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Levy Nuclear Plant Units 1 and 2 (LNP) Section 404(b)(1) Alternatives Analysis

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Acronyms and Abbreviations

AP1000	Westinghouse Electric Company, LLC, AP1000 Reactor
APE	Area of Potential Effect
APT	Aquifer Performance Testing
ARNI	Aquatic Resources of National Importance
BMAP	basin management action plan
BMP	best management practice
BRA	Biological Research Associates, Inc.
BTA	best technology available
BTS	U.S. Department of Transportation Bureau of Transportation Statistics
CEQ	Council on Environmental Quality
CERP	Comprehensive Everglades Restoration Plan
CFBC	Cross Florida Barge Canal
CFR	Code of Federal Regulations
cfs	cubic feet per second
CO_2	carbon dioxide
COLA	Combined License Application
CREC	Crystal River Energy Complex
CSXT	CX Transportation
CWA	Clean Water Act
CWIS	cooling water intake structure
DFIRM	Digital Flood Insurance Rate Map
DOE	U.S. Department of Energy
DSM	demand-side management
DWRM2	District Wide Regulation Model, Version 2
EAB	exclusion area boundary
EFS	Evaluation of Florida Sites
EIA	Energy Information Administration
EMP	Environmental Monitoring Plan
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ER	Environmental Report
ERP	Environmental Resource Permit
ESRI	Environmental Systems Research Institute
ESRP	Environmental Standard Review Plan
FAA	Federal Aviation Authority
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FDOH	Florida Department of Health
FDOT	Florida Department of Transportation
FDRP	Florida Division of Recreation and Parks
FEMA	Federal Emergency Management Agency
FGDL	Florida Geographic Data Library

Acronyms and Abbreviations, Continued

FIRM	Flood Insurance Rate Map
FLUCCS	Florida Land Use Cover and Forms Classification System
FNAI	Florida Natural Areas Inventory
FNOR	Florida Northern Railroad
fps	feet per second
FPSC	Florida Public Service Commission
ft.	foot/feet
FWC	Florida Fish and Wildlife Conservation Commission
gCO2eq/kWh	grams of carbon dioxide equivalent per kilowatt hour
GEIS	Generic Environmental Impact Statement
GIS	geographic information system
IGCC	integrated gasification-combined cycle
IRP	Integrated Resource Plan
kV	kilovolt
kWe	kilowatts electric
LDR	land development regulation
LEDPA	least environmentally damaging practicable alternative
LNP	Levy Nuclear Plant Units 1 and 2
LWCF	Land and Water Conservation
m.	meter
mfl	minimum flow level
mgd	million gallons per day
MSW	municipal solid wastes
MW	megawatts
MWe	megawatt electric
MWh	megawatt hours
NA	not applicable
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRCS	Natural Resource Conservation Service
NREL	National Renewable Energy Laboratory
NRHP	National Register of Historic Places
NRP	National Register of Historic Places
NUREG	NRC Regulation
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
OFW	Outstanding Florida Waters
OSHA	Occupational Safety and Health Administration
PEF	Progress Energy Florida, Inc.

Acronyms and Abbreviations, Continued

PIR	public interest review
PV	photovoltaic
RAI	request for additional information
ROI	region of interest
ROW	right-of-way
SCA	Site Certification Application
SFWMD	South Florida Water Management District
SHPO	State Historic Preservation Officer
SJRWMD	St. Johns River Water Management District
SO_2	sulphur dioxide
SRWMD	Suwannee River Water Management District
TCLP	Toxicity Characteristic Leaching Procedure
TMDL	total maximum daily load
TMR	Telescopic Mesh Refinement
TYSP	Ten-Year Site Plan
UPARR	Urban Park and Recreation Recovery
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WMD	Water Management District
WMP	Wetlands Mitigation Plan
WRCA	water resource caution area

Executive Summary

Progress Energy Florida, Inc. (PEF) proposes to build and operate two Westinghouse Electric Company, LLC (Westinghouse), AP1000 Reactor (AP1000) units in Levy County, Florida. The purpose of constructing and operating the proposed Levy Nuclear Plant Units 1 and 2 (LNP) is to meet the public's need for reliable increased electrical baseload capacity in PEF's service area.

The selection of nuclear power generation technology was based on an alternatives analysis that evaluated the available technology options to meet the project's purpose. This alternatives analysis summarizes the potential impacts on aquatic environments from the construction of new nuclear power plants at the alternative sites, and used the best available information at the time of the analysis. This analysis was performed on five alternative sites: LNP, Crystal River, Dixie 1, Highlands, and Putnam 3. The no-action alternative and Crystal River site were evaluated and it was determined that neither alternative met the purpose and need of the project. Both alternatives were therefore eliminated from the analysis.

For the least environmentally damaging practicable alternative (LEDPA) analysis, the determination of impacts was based on site-specific data for each of the four remaining alternative sites using a conceptual design for a 2-unit Westinghouse AP1000 site. The offsite impacts were based on typical requirements of this design and further refined based on site-specific constraints. The transmission lines needed for each site were based on the recommendations in the 2006 Navigant Transmission Impact Study (Navigant Consulting, 2006). The right-of-way (ROW) widths were based on the line voltage and whether the new transmission line was collocated with existing lines. Three of the alternative sites (Dixie 1, Highlands, and Putnam 3) required a reservoir to meet cooling water or water storage requirements. Reservoir impacts were based on a standard reservoir size. This approach allowed for a direct comparison of the environmental and public interest factors across the four alternative sites, with the goal of identifying the LEDPA site.

The "impacts to review" factors outlined in the Section 404(b)(1) analysis in the Clean Water Act (Title 40 Code of Federal Regulations [CFR] Part 230) were evaluated in a decision matrix to determine the LEDPA site. As summarized in Table ES-1, the LEDPA site was determined to be the LNP site, which had an overall score of 74.6. Additional analysis of public interest review factors (described in 33 CFR 320) concluded that the LNP site had the lowest amount of impacts for these factors compared to the other alternative sites.

TABLE ES-1
LEDPA Consolidated Score[a]

LNP	Dixie 1	Highlands	Putnam 3
72.6	62.7	56.9	54.5

[a] Based on weighted rankings; highest score represents LEDPA site.

1.0 Introduction

This document supports the response to Request for Additional Information (RAI) U.S. Army Corps of Engineers (USACE) 14 (U.S. Nuclear Regulatory Commission [NRC] Letter ML0926501752 dated September 25, 2009) and USACE comment letter received March 5, 2010. This document responds directly to the issue of the least environmentally damaging practicable alternative (LEDPA) analysis, submitted pursuant to the Section 404(b)(1) guidelines under the Clean Water Act (CWA). This document is a compilation of information related to the alternative sites to assist the USACE in performing the alternatives analysis. However, it is not intended to be a substitute for the whole body of evidence relating to "special aquatic sites" and/or alternatives that is presented in the Combined License Application (COLA) Environmental Report (ER), submitted pursuant to the National Environmental Policy Act of 1969 (NEPA) and its amendments[1], the State of Florida Site Certification Application (SCA), and additional supplemental permit information supplied directly to the USACE, the NRC, the Florida Department of Environmental Protection (FDEP), and other state agencies. This response specifically addresses the issue of alternatives to potential aquatic environmental impacts, including wetlands, and replaces the previously submitted alternatives analysis.

Progress Energy Florida, Inc.'s (PEF's) alternatives review in ER Chapter 9 was based on the overall site selection process and the details of the alternative sites evaluated in PEF's proprietary Evaluation of Florida Sites (EFS) (PEF, 2007) performed in accordance with NRC Regulation (NUREG)-1555, Environmental Standard Review Plan (ESRP). The Electric Power Research Institute (EPRI) *Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application* (EPRI, 2002) was also used to provide guidance during PEF's alternative site selection and review process.

1.1 Project Background

PEF proposes to build and operate two Westinghouse Electric Company, LLC (Westinghouse), AP1000 Reactors (AP1000), an advanced passive light water nuclear plant design certified under Title 10 Code of Federal Regulations (CFR) Part 52, Subpart B, at the Levy Nuclear Plant Units 1 and 2 (LNP) site in Levy County, Florida. The project also includes new electrical transmission lines and substations and associated facilities both onsite and offsite.

PEF has developed a comprehensive ER for the LNP to address environmental issues associated with its COLA. The ER follows the content and organization of the NRC *Standard Review Plans for Environmental Reviews for Nuclear Power Plants*, also known as NUREG-1555, Revision 0 (October 1999). The ER describes the existing environment at the LNP site and the vicinity, summarizes the environmental impacts of construction and operation, considers appropriate mitigation measures, and reviews alternative sites. The ER assesses

[1] Under 40 CFR 230.210, an alternative analysis submitted for purposes of NEPA shall also be considered for purposes of LEDPA. See 40 CFR 230.210(4).

the environmental impacts from the construction and operation of two AP1000 units at the LNP site and describes the project, potential alternatives, and the methods and sources used in the environmental impact analysis.

1.2 Proposed Action

PEF proposes to build and operate two AP1000 units at the LNP site located in Levy County, Florida. The AP1000 units will use a recirculating cooling water system, and waste heat will be dissipated by a series of mechanical draft cooling towers, which will draw makeup cooling water from the Cross Florida Barge Canal (CFBC). Cooling tower blowdown will be transported in two pipelines (one for each unit) from the LNP and discharged into the Crystal River Energy Complex (CREC) discharge canal and, ultimately, into the Gulf of Mexico.

1.3 Specific Activity Requiring Department of Army Permit

The USACE Regulatory Program has substantial statutory authority concerning dredging and filling in navigable waters, including wetlands, of the United States. Construction of structures in wetlands and regulated waterways constitute activities that may be considered water dependent and require USACE Section 404 and Section 10 permits. Section 404 of the CWA regulates the discharge of fill material in waters of the United States (navigable or not), whereby the discharge has the effect of raising the bottom elevation (40 CFR 230). Section 10 of the Rivers and Harbors Act regulates all work in navigable waters of the United States that may affect the navigable capacity of such waters (33 CFR 322). The proposed LNP project involves unavoidable impacts to jurisdictional wetlands and streams that are subject to the rebuttable presumption concerning non-water-dependent activities pursuant to Section 404 regulations under the CWA.

PEF's proposed LNP project including construction of the power block and ancillary facilities, makeup and blowdown pipelines, and transmission lines will affect the aquatic environment. Wetland impacts are expected to result from the construction of the reactor on the project site, makeup and blowdown pipelines, barge slip, and transmission lines. Direct discharges of dredged or fill material will result from the construction of the cooling water intake structure (CWIS) and barge slip on the CFBC and blowdown pipeline crossing of the CFBC.

1.4 Analysis Methodology

The primary purpose of the alternatives analysis was to summarize the potential impacts on aquatic sites from the construction of new nuclear power plants at five sites identified in the EFS (PEF, 2007)using the best available information consistently available at the time of the analysis. This analysis included identification of the impact of the no-action alternative, reviewed possible energy-producing resources that could be used as alternatives to the proposed action, and the description of the process for identification of the five alternative sites. The no-action alternative and review of other viable energy-producing technologies are described in Section 3.2.

The alternatives analysis was performed on five sites: LNP, Crystal River, Dixie 1, Highlands, and Putnam 3, as defined in the EFS (PEF, 2007). The Crystal River site was determined to be not-practicable because it did not meet the purpose and need of this project, as described in Section 3.2.3.3. The remaining four sites were considered to be practicable and were analyzed in this LEDPA alternatives analysis. Of these sites, the LNP site was defined in the ER as the proposed site. The detailed analysis for the remaining four alternative sites is presented in Section 4.0. The overview map showing the locations of the sites is presented on Figure 1.4-1.

To evaluate the baseline conditions present at each alternative site, an overall site area boundary was defined as a 6,000-acre circle, with the centerpoint located at the centerpoint of Units 1 and 2. This boundary provides a measure of the overall conditions on each site for further geographical analysis. The 6,000-acre size was identified based on the convention that a representative site size for a 2-unit nuclear power plant, including exclusion area boundary (EAB), ancillary features, construction laydown areas, security zones, and a cooling water storage reservoir, is 2,000 acres. A site area of 6,000 acres (three times the nominal area requirement) provides a consistent basis for comparison of sites, while also providing flexibility for locating plant components within the vicinity of the evaluated area.

Direct impacts include onsite facilities (cooling towers, reactor buildings, and other auxiliary structures), offsite facilities (intake and blowdown pipelines, transportation access, and site access roads), and transmission lines for all sites. For the analysis, standard features used to determine impacts were based on site-specific data for each alternative site using the LNP site conceptual design that is representative of a 2-unit Westinghouse AP1000 site. The offsite impacts were based on typical requirements and then further refined based on site-specific constraints. This approach allowed for a direct comparison of the LEDPA environmental and public interest factors across all four alternative sites.

Three of the alternative sites (Dixie 1, Highlands, and Putnam 3) were also identified in the EFS as needing a reservoir to meet cooling water or water storage requirements. A standard reservoir size was assumed to be required for these sites. This analysis includes potential impacts on the evaluation parameters listed in 40 CFR 230(10), which is consistent with Section 404(b)(1) guidelines. Additionally, the alternative sites were evaluated for impacts to public interest review factors as described in CFR 320.

To approximate the impacts from specific project elements at the four alternative sites, a conceptual site layout was developed that includes the following elements:

- Units 1 and 2 (including reactors, steam generators, and ancillary facilities)
- Cooling towers
- Stormwater ponds
- Switchyard
- Switchyard connector
- Auxiliary buildings
- Laydown areas

The relative location and orientation of these elements to each other remained fixed for all four alternative sites. Figure 1.4-2 shows the typical site layout approach used for the overall site area, onsite impact area, reservoir impact area, transmission corridors, and offsite corridors at the alternative sites. For the LNP site, the location and orientation of these

structures was used as described in the ER. Structures on the other alternative sites were based on the LNP layout so that direct comparisons could be made. For the other sites, the location and orientation of the conceptual site layout was optimized based on the following criteria:

- EAB Flexibility –The conceptual site layout was located near the center of the site with a minimum distance of 5,000 feet (ft.) to the nearest public road.
- All onsite structures were located within the 6,000-acre area with the exception of the reservoir. A minimum of 50 percent of the reservoir was located within the 6,000-acre area to account for property issues and engineering constraints, and to minimize constructability concerns.
- Wetland Avoidance –The location and orientation were optimized to avoid the total area classified as wetlands by the State Water Management Districts (WMDs), Florida Land Use Cover and Forms Classification System (FLUCCS) data, and National Wetlands Inventory (NWI) data.
- Floodplain Avoidance –The location and orientation were optimized to avoid Federal Emergency Management Agency (FEMA) 100-year floodplains to the extent possible.

To estimate the impact area of the intake and blowdown pipelines, corridors from the boundary of the conceptual site layout to the nearest suitable water source were established for each site. While impacts from pipeline construction would likely be temporary, this analysis conservatively assumed that all impacts were permanent and treated them the same way as onsite impacts were treated. To estimate the impact area of a potential railroad spur or heavy haul road, a corridor from the boundary of the conceptual site layout to the nearest active railroad or barge access was created. These impacts were also considered permanent. The EFS includes a railroad spur as an option for all sites analyzed in that document (PEF, 2007). While site-specific designs identified a heavy haul road instead of a rail spur for LNP, impacts from a heavy transportation corridor were included to maintain consistent types of impacts across the sites in this analysis.

Offsite corridors, including intake and blowdown pipelines, access roads, and heavy transportation corridors, were defined as follows:

- Single intake or blowdown discharge pipeline corridor width of 100 ft.
- Collocated intake and blowdown discharge pipelines corridor width of 150 ft.
- Access road corridor width of 50 ft.
- Transportation corridor (railroad or heavy haul road) width of 150 ft.

The locations of the offsite corridors were optimized for the following:

- Intake and Blowdown Discharge Point Separation –The location of the intake and blowdown discharge points was optimized to maintain a distance of at least 5,280 ft. between the intake and discharge points.
- Wetland Avoidance –The offsite corridor routes were optimized to reduce impacts on areas classified as wetlands by WMD, FLUCCS, and NWI data.

In the EFS, the Dixie 1, Highlands, and Putnam 3 sites were identified as needing a reservoir to meet project requirements. A standard reservoir size was calculated for the two units at

these three sites based on drought-resistance parameters. The assumptions used to size the reservoir were as follows:

- Four cycles of concentration
- Total cooling water requirement of 55 million gallons per day (mgd)
- Storage for 90 days
- Effective reservoir depth of 10 ft.

These parameters produced a 1,500-acre reservoir impact area within the site area. For the three sites, the reservoir was given a rectangular shape, with dimensions of 6,600 ft. by 9,900 ft., and the location was optimized as described previously to avoid the total area of wetlands impacts first, followed by avoidance of floodplains if possible. The impacts associated with the reservoir were considered permanent impacts. The assumption to provide 90 days of storage was determined based on allowing the operation of the units during a short-term drought when no makeup water would be withdrawn from the water source. This assumption was used to provide a minimum size estimate for the reservoir. This assumption is considered reasonable, since in peninsular Florida historic monthly water budgets reflect deficiencies between 3 and 9 months out of a typical year (Fernald and Purdam, 1998). Therefore this sized reservoir is estimated to allow for the production of reliable power in a typical year or short-term drought. During an atypical year (severe drought) more water withdrawals than could be supported by the freshwater sources or a reservoir of this size may be required to continue to produce reliable power. Thefore size of the reservoir is likely a conservative estimate for the reservoir needed. If additional storage were needed (greater than 90 days), the reservoir would need to be larger. The 90-day storage was used as a basis for the minimum amount of time that would be required for operation of the units during a short-term drought; however, no detailed engineering studies have been performed to date to estimate the exact needs. If resource agencies or engineering studies indicate that more than 90 days of storage would be required for long-term drought mitigation, the size and relative impacts would be larger. The size of the reservoir was determined to be applicable for this analysis since it provided a bounding level of impacts for the sites that needed a reservoir so that direct comparisons could be made to the LNP site (that does not require a reservoir). Since the final size of a reservoir would likely be influenced by negotiations with resource agencies and site-specific needs, this minimum-sized reservoir should be used for this analysis so the associated impacts for the three sites requiring a reservoir (Dixie 1, Highlands, and Putnam 3) are not overestimated.

The transmission corridor routes were based on the recommendations in the Navigant study (Navigant Consulting, 2006), and the widths were based on line size and the presence of existing lines. The transmission corridors were optimized to be collocated with existing lines or other linear features such as roads to reduce environmental impacts; however, they were not optimized at this time from an engineering stand point. The Navigant report summarizes the necessary transmission infrastructure needed for all sites analyzed in Section 4.0 of this LEDPA analysis. Specific details include the size, number, and location of transmission lines needed to connect to the existing power grid, as well as system reliability concerns. The recommendations for the LNP site were later refined, and described in the ER. However, the unmodified recommendations identified in the Navigant study for the LNP site were used for this analysis to maintain a consistent methodology and level of detail across all four sites analyzed. To determine the width of the rights-of-way (ROWs) needed

for each line, a series of assumptions were made based on the size of the lines and the presence of the existing ROW:

- New 500-kilovolt (kV) lines require a 220-ft. ROW per line
- New lines adjacent to existing lines require 150 ft. between the centerline of the existing structure, centerline of new structure, and an additional 110 ft. to the edge of the ROