to introduce you to the project and to make data available to you.

Florida Power & Light Company

700 Universe Boulevard, Juno Beach, FL 33408

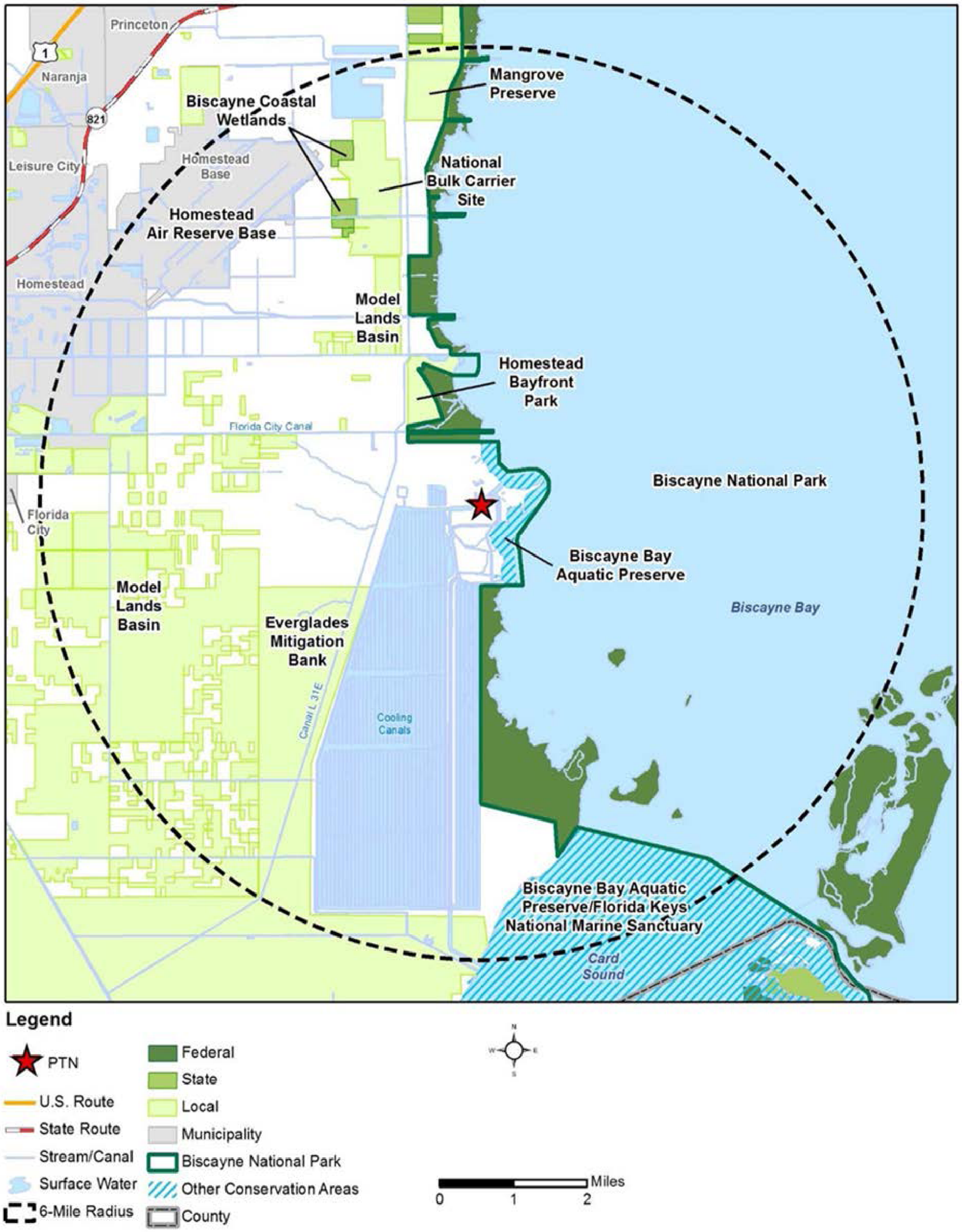
FPL appreciates your participation in the consultation process. If you have any comments or questions, please contact Jena Mier at (561) 691-2209 or via e-mail at Jena.Mier@fpl.com.

Sincerely,

Matthew J. Raffenberg
Sr. Director of Environmental Licensing & Permitting

Attachment 1: PTN Location within 6-mile Radius
Attachment 2: Cultural Sites Occurring within 6-mile Radius of PTN Site

Attachment 1: PTN Location within 6-mile Radius



Attachment 2: Cultural Sites Occurring within 6-mile Radius of PTN Site

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[a]
DA12863	K-9 Cemetery	Miami-Dade	Homestead	Eligible
DA11918	SW 117th Avenue/North Canal Bridge	Miami-Dade	Homestead	Eligible
DA12618	SW 117th Avenue / Canal C-103 Bridge	Miami-Dade	Homestead	Ineligible
DA14366	SW 127th Avenue / Canal C-103 Bridge	Miami-Dade	Homestead	Ineligible
DA12835	Building 246 Guard House	Miami-Dade	Homestead	Ineligible
DA12836	Building 260 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12837	Building 261 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12838	Building 262 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12839	Building 263 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12840	Building 264 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12841	Building 265 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12842	Building 269 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12843	Building 270 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12844	Building 271 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12845	Building 272 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12846	Building 273 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12847	Building 274 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12848	Building 277 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12849	Building 278 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12850	Building 279 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12851	Building 280 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12852	Building 281 Magazine Igloo	Miami-Dade	Homestead	Ineligible
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FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[a]
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DA12855	Building 286 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12856	Building 287 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12857	Building 288 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12859	Building 701 SAC Alert Crew Quarters	Miami-Dade	Homestead	Ineligible
DA12861	Building 4055 Hush House	Miami-Dade	Homestead	Ineligible
DA12862	Building 4064 Hush House	Miami-Dade	Homestead	Ineligible
DA12617	SW 107th Avenue/Canal C102 Bridge	Miami-Dade	Perrine	Not Evaluated
DA11941	Channel Ballast, BISC-5	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11942	University Dock, BISC-6	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11943	Black Wreck, "Marty's Lost Site". . .	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11944	Jordan's Ballast, Sorelaw's Ballast, . . .	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11945	Cement Barge Wreck, BISC-11	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA11948	BISC-20, HMS Fowey, Legare Anchorage	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11949	Sands Cut Ballast Piles, BISC-024	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11950	BISC-25, Reef Ballast, Reef Ballast Scat	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11951	BISC-26, Machinery Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11952	BISC-28, Elkhorn Reef Ballast	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11953	BISC-29, Reef Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA11957	BISC-33, Outline Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11958	BISC-35, Pillar Dollar Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[a]
DA11960	BISC-51, Legare Barrels	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA11962	BISC-53, Bottle Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA11974	BISC-68, Anchor (Alias: Old Anchor Reef)	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA11983	BISC-80, Triumph Reef Metal Scatter	Miami-Dade	Arsenicker Keys	Not Evaluated

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[(a)]
DA11984	BISC-114, Boca Chita North Pontoon	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA11986	BISC-87, Steel Frames	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA11988	BISC-89, Sunken Bell Buoy	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11989	BISC-90, Tannehill Cannon	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11995	BISC-100, Pacific Reef Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11996	BISC-101, Debbet Site Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA12619	SW 328th Street / Canal C-107 Bridge	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14302	BISC-99, Grapnel Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14303	BISC-115, Coral Chain Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14304	BISC-116, Patch Reef Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14305	BISC-118, Lionfish Killer Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14307	BISC-120, Shrimp Boat	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14308	BISC-121, Corsair Wreckage	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14309	BISC-122, Anchor Holding Fast	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14310	BISC-123, Rocky Reef Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14311	BISC-124, The Wall Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14312	BISC-125, Straits of Florida Debris	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14315	BISC-130, Reef Tower Ballast	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14317	BISC-132, Boiler	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14318	BISC-133, Olive Jar Survey Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14319	BISC-134, Wreck Scatter	Miami-Dade	Arsenicker Keys	Not Evaluated

Florida Master Site File (FMSF), July 2017
[a] National Register of Historic Places status is based on information provided in the FMSF.

January 30, 2018

Mr. Paul Backhouse FPLSTF-17-0264
Tribal Historic Preservation Officer
Seminole Tribe of Florida
30290 Josie Billie Hwy, PMB 1004
Clewiston, FL 33440

Dear Mr. Paul Backhouse:

Florida Power & Light Company (FPL) has submitted an application to renew the operating license for its Turkey Point Nuclear Plant Units 3 and 4 (PTN) for another 20-years to meet future power generating needs. PTN has been an integral part of Miami-Dade County for nearly 45-years, producing clean, reliable and zero-emissions electricity that powers hundreds of thousands of homes and local businesses. FPL recently modernized PTN by replacing a substantial amount of key equipment including turbine rotors, pipes, valves, machinery, and digital control systems. This license renewal effort will not require any refurbishments, construction, or physical changes to PTN.

As part of the renewal process, the U.S. Nuclear Regulatory Commission (NRC) requires that the license renewal application include an environmental report (ER) that assesses the environmental impacts of continued operation. The ER discusses historic and cultural resources, including tribal cultural resources, near the PTN site. As part of the renewal process, the NRC may request an informal or formal consultation in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470), as implemented by 36 CFR 800 (Protection of Historic Properties). FPL does not intend for any discussions between the Tribe and FPL to take the place of any official Section 106 consultation that has been or will be conducted. It is our intent by this letter to introduce you to the project and to make available any data you need to ensure an efficient and effective consultation process.

PTN is located on the southeastern coast of Florida in unincorporated southeastern Miami-Dade County, approximately 25-miles south of Miami. This location is situated in portions of Sections 27, 28, 29, 31, 32, 33, and 34, Township 57 South, Range 60 East. The site borders Biscayne Bay (Biscayne National Park) and Card Sound (Attachment 1). We have conducted a search of the Florida Master Site File records available in GIS and tabular format within 6-mile radius of PTN (Attachment 1). The 6-mile radius also includes portions of the incorporated cities of Florida City and Homestead, and the unincorporated community of Homestead Base. Attachment 2 presents currently recorded cultural resources within a 6-mile radius of PTN.

Again, the license renewal effort will not require any refurbishments, construction, or physical changes to PTN. It is our intent by this letter to introduce you to the project and to make data available to you.

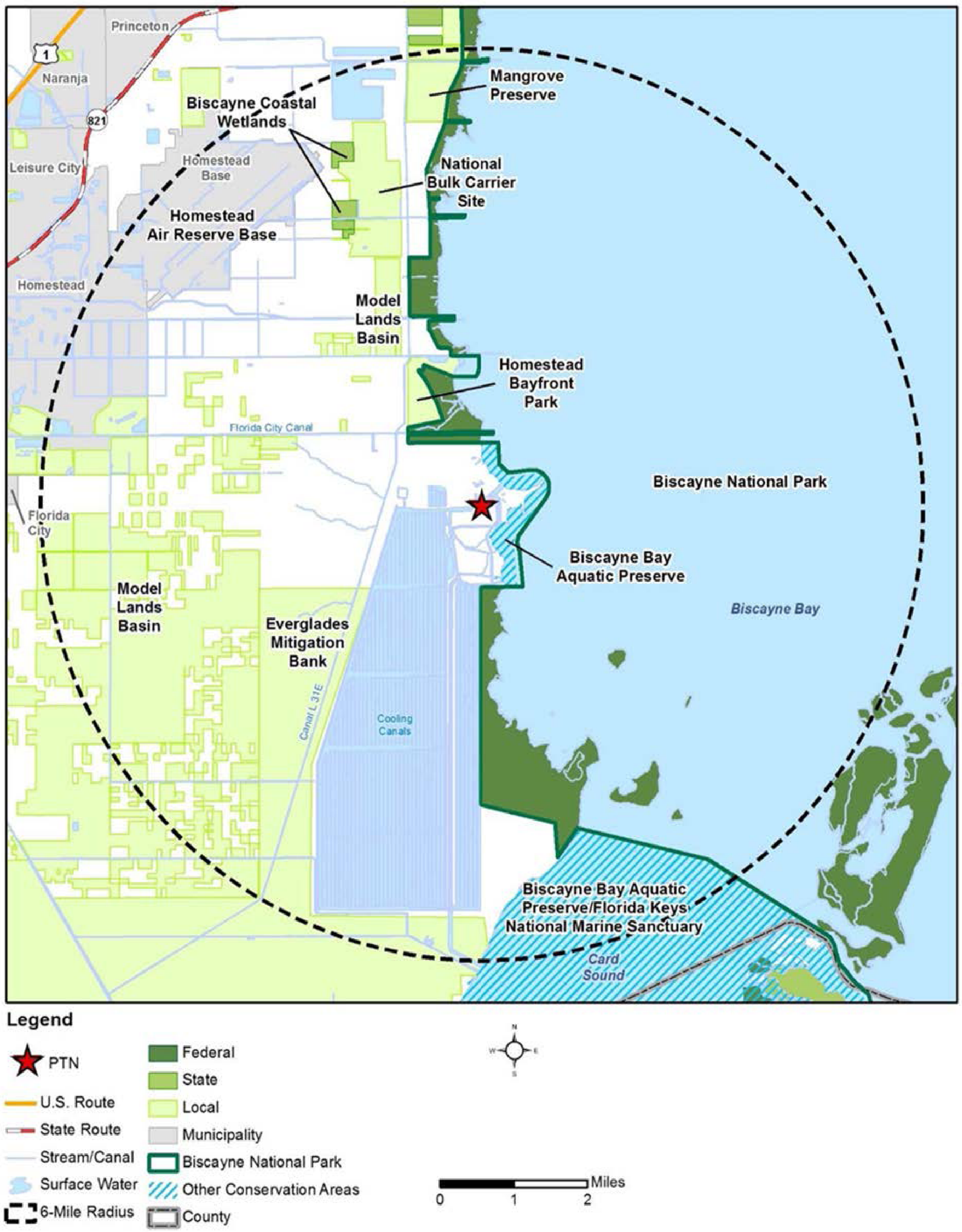
If you would like additional information about the project, please contact Tribal Affairs Agnes Ramsey at (561) 691-2820 or via e-mail at Agnes.Ramsey@fpl.com. In addition, you can contact Jena Mier at (561) 691-2209 or via e-mail Jena.Mier@fpl.com.

Sincerely,

Matthew J. Raffenberg
Sr. Director of Environmental Licensing & Permitting

Attachment 1: PTN Location and 6-mile Radius
Attachment 2: Cultural Sites Occurring within 6-mile Radius of the PTN Site

Attachment 1: PTN Location and 6-mile Radius



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DA11988	BISC-89, Sunken Bell Buoy	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11989	BISC-90, Tannehill Cannon	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11995	BISC-100, Pacific Reef Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11996	BISC-101, Debbet Site Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA12619	SW 328th Street / Canal C-107 Bridge	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14302	BISC-99, Grapnel Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14303	BISC-115, Coral Chain Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14304	BISC-116, Patch Reef Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14305	BISC-118, Lionfish Killer Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA14310	BISC-123, Rocky Reef Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14311	BISC-124, The Wall Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14312	BISC-125, Straits of Florida Debris	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14315	BISC-130, Reef Tower Ballast	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14317	BISC-132, Boiler	Miami-Dade	Arsenicker Keys	Not Evaluated
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Florida Master Site File (FMSF), July 2017
[a] National Register of Historic Places status is based on information provided in the FMSF.

January 30, 2018

Mr. Gary Batton FPLCNO-17-0257
Chief
The Choctaw Nation of Oklahoma
P.O. Box 1210
Durant, OK 74702-1210

Dear Mr. Batton:

Florida Power & Light Company (FPL) has submitted an application to renew the operating license for its Turkey Point Nuclear Plant Units 3 and 4 (PTN) for another 20-years to meet future power generating needs. PTN has been an integral part of Miami-Dade County for nearly 45-years, producing clean, reliable and zero-emissions electricity that powers hundreds of thousands of homes and local businesses. FPL recently modernized PTN by replacing a substantial amount of key equipment including turbine rotors, pipes, valves, machinery, and digital control systems. This license renewal effort will not require any refurbishments, construction, or physical changes to PTN.

As part of the renewal process, the U.S. Nuclear Regulatory Commission (NRC) requires that the license renewal application include an environmental report (ER) that assesses the environmental impacts of continued operation. The ER discusses historic and cultural resources, including tribal cultural resources, near the PTN site. As part of the renewal process, the NRC may request an informal or formal consultation in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470), as implemented by 36 CFR 800 (Protection of Historic Properties). FPL does not intend for any discussions between the Tribe and FPL to take the place of any official Section 106 consultation that has been or will be conducted. It is our intent by this letter to introduce you to the project and to make available any data you need to ensure an efficient and effective consultation process.

PTN is located on the southeastern coast of Florida in unincorporated southeastern Miami-Dade County, approximately 25-miles south of Miami. This location is situated in portions of Sections 27, 28, 29, 31, 32, 33, and 34, Township 57 South, Range 60 East. The site borders Biscayne Bay (Biscayne National Park) and Card Sound (Attachment 1). We have conducted a search of the Florida Master Site File records available in GIS and tabular format within 6-mile radius of PTN (Attachment 1). The 6-mile radius also includes portions of the incorporated cities of Florida City and Homestead, and the unincorporated community of Homestead Base. Attachment 2 presents currently recorded cultural resources within a 6-mile radius of PTN.

Again, the license renewal effort will not require any refurbishments, construction, or physical changes to PTN. It is our intent by this letter to introduce you to the project and to make data available to you.

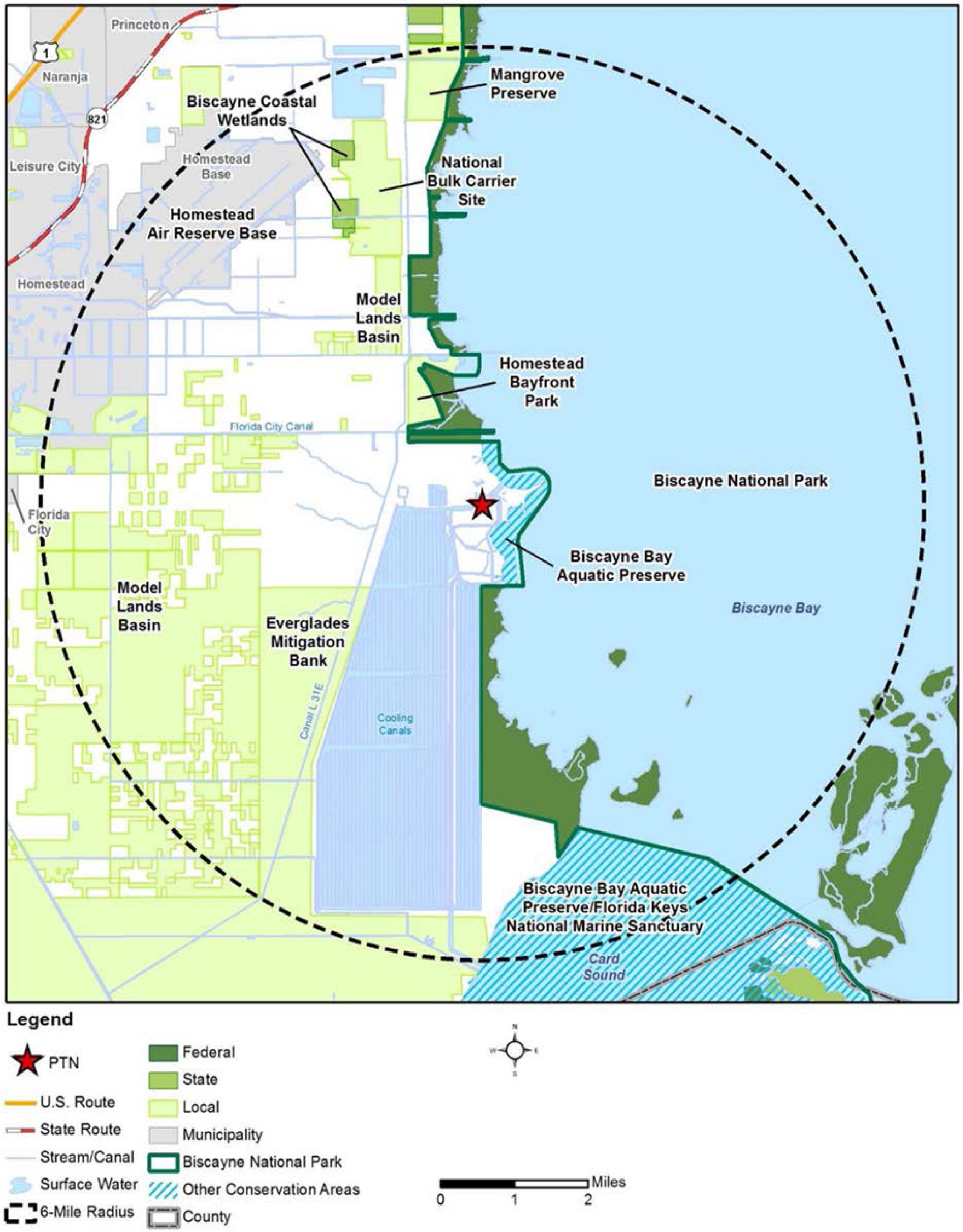
If you would like additional information about the project, please contact Tribal Affairs Agnes Ramsey at (561) 691-2820 or via e-mail at Agnes.Ramsey@fpl.com. In addition, you can contact Jena Mier at (561) 691-2209 or via e-mail Jena.Mier@fpl.com.

Sincerely,

Matthew J. Raffenberg
Sr. Director of Environmental Licensing & Permitting

Attachment 1: PTN Location and 6-mile Radius
Attachment 2: Cultural Sites Occurring within 6-mile Radius of the PTN Site

Attachment 1: PTN Location and 6-mile Radius



Attachment 2: Cultural Sites Occurring within 6-mile radius of the PTN Site

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[a]
DA12863	K-9 Cemetery	Miami-Dade	Homestead	Eligible
DA11918	SW 117th Avenue/North Canal Bridge	Miami-Dade	Homestead	Eligible
DA12618	SW 117th Avenue / Canal C-103 Bridge	Miami-Dade	Homestead	Ineligible
DA14366	SW 127th Avenue / Canal C-103 Bridge	Miami-Dade	Homestead	Ineligible
DA12835	Building 246 Guard House	Miami-Dade	Homestead	Ineligible
DA12836	Building 260 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12837	Building 261 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12838	Building 262 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12839	Building 263 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12840	Building 264 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12841	Building 265 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12842	Building 269 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12843	Building 270 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12844	Building 271 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12845	Building 272 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12846	Building 273 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12847	Building 274 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12848	Building 277 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12849	Building 278 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12850	Building 279 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12851	Building 280 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12852	Building 281 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12853	Building 282 Magazine Igloo	Miami-Dade	Homestead	Ineligible

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[(a)]
DA12854	Building 285 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12855	Building 286 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12856	Building 287 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12857	Building 288 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12859	Building 701 SAC Alert Crew Quarters	Miami-Dade	Homestead	Ineligible
DA12861	Building 4055 Hush House	Miami-Dade	Homestead	Ineligible
DA12862	Building 4064 Hush House	Miami-Dade	Homestead	Ineligible
DA12617	SW 107th Avenue/Canal C102 Bridge	Miami-Dade	Perrine	Not Evaluated
DA11941	Channel Ballast, BISC-5	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11942	University Dock, BISC-6	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11943	Black Wreck, "Marty's Lost Site". . .	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11944	Jordan's Ballast, Sorelaw's Ballast, . . .	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11945	Cement Barge Wreck, BISC-11	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11947	Cement Barge Wreck, BISC-11	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11948	BISC-20, HMS Fowey, Legare Anchorage	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11949	Sands Cut Ballast Piles, BISC-024	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11950	BISC-25, Reef Ballast, Reef Ballast Scat	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11951	BISC-26, Machinery Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11952	BISC-28, Elkhorn Reef Ballast	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11953	BISC-29, Reef Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11954	BISC-30, Morgans Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11955	BISC-31, Stairs Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11956	BISC-32, Ball Buoy Wreck (Anomaly #12. . .)	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11957	BISC-33, Outline Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11958	BISC-35, Pillar Dollar Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated

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DA11960	BISC-51, Legare Barrels	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11961	BISC-52, South Pacific Reef Ballast Scat	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11962	BISC-53, Bottle Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11963	BISC-55, Biscayne Channel Barge	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11964	BISC-56, Bug Light Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11965	BISC-57, Bell Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11966	BISC-58, Brick Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11967	BISC-59, Boxcar Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA11969	BISC-61, Second Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11970	BISC-62, Cannon Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11971	BISC-63, Fowey Rock Barrels	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11972	BISC-64, I-Beam Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11973	BISC-66, Ballast Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11974	BISC-68, Anchor (Alias: Old Anchor Reef)	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11975	BISC-70, Safety Valve Barge	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11976	BISC-73, Ore Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
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Florida Master Site File (FMSF), July 2017
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January 30, 2018

Ms. Jeanine Bennett, Esq. FPLMTI-17-0260
General Counsel
Miccosukee Tribe of Indians of Florida
Tamiami Station, P.O. Box 440021
Miami, FL 33144

Dear Ms. Bennett:

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Sincerely,

Matthew J. Raffenberg
Sr. Director of Environmental Licensing & Permitting

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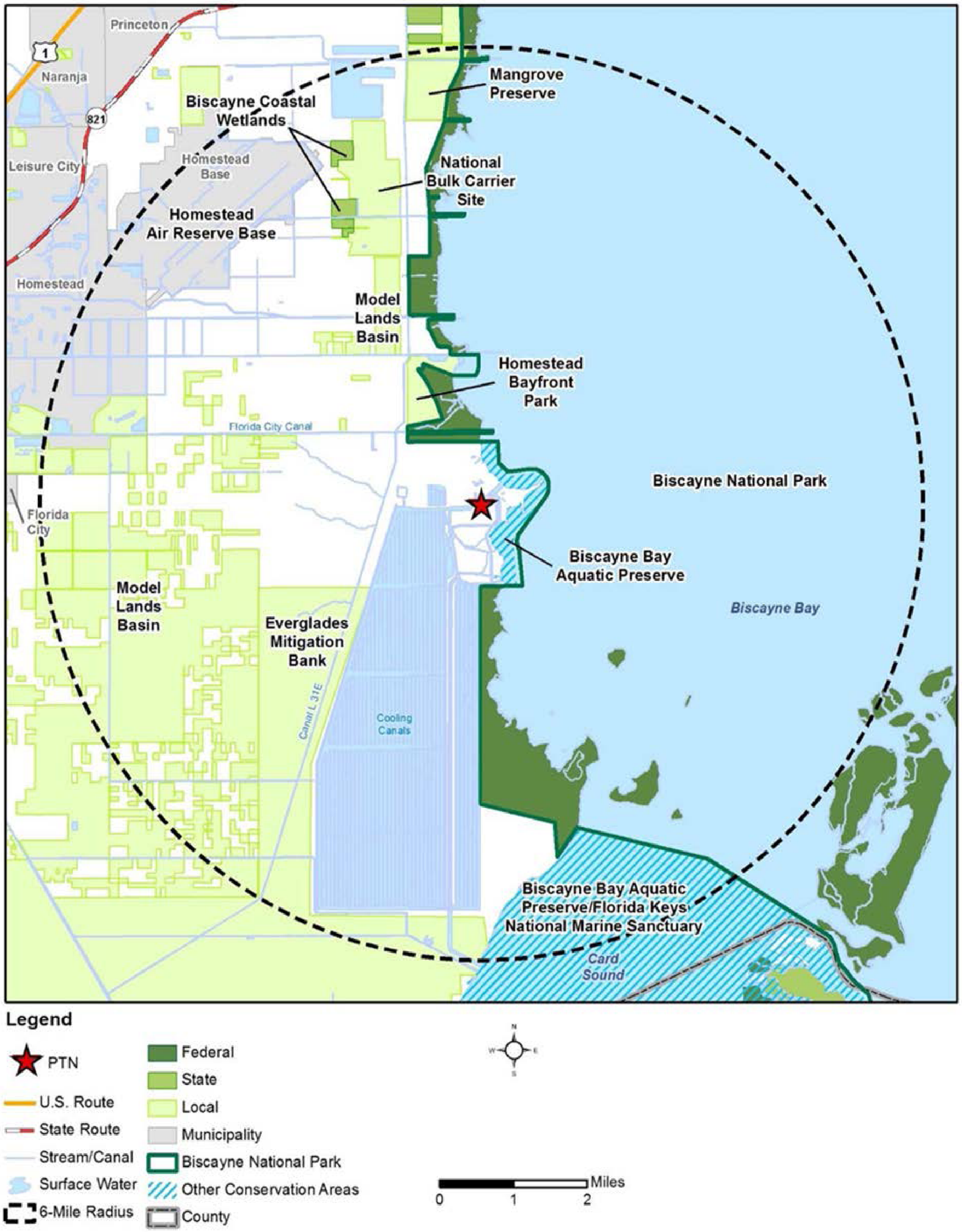

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DA12845	Building 272 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12846	Building 273 Magazine Igloo	Miami-Dade	Homestead	Ineligible
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DA12848	Building 277 Magazine Igloo	Miami-Dade	Homestead	Ineligible
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DA12850	Building 279 Magazine Igloo	Miami-Dade	Homestead	Ineligible
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[a] National Register of Historic Places status is based on information provided in the FMSF.

January 30, 2018

Mr. Billy Cypress FPLMTI-17-0255
Chairman
Miccosukee Tribe of Indians of Florida
Tamiami Station, P.O. Box 440021
Miami, FL 33144

Dear Mr. Cypress:

Florida Power & Light Company (FPL) has submitted an application to renew the operating license for its Turkey Point Nuclear Plant Units 3 and 4 (PTN) for another 20-years to meet future power generating needs. PTN has been an integral part of Miami-Dade County for nearly 45-years, producing clean, reliable and zero-emissions electricity that powers hundreds of thousands of homes and local businesses. FPL recently modernized PTN by replacing a substantial amount of key equipment including turbine rotors, pipes, valves, machinery, and digital control systems. This license renewal effort will not require any refurbishments, construction, or physical changes to PTN.

As part of the renewal process, the U.S. Nuclear Regulatory Commission (NRC) requires that the license renewal application include an environmental report (ER) that assesses the environmental impacts of continued operation. The ER discusses historic and cultural resources, including tribal cultural resources, near the PTN site. As part of the renewal process, the NRC may request an informal or formal consultation in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470), as implemented by 36 CFR 800 (Protection of Historic Properties). FPL does not intend for any discussions between the Tribe and FPL to take the place of any official Section 106 consultation that has been or will be conducted. It is our intent by this letter to introduce you to the project and to make available any data you need to ensure an efficient and effective consultation process.

PTN is located on the southeastern coast of Florida in unincorporated southeastern Miami-Dade County, approximately 25-miles south of Miami. This location is situated in portions of Sections 27, 28, 29, 31, 32, 33, and 34, Township 57 South, Range 60 East. The site borders Biscayne Bay (Biscayne National Park) and Card Sound (Attachment 1). We have conducted a search of the Florida Master Site File records available in GIS and tabular format within 6-mile radius of PTN (Attachment 1). The 6-mile radius also includes portions of the incorporated cities of Florida City and Homestead, and the unincorporated community of Homestead Base. Attachment 2 presents currently recorded cultural resources within a 6-mile radius of PTN.

Again, the license renewal effort will not require any refurbishments, construction, or physical changes to PTN. It is our intent by this letter to introduce you to the project and to make data available to you.

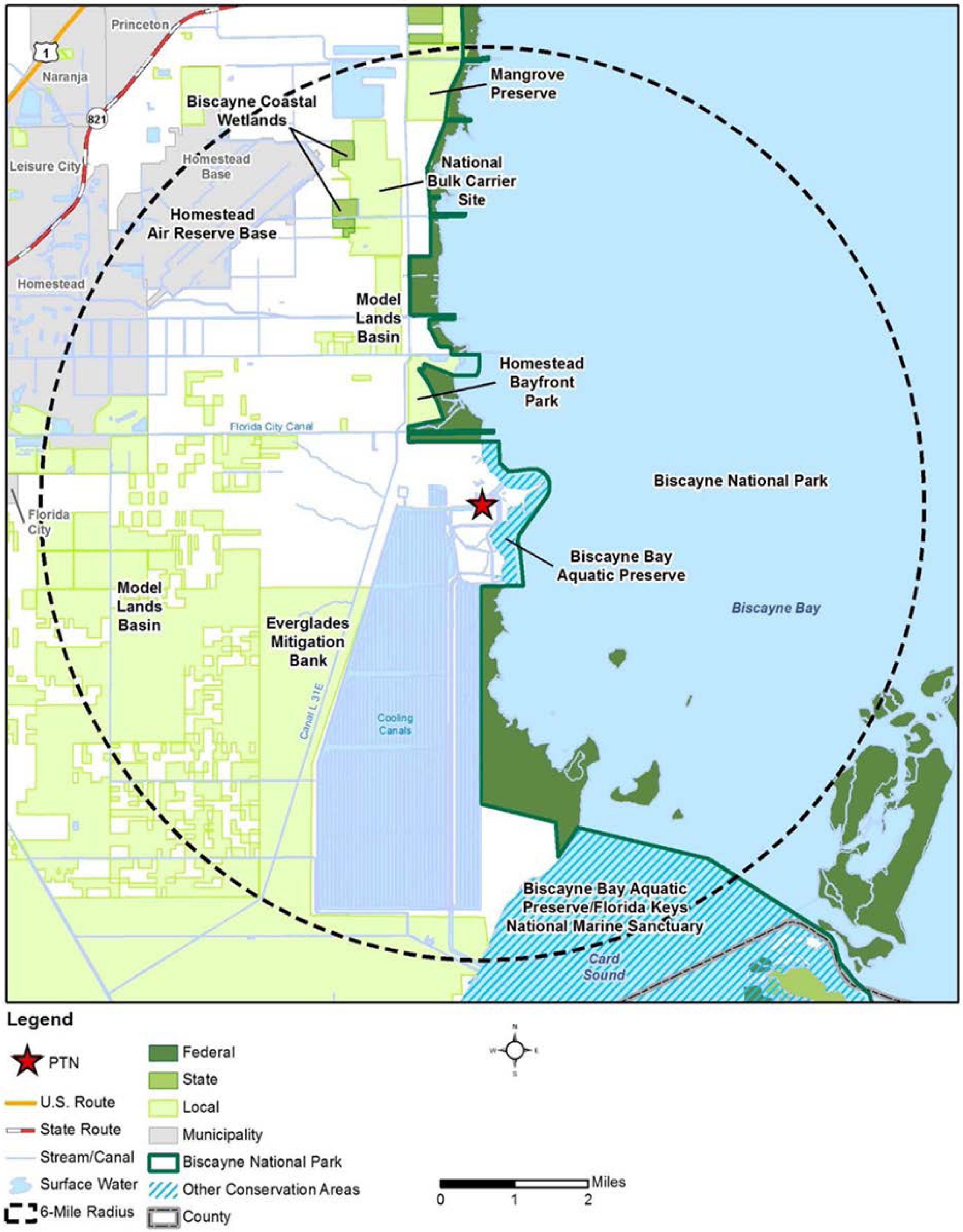
If you would like additional information about the project, please contact Tribal Affairs Agnes Ramsey at (561) 691-2820 or via e-mail at Agnes.Ramsey@fpl.com. In addition, you can contact Jena Mier at (561) 691-2209 or via e-mail Jena.Mier@fpl.com.

Sincerely,

Matthew J. Raffenberg
Sr. Director of Environmental Licensing & Permitting

Attachment 1: PTN Location and 6-mile Radius
Attachment 2: Cultural Sites Occurring within 6-mile Radius of the PTN Site

Attachment 1: PTN Location and 6-mile Radius



Attachment 2: Cultural Sites Occurring within 6-mile radius of the PTN Site

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[(a)]
DA12863	K-9 Cemetery	Miami-Dade	Homestead	Eligible
DA11918	SW 117th Avenue/North Canal Bridge	Miami-Dade	Homestead	Eligible
DA12618	SW 117th Avenue / Canal C-103 Bridge	Miami-Dade	Homestead	Ineligible
DA14366	SW 127th Avenue / Canal C-103 Bridge	Miami-Dade	Homestead	Ineligible
DA12835	Building 246 Guard House	Miami-Dade	Homestead	Ineligible
DA12836	Building 260 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12837	Building 261 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12838	Building 262 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12839	Building 263 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12840	Building 264 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12841	Building 265 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12842	Building 269 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12843	Building 270 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12844	Building 271 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12845	Building 272 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12846	Building 273 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12847	Building 274 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12848	Building 277 Magazine Igloo	Miami-Dade	Homestead	Ineligible
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DA12850	Building 279 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12851	Building 280 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12852	Building 281 Magazine Igloo	Miami-Dade	Homestead	Ineligible
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FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[a]
DA12854	Building 285 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12855	Building 286 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12856	Building 287 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12857	Building 288 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12859	Building 701 SAC Alert Crew Quarters	Miami-Dade	Homestead	Ineligible
DA12861	Building 4055 Hush House	Miami-Dade	Homestead	Ineligible
DA12862	Building 4064 Hush House	Miami-Dade	Homestead	Ineligible
DA12617	SW 107th Avenue/Canal C102 Bridge	Miami-Dade	Perrine	Not Evaluated
DA11941	Channel Ballast, BISC-5	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11942	University Dock, BISC-6	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11943	Black Wreck, "Marty's Lost Site". . .	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11944	Jordan's Ballast, Sorelaw's Ballast, . . .	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11945	Cement Barge Wreck, BISC-11	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11947	Cement Barge Wreck, BISC-11	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11948	BISC-20, HMS Fowey, Legare Anchorage	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11949	Sands Cut Ballast Piles, BISC-024	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11950	BISC-25, Reef Ballast, Reef Ballast Scat	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11951	BISC-26, Machinery Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11952	BISC-28, Elkhorn Reef Ballast	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11953	BISC-29, Reef Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA11973	BISC-66, Ballast Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11974	BISC-68, Anchor (Alias: Old Anchor Reef)	Miami-Dade	Arsenicker Keys	Not Evaluated
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Florida Master Site File (FMSF), July 2017
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January 30, 2018

Ms. Stephanie Bryan
Chairwoman
Poarch Band of Creek Indians
5811 Jack Springs Road
Atmore, AL 36502

FPLPBC-17-0266

Dear Ms. Bryan:

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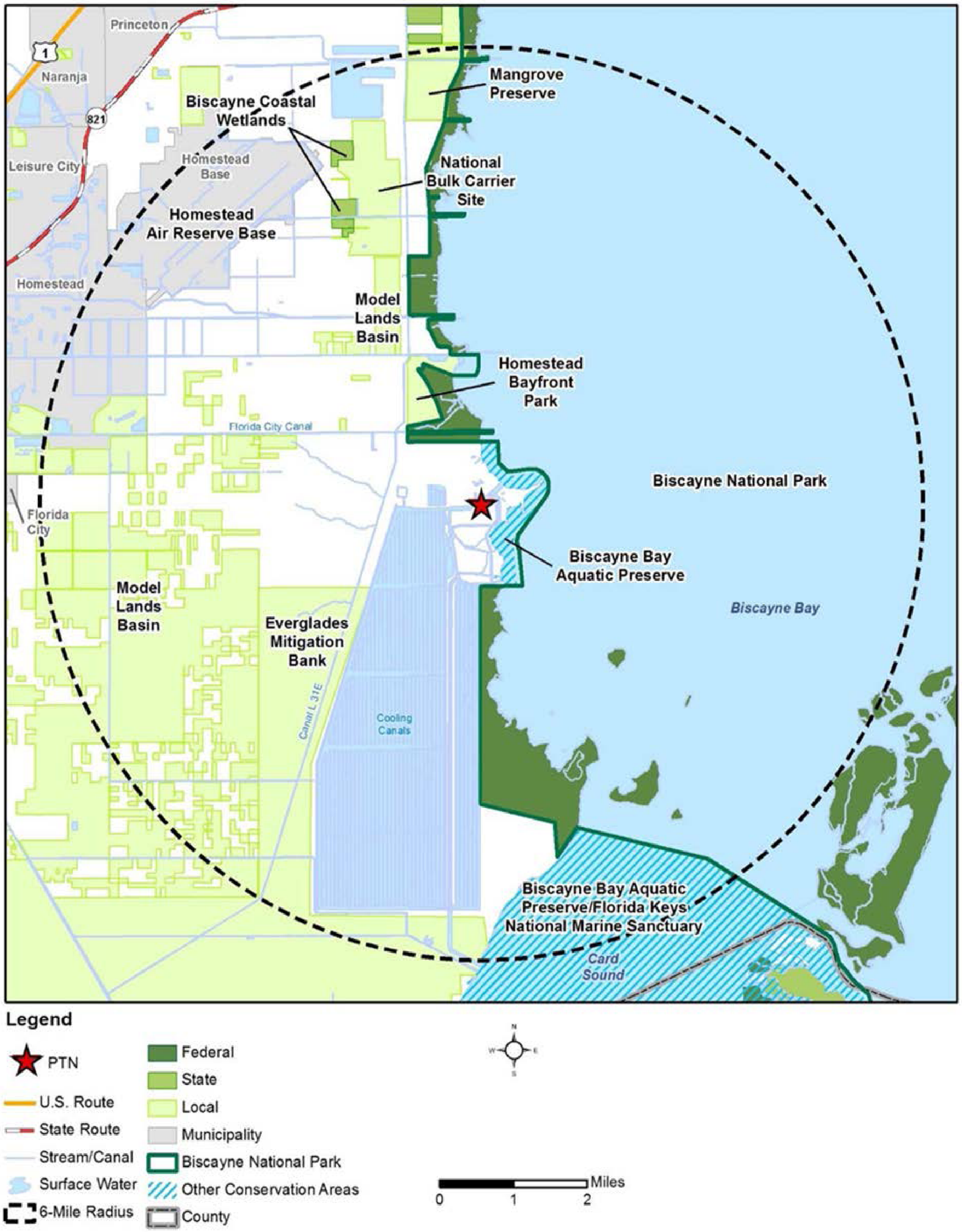

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January 30, 2018

Mr. James Floyd FPLMNT-17-0259
Principle Chief
Muscogee (Creek) Nation
P.O. Box 580
Okmulgee, OK 74447

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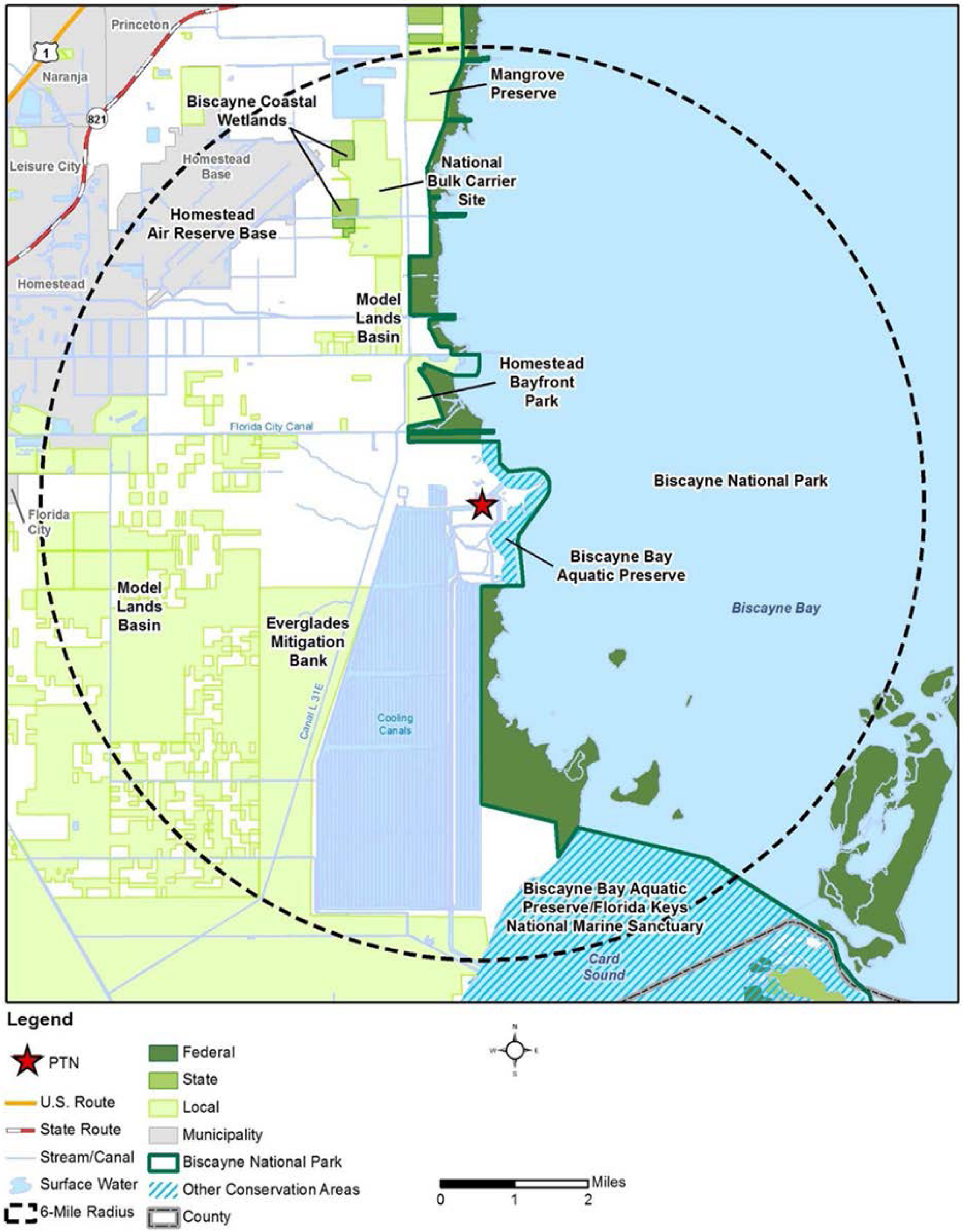
Sincerely,

Matthew J. Raffenberg
Sr. Director of Environmental Licensing & Permitting

Attachment 1: PTN Location and 6-mile Radius
Attachment 2: Cultural Sites Occurring within 6-mile Radius of the PTN Site

Attachment 1: PTN Location and 6-mile Radius



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DA12839	Building 263 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12840	Building 264 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12841	Building 265 Magazine Igloo	Miami-Dade	Homestead	Ineligible
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DA12843	Building 270 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12844	Building 271 Magazine Igloo	Miami-Dade	Homestead	Ineligible
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DA12861	Building 4055 Hush House	Miami-Dade	Homestead	Ineligible
DA12862	Building 4064 Hush House	Miami-Dade	Homestead	Ineligible
DA12617	SW 107th Avenue/Canal C102 Bridge	Miami-Dade	Perrine	Not Evaluated
DA11941	Channel Ballast, BISC-5	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11942	University Dock, BISC-6	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA11944	Jordan's Ballast, Sorelaw's Ballast, . . .	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11945	Cement Barge Wreck, BISC-11	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA11948	BISC-20, HMS Fowey, Legare Anchorage	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11949	Sands Cut Ballast Piles, BISC-024	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11950	BISC-25, Reef Ballast, Reef Ballast Scat	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11951	BISC-26, Machinery Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
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Florida Master Site File (FMSF), July 2017
[a] National Register of Historic Places status is based on information provided in the FMSF.

January 30, 2018

Mr. Leonard Harjo FPLSNO-17-0261
Chief
Seminole Nation of Oklahoma
P.O. Box 1498
Wewoka, OK 74884

Dear Mr. Harjo:

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As part of the renewal process, the U.S. Nuclear Regulatory Commission (NRC) requires that the license renewal application include an environmental report (ER) that assesses the environmental impacts of continued operation. The ER discusses historic and cultural resources, including tribal cultural resources, near the PTN site. As part of the renewal process, the NRC may request an informal or formal consultation in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470), as implemented by 36 CFR 800 (Protection of Historic Properties). FPL does not intend for any discussions between the Tribe and FPL to take the place of any official Section 106 consultation that has been or will be conducted. It is our intent by this letter to introduce you to the project and to make available any data you need to ensure an efficient and effective consultation process.

PTN is located on the southeastern coast of Florida in unincorporated southeastern Miami-Dade County, approximately 25-miles south of Miami. This location is situated in portions of Sections 27, 28, 29, 31, 32, 33, and 34, Township 57 South, Range 60 East. The site borders Biscayne Bay (Biscayne National Park) and Card Sound (Attachment 1). We have conducted a search of the Florida Master Site File records available in GIS and tabular format within 6-mile radius of PTN (Attachment 1). The 6-mile radius also includes portions of the incorporated cities of Florida City and Homestead, and the unincorporated community of Homestead Base. Attachment 2 presents currently recorded cultural resources within a 6-mile radius of PTN.

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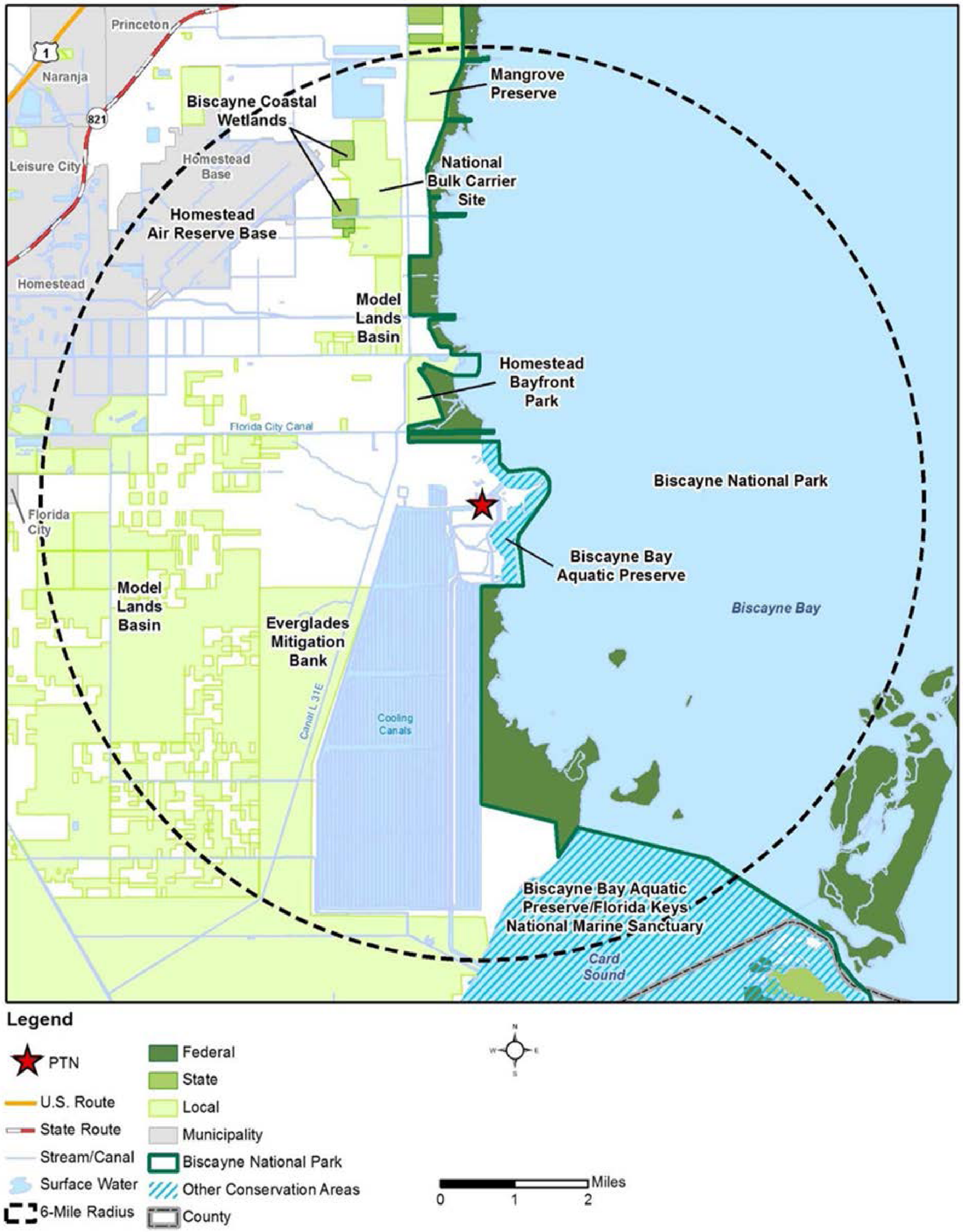

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January 30, 2018

Ms. Corain Lowe-Zepeda
Tribal Historic Preservation Officer
Muscogee (Creek) Nation
P.O. Box 580
Okmulgee, OK 74447

FPLMNT-17-0256

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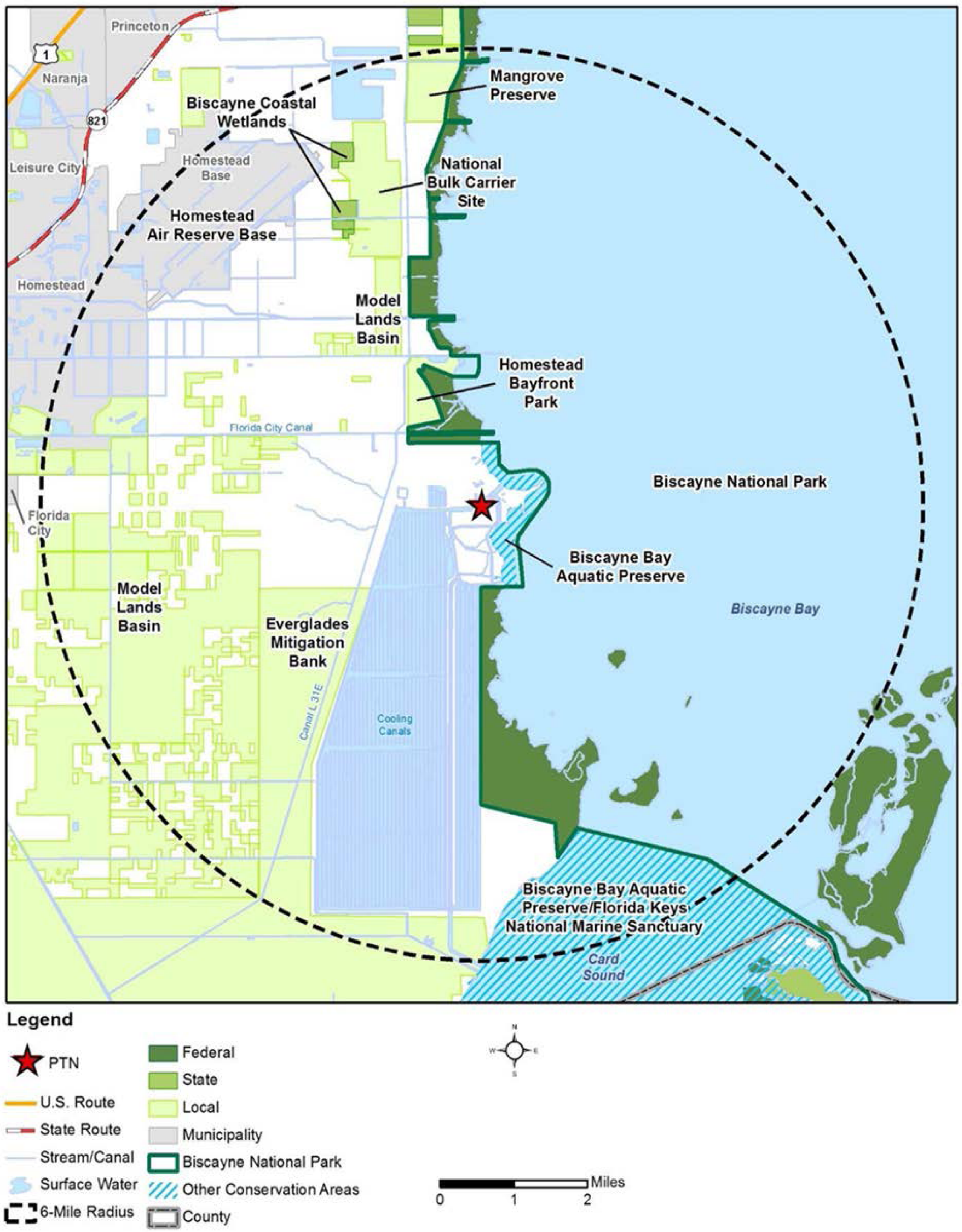

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DA12835	Building 246 Guard House	Miami-Dade	Homestead	Ineligible
DA12836	Building 260 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12837	Building 261 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12838	Building 262 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12839	Building 263 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12840	Building 264 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12841	Building 265 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12842	Building 269 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12843	Building 270 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12844	Building 271 Magazine Igloo	Miami-Dade	Homestead	Ineligible
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DA12847	Building 274 Magazine Igloo	Miami-Dade	Homestead	Ineligible
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DA12851	Building 280 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12852	Building 281 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12853	Building 282 Magazine Igloo	Miami-Dade	Homestead	Ineligible

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[a]
DA12854	Building 285 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12855	Building 286 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12856	Building 287 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12857	Building 288 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12859	Building 701 SAC Alert Crew Quarters	Miami-Dade	Homestead	Ineligible
DA12861	Building 4055 Hush House	Miami-Dade	Homestead	Ineligible
DA12862	Building 4064 Hush House	Miami-Dade	Homestead	Ineligible
DA12617	SW 107th Avenue/Canal C102 Bridge	Miami-Dade	Perrine	Not Evaluated
DA11941	Channel Ballast, BISC-5	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11942	University Dock, BISC-6	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11943	Black Wreck, "Marty's Lost Site". . .	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11944	Jordan's Ballast, Sorelaw's Ballast, . . .	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11945	Cement Barge Wreck, BISC-11	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11947	Cement Barge Wreck, BISC-11	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11948	BISC-20, HMS Fowey, Legare Anchorage	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11949	Sands Cut Ballast Piles, BISC-024	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11950	BISC-25, Reef Ballast, Reef Ballast Scat	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11951	BISC-26, Machinery Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11952	BISC-28, Elkhorn Reef Ballast	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11953	BISC-29, Reef Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11954	BISC-30, Morgans Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11955	BISC-31, Stairs Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11956	BISC-32, Ball Buoy Wreck (Anomaly #12. . .)	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11957	BISC-33, Outline Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11958	BISC-35, Pillar Dollar Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated

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DA11960	BISC-51, Legare Barrels	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11961	BISC-52, South Pacific Reef Ballast Scat	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11962	BISC-53, Bottle Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11963	BISC-55, Biscayne Channel Barge	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11964	BISC-56, Bug Light Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11965	BISC-57, Bell Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11966	BISC-58, Brick Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11967	BISC-59, Boxcar Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11968	BISC-59, Captain Ed's Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11969	BISC-61, Second Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11970	BISC-62, Cannon Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11971	BISC-63, Fowey Rock Barrels	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11972	BISC-64, I-Beam Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11973	BISC-66, Ballast Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11974	BISC-68, Anchor (Alias: Old Anchor Reef)	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11975	BISC-70, Safety Valve Barge	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11976	BISC-73, Ore Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11977	BISC-74, Aladdin Lamp Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11978	BISC-75, Ring Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11979	BISC-76, Admiralty Anchor, Alice's. . .	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11980	BISC-77, Reef Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11981	BISC-78, Old Rhodes Ballast, Chris'. . .	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11982	BISC-79, Triumph Reef South Ballast	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11983	BISC-80, Triumph Reef Metal Scatter	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11984	BISC-114, Boca Chita North Pontoon	Miami-Dade	Arsenicker Keys	Not Evaluated

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[(a)]
DA11985	BISC-86, Anchor Fluke	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11986	BISC-87, Steel Frames	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11987	BISC-88, Stock Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11988	BISC-89, Sunken Bell Buoy	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11989	BISC-90, Tannehill Cannon	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11995	BISC-100, Pacific Reef Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11996	BISC-101, Debbet Site Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA12619	SW 328th Street / Canal C-107 Bridge	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14302	BISC-99, Grapnel Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14303	BISC-115, Coral Chain Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14304	BISC-116, Patch Reef Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14305	BISC-118, Lionfish Killer Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14307	BISC-120, Shrimp Boat	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14308	BISC-121, Corsair Wreckage	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14309	BISC-122, Anchor Holding Fast	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14310	BISC-123, Rocky Reef Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14311	BISC-124, The Wall Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14312	BISC-125, Straits of Florida Debris	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14315	BISC-130, Reef Tower Ballast	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14317	BISC-132, Boiler	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14318	BISC-133, Olive Jar Survey Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14319	BISC-134, Wreck Scatter	Miami-Dade	Arsenicker Keys	Not Evaluated

Florida Master Site File (FMSF), July 2017
[a] National Register of Historic Places status is based on information provided in the FMSF.

FPL

January 30, 2018

Ms. Natalie Harjo
Historic Preservation
Seminole Nation of Oklahoma
P.O. Box 1498
Wewoka, OK 74884

FPLSNO-17-0263

Dear Ms. Natalie Harjo:

Florida Power & Light Company (FPL) has submitted an application to renew the operating license for its Turkey Point Nuclear Plant Units 3 and 4 (PTN) for another 20-years to meet future power generating needs. PTN has been an integral part of Miami-Dade County for nearly 45-years, producing clean, reliable and zero-emissions electricity that powers hundreds of thousands of homes and local businesses. FPL recently modernized PTN by replacing a substantial amount of key equipment including turbine rotors, pipes, valves, machinery, and digital control systems. This license renewal effort will not require any refurbishments, construction, or physical changes to PTN.

As part of the renewal process, the U.S. Nuclear Regulatory Commission (NRC) requires that the license renewal application include an environmental report (ER) that assesses the environmental impacts of continued operation. The ER discusses historic and cultural resources, including tribal cultural resources, near the PTN site. As part of the renewal process, the NRC may request an informal or formal consultation in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470), as implemented by 36 CFR 800 (Protection of Historic Properties). FPL does not intend for any discussions between the Tribe and FPL to take the place of any official Section 106 consultation that has been or will be conducted. It is our intent by this letter to introduce you to the project and to make available any data you need to ensure an efficient and effective consultation process.

PTN is located on the southeastern coast of Florida in unincorporated southeastern Miami-Dade County, approximately 25-miles south of Miami. This location is situated in portions of Sections 27, 28, 29, 31, 32, 33, and 34, Township 57 South, Range 60 East. The site borders Biscayne Bay (Biscayne National Park) and Card Sound (Attachment 1). We have conducted a search of the Florida Master Site File records available in GIS and tabular format within 6-mile radius of PTN (Attachment 1). The 6-mile radius also includes portions of the incorporated cities of Florida City and Homestead, and the unincorporated community of Homestead Base. Attachment 2 presents currently recorded cultural resources within a 6-mile radius of PTN.

Again, the license renewal effort will not require any refurbishments, construction, or physical changes to PTN. It is our intent by this letter to introduce you to the project and to make data available to you.

If you would like additional information about the project, please contact Tribal Affairs Agnes Ramsey at (561) 691-2820 or via e-mail at Agnes.Ramsey@fpl.com. In addition, you can contact Jena Mier at (561) 691-2209 or via e-mail Jena.Mier@fpl.com.

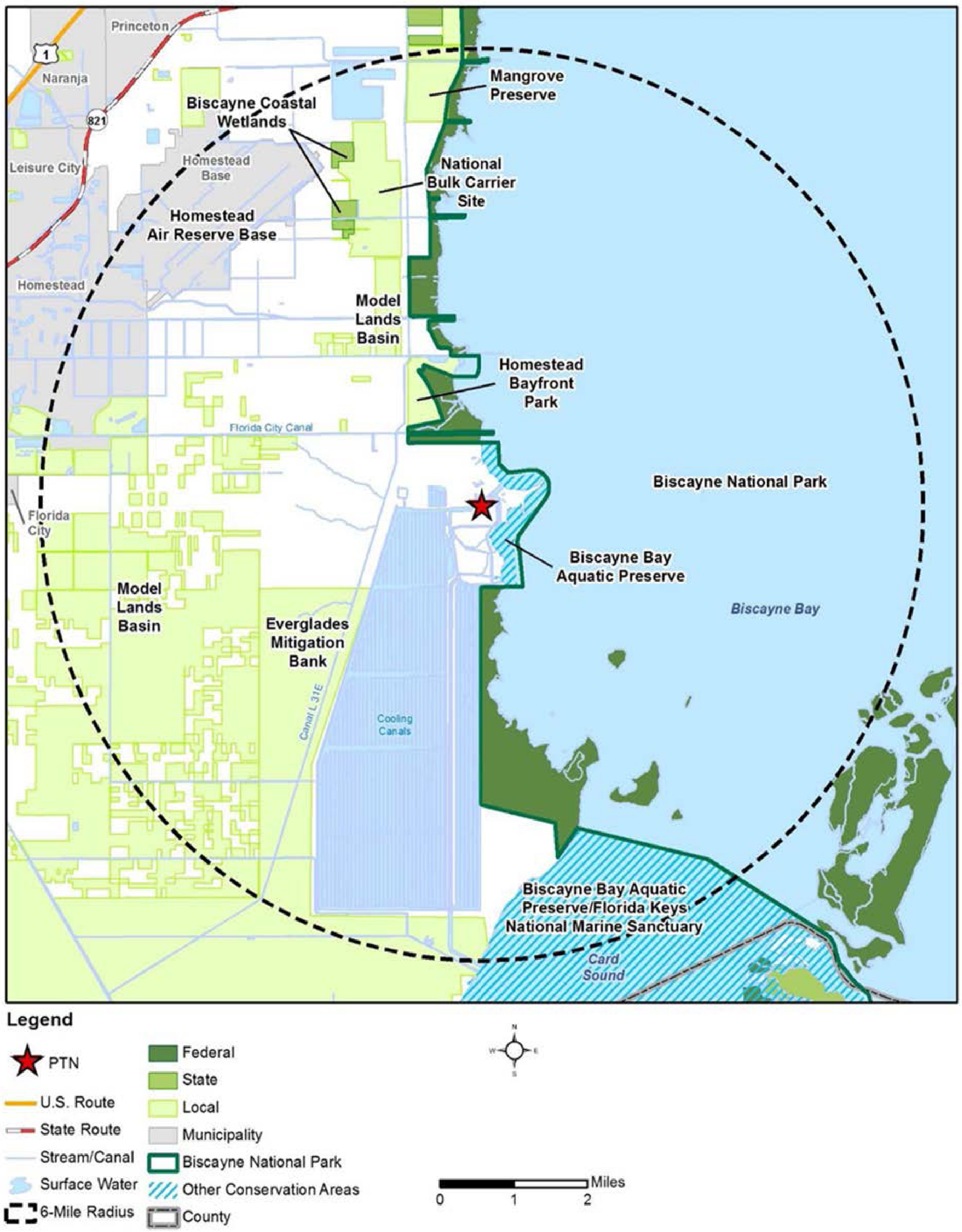
Sincerely,

Matthew J. Raffenberg

Matthew J. Raffenberg
Sr. Director of Environmental Licensing & Permitting

Attachment 1: PTN Location and 6-mile Radius
Attachment 2: Cultural Sites Occurring within 6-mile Radius of the PTN Site

Attachment 1: PTN Location and 6-mile Radius



Attachment 2: Cultural Sites Occurring within 6-mile radius of the PTN Site

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[(a)]
DA12863	K-9 Cemetery	Miami-Dade	Homestead	Eligible
DA11918	SW 117th Avenue/North Canal Bridge	Miami-Dade	Homestead	Eligible
DA12618	SW 117th Avenue / Canal C-103 Bridge	Miami-Dade	Homestead	Ineligible
DA14366	SW 127th Avenue / Canal C-103 Bridge	Miami-Dade	Homestead	Ineligible
DA12835	Building 246 Guard House	Miami-Dade	Homestead	Ineligible
DA12836	Building 260 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12837	Building 261 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12838	Building 262 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12839	Building 263 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12840	Building 264 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12841	Building 265 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12842	Building 269 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12843	Building 270 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12844	Building 271 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12845	Building 272 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12846	Building 273 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12847	Building 274 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12848	Building 277 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12849	Building 278 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12850	Building 279 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12851	Building 280 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12852	Building 281 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12853	Building 282 Magazine Igloo	Miami-Dade	Homestead	Ineligible

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[a]
DA12854	Building 285 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12855	Building 286 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12856	Building 287 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12857	Building 288 Munitions Storage	Miami-Dade	Homestead	Ineligible
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DA12861	Building 4055 Hush House	Miami-Dade	Homestead	Ineligible
DA12862	Building 4064 Hush House	Miami-Dade	Homestead	Ineligible
DA12617	SW 107th Avenue/Canal C102 Bridge	Miami-Dade	Perrine	Not Evaluated
DA11941	Channel Ballast, BISC-5	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA11945	Cement Barge Wreck, BISC-11	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11947	Cement Barge Wreck, BISC-11	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11948	BISC-20, HMS Fowey, Legare Anchorage	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11949	Sands Cut Ballast Piles, BISC-024	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11950	BISC-25, Reef Ballast, Reef Ballast Scat	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11951	BISC-26, Machinery Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11952	BISC-28, Elkhorn Reef Ballast	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11953	BISC-29, Reef Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11954	BISC-30, Morgans Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11955	BISC-31, Stairs Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA11957	BISC-33, Outline Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11958	BISC-35, Pillar Dollar Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[a]
DA11960	BISC-51, Legare Barrels	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11961	BISC-52, South Pacific Reef Ballast Scat	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA11966	BISC-58, Brick Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA14304	BISC-116, Patch Reef Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA14317	BISC-132, Boiler	Miami-Dade	Arsenicker Keys	Not Evaluated
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Florida Master Site File (FMSF), July 2017
[a] National Register of Historic Places status is based on information provided in the FMSF

January 30, 2018

Mr. Marcellus Osceola, Jr. FPLSTF-17-0262
Chairman
Seminole Tribe of Florida
6300 Stirling Road
Hollywood, FL 33024

Dear Mr. Osceola:

Florida Power & Light Company (FPL) has submitted an application to renew the operating license for its Turkey Point Nuclear Plant Units 3 and 4 (PTN) for another 20-years to meet future power generating needs. PTN has been an integral part of Miami-Dade County for nearly 45-years, producing clean, reliable and zero-emissions electricity that powers hundreds of thousands of homes and local businesses. FPL recently modernized PTN by replacing a substantial amount of key equipment including turbine rotors, pipes, valves, machinery, and digital control systems. This license renewal effort will not require any refurbishments, construction, or physical changes to PTN.

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Again, the license renewal effort will not require any refurbishments, construction, or physical changes to PTN. It is our intent by this letter to introduce you to the project and to make data available to you.

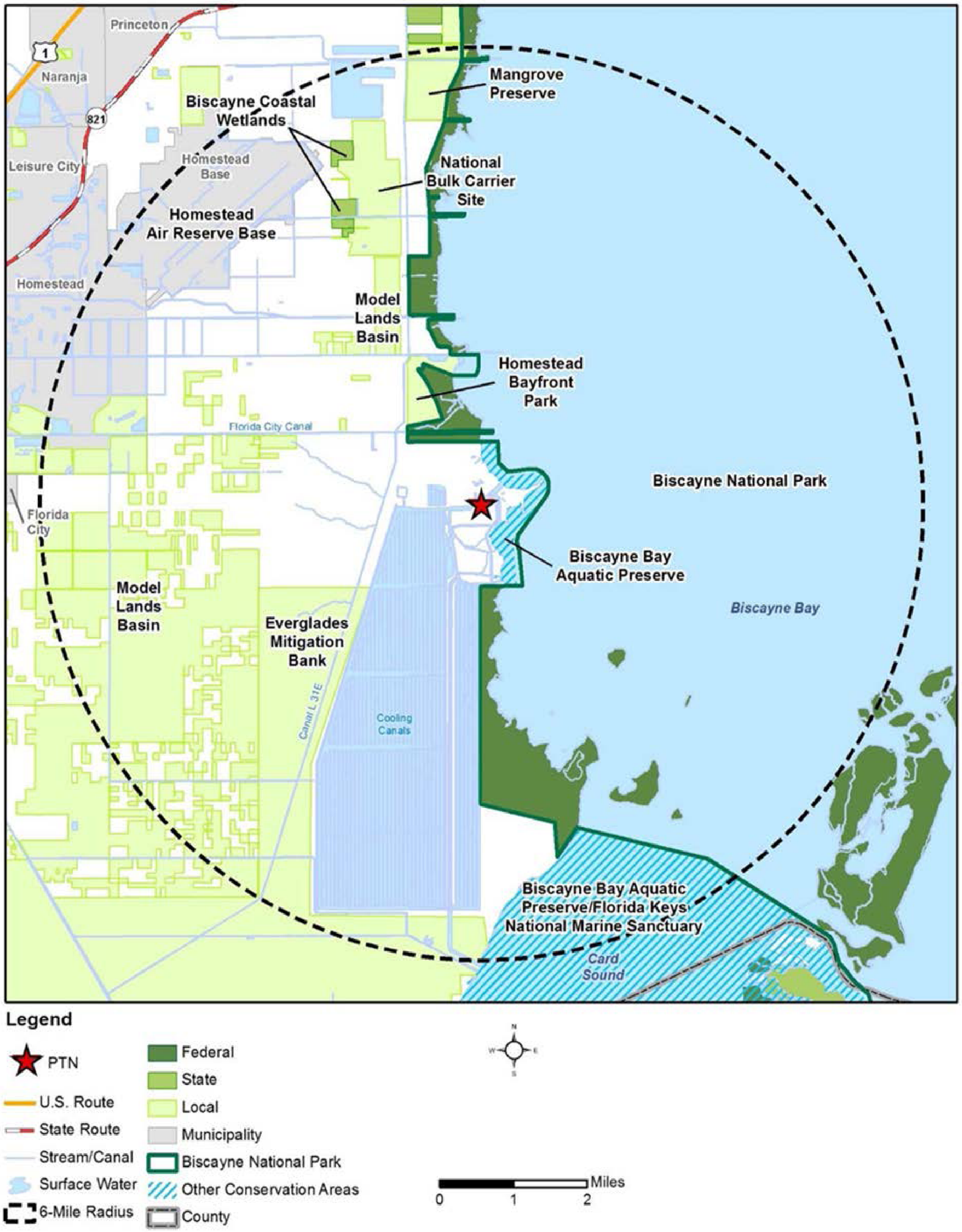
If you would like additional information about the project, please contact Tribal Affairs Agnes Ramsey at (561) 691-2820 or via e-mail at Agnes.Ramsey@fpl.com. In addition, you can contact Jena Mier at (561) 691-2209 or via e-mail Jena.Mier@fpl.com.

Sincerely,

Matthew J. Raffenberg
Sr. Director of Environmental Licensing & Permitting

Attachment 1: PTN Location and 6-mile Radius
Attachment 2: Cultural Sites Occurring within 6-mile Radius of the PTN Site

Attachment 1: PTN Location and 6-mile Radius



Attachment 2: Cultural Sites Occurring within 6-mile radius of the PTN Site

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DA11918	SW 117th Avenue/North Canal Bridge	Miami-Dade	Homestead	Eligible
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DA12856	Building 287 Munitions Storage	Miami-Dade	Homestead	Ineligible
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DA12861	Building 4055 Hush House	Miami-Dade	Homestead	Ineligible
DA12862	Building 4064 Hush House	Miami-Dade	Homestead	Ineligible
DA12617	SW 107th Avenue/Canal C102 Bridge	Miami-Dade	Perrine	Not Evaluated
DA11941	Channel Ballast, BISC-5	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11942	University Dock, BISC-6	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11943	Black Wreck, "Marty's Lost Site". . .	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11944	Jordan's Ballast, Sorelaw's Ballast, . . .	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA11947	Cement Barge Wreck, BISC-11	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11948	BISC-20, HMS Fowey, Legare Anchorage	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11949	Sands Cut Ballast Piles, BISC-024	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11950	BISC-25, Reef Ballast, Reef Ballast Scat	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11951	BISC-26, Machinery Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11952	BISC-28, Elkhorn Reef Ballast	Miami-Dade	Arsenicker Keys	Not Evaluated
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FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[a]
DA11960	BISC-51, Legare Barrels	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11961	BISC-52, South Pacific Reef Ballast Scat	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11962	BISC-53, Bottle Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11963	BISC-55, Biscayne Channel Barge	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA11971	BISC-63, Fowey Rock Barrels	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11972	BISC-64, I-Beam Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11973	BISC-66, Ballast Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA11975	BISC-70, Safety Valve Barge	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA11979	BISC-76, Admiralty Anchor, Alice's. . .	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA11982	BISC-79, Triumph Reef South Ballast	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11983	BISC-80, Triumph Reef Metal Scatter	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11984	BISC-114, Boca Chita North Pontoon	Miami-Dade	Arsenicker Keys	Not Evaluated

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DA11987	BISC-88, Stock Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11988	BISC-89, Sunken Bell Buoy	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11989	BISC-90, Tannehill Cannon	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11995	BISC-100, Pacific Reef Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11996	BISC-101, Debbet Site Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA14302	BISC-99, Grapnel Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14303	BISC-115, Coral Chain Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA14311	BISC-124, The Wall Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
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DA14317	BISC-132, Boiler	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14318	BISC-133, Olive Jar Survey Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14319	BISC-134, Wreck Scatter	Miami-Dade	Arsenicker Keys	Not Evaluated

Florida Master Site File (FMSF), July 2017
[a] National Register of Historic Places status is based on information provided in the FMSF

January 30, 2018

Tribal Historic Preservation Officer
Poarch Band of Creek Indians
5811 Jack Springs Road
Atmore, AL 36502

FPLPBC-17-0265

To whom it may concern:

Florida Power & Light Company (FPL) has submitted an application to renew the operating license for its Turkey Point Nuclear Plant Units 3 and 4 (PTN) for another 20-years to meet future power generating needs. PTN has been an integral part of Miami-Dade County for nearly 45-years, producing clean, reliable and zero-emissions electricity that powers hundreds of thousands of homes and local businesses. FPL recently modernized PTN by replacing a substantial amount of key equipment including turbine rotors, pipes, valves, machinery, and digital control systems. This license renewal effort will not require any refurbishments, construction, or physical changes to PTN.

As part of the renewal process, the U.S. Nuclear Regulatory Commission (NRC) requires that the license renewal application include an environmental report (ER) that assesses the environmental impacts of continued operation. The ER discusses historic and cultural resources, including tribal cultural resources, near the PTN site. As part of the renewal process, the NRC may request an informal or formal consultation in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470), as implemented by 36 CFR 800 (Protection of Historic Properties). FPL does not intend for any discussions between the Tribe and FPL to take the place of any official Section 106 consultation that has been or will be conducted. It is our intent by this letter to introduce you to the project and to make available any data you need to ensure an efficient and effective consultation process.

PTN is located on the southeastern coast of Florida in unincorporated southeastern Miami-Dade County, approximately 25-miles south of Miami. This location is situated in portions of Sections 27, 28, 29, 31, 32, 33, and 34, Township 57 South, Range 60 East. The site borders Biscayne Bay (Biscayne National Park) and Card Sound (Attachment 1). We have conducted a search of the Florida Master Site File records available in GIS and tabular format within 6-mile radius of PTN (Attachment 1). The 6-mile radius also includes portions of the incorporated cities of Florida City and Homestead, and the unincorporated community of Homestead Base. Attachment 2 presents currently recorded cultural resources within a 6-mile radius of PTN.

Again, the license renewal effort will not require any refurbishments, construction, or physical changes to PTN. It is our intent by this letter to introduce you to the project and to make data available to you.

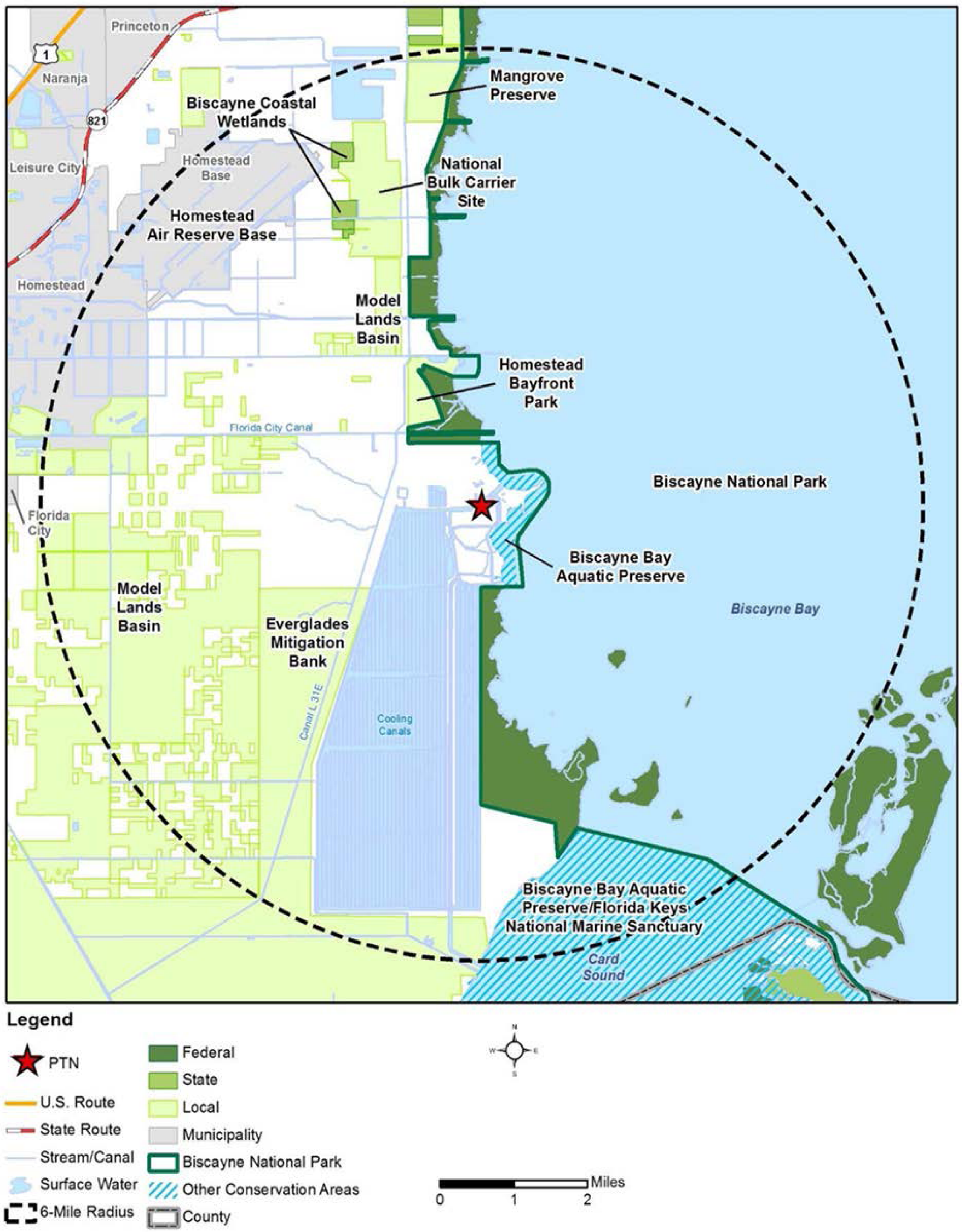
If you would like additional information about the project, please contact Tribal Affairs Agnes Ramsey at (561) 691-2820 or via e-mail at Agnes.Ramsey@fpl.com. In addition, you can contact Jena Mier at (561) 691-2209 or via e-mail Jena.Mier@fpl.com.

Sincerely,

Matthew J. Raffenberg
Sr. Director of Environmental Licensing & Permitting

Attachment 1: PTN Location and 6-mile Radius
Attachment 2: Cultural Sites Occurring within 6-mile Radius of the PTN Site

Attachment 1: PTN Location and 6-mile Radius



Attachment 2: Cultural Sites Occurring within 6-mile radius of the PTN Site

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[(a)]
DA12863	K-9 Cemetery	Miami-Dade	Homestead	Eligible
DA11918	SW 117th Avenue/North Canal Bridge	Miami-Dade	Homestead	Eligible
DA12618	SW 117th Avenue / Canal C-103 Bridge	Miami-Dade	Homestead	Ineligible
DA14366	SW 127th Avenue / Canal C-103 Bridge	Miami-Dade	Homestead	Ineligible
DA12835	Building 246 Guard House	Miami-Dade	Homestead	Ineligible
DA12836	Building 260 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12837	Building 261 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12838	Building 262 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12839	Building 263 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12840	Building 264 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12841	Building 265 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12842	Building 269 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12843	Building 270 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12844	Building 271 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12845	Building 272 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12846	Building 273 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12847	Building 274 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12848	Building 277 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12849	Building 278 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12850	Building 279 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12851	Building 280 Magazine Igloo	Miami-Dade	Homestead	Ineligible
DA12852	Building 281 Magazine Igloo	Miami-Dade	Homestead	Ineligible
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FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[a]
DA12854	Building 285 Munitions Storage	Miami-Dade	Homestead	Ineligible
DA12855	Building 286 Munitions Storage	Miami-Dade	Homestead	Ineligible
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Florida Master Site File (FMSF), July 2017
[a] National Register of Historic Places status is based on information provided in the FMSF.

January 30, 2018

Mr. Ian Thompson
Tribal Historic Preservation Officer
The Choctaw Nation of Oklahoma
P.O. Box 1210
Durant, OK 74702-1210

FPLCNO-17-0258

Dear Mr. Thompson:

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Sincerely,

Matthew J. Raffenberg
Sr. Director of Environmental Licensing & Permitting

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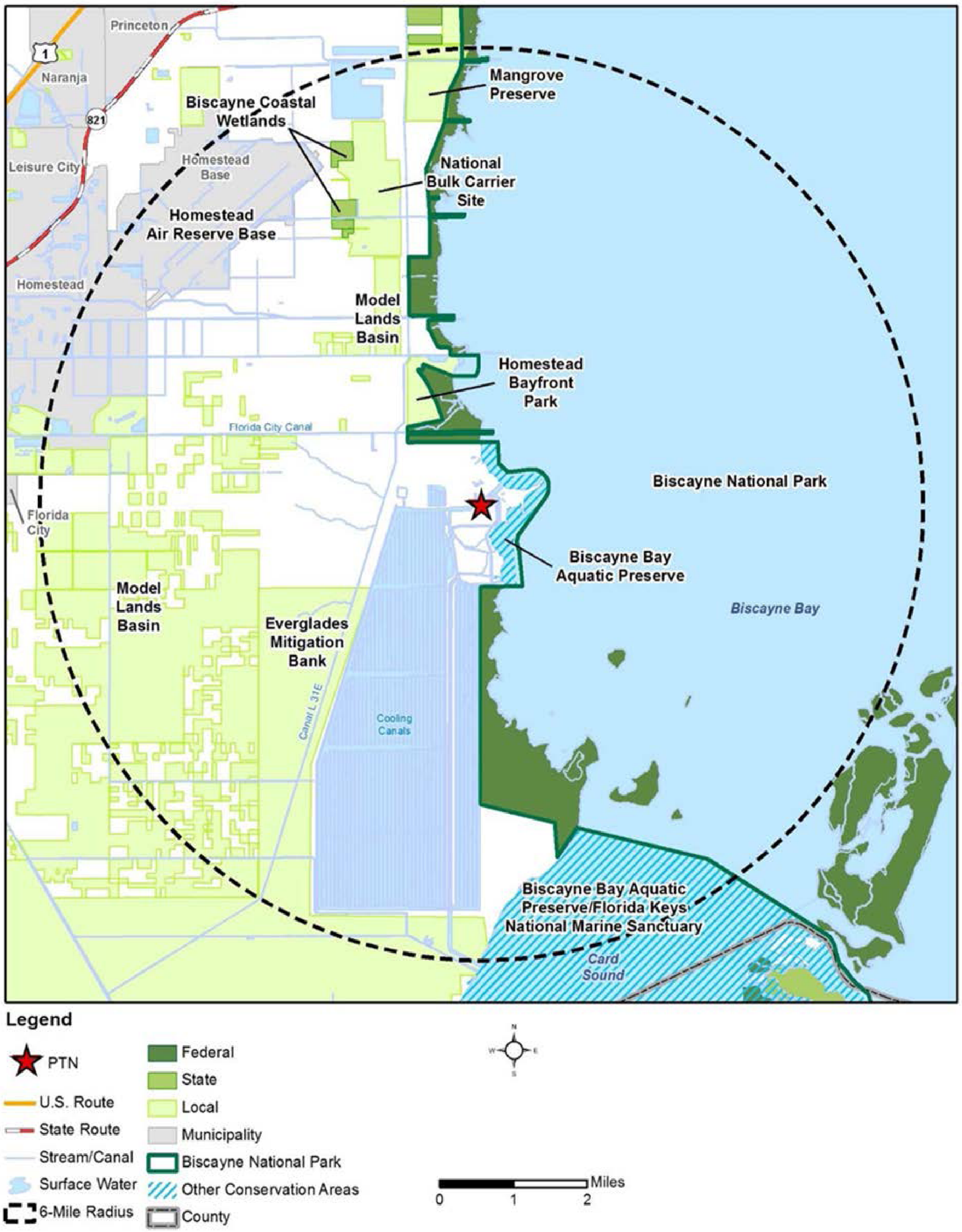

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DA11954	BISC-30, Morgans Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11955	BISC-31, Stairs Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11956	BISC-32, Ball Buoy Wreck (Anomaly #12. . .)	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11957	BISC-33, Outline Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11958	BISC-35, Pillar Dollar Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[(a)]
DA11960	BISC-51, Legare Barrels	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11961	BISC-52, South Pacific Reef Ballast Scat	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11962	BISC-53, Bottle Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11963	BISC-55, Biscayne Channel Barge	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11964	BISC-56, Bug Light Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11965	BISC-57, Bell Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11966	BISC-58, Brick Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11967	BISC-59, Boxcar Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11968	BISC-59, Captain Ed's Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11969	BISC-61, Second Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11970	BISC-62, Cannon Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11971	BISC-63, Fowey Rock Barrels	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11972	BISC-64, I-Beam Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11973	BISC-66, Ballast Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11974	BISC-68, Anchor (Alias: Old Anchor Reef)	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11975	BISC-70, Safety Valve Barge	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11976	BISC-73, Ore Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11977	BISC-74, Aladdin Lamp Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11978	BISC-75, Ring Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11979	BISC-76, Admiralty Anchor, Alice's. . .	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11980	BISC-77, Reef Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11981	BISC-78, Old Rhodes Ballast, Chris'. . .	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11982	BISC-79, Triumph Reef South Ballast	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11983	BISC-80, Triumph Reef Metal Scatter	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11984	BISC-114, Boca Chita North Pontoon	Miami-Dade	Arsenicker Keys	Not Evaluated

FMSF ID#	Resource Name	County	Quadrangle	NRHP Status[(a)]
DA11985	BISC-86, Anchor Fluke	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11986	BISC-87, Steel Frames	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11987	BISC-88, Stock Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11988	BISC-89, Sunken Bell Buoy	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11989	BISC-90, Tannehill Cannon	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11995	BISC-100, Pacific Reef Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA11996	BISC-101, Debbet Site Wreck	Miami-Dade	Arsenicker Keys	Not Evaluated
DA12619	SW 328th Street / Canal C-107 Bridge	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14302	BISC-99, Grapnel Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14303	BISC-115, Coral Chain Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14304	BISC-116, Patch Reef Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14305	BISC-118, Lionfish Killer Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14307	BISC-120, Shrimp Boat	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14308	BISC-121, Corsair Wreckage	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14309	BISC-122, Anchor Holding Fast	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14310	BISC-123, Rocky Reef Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14311	BISC-124, The Wall Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14312	BISC-125, Straits of Florida Debris	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14315	BISC-130, Reef Tower Ballast	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14317	BISC-132, Boiler	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14318	BISC-133, Olive Jar Survey Anchor	Miami-Dade	Arsenicker Keys	Not Evaluated
DA14319	BISC-134, Wreck Scatter	Miami-Dade	Arsenicker Keys	Not Evaluated

Florida Master Site File (FMSF), July 2017
[a] National Register of Historic Places status is based on information provided in the FMSF.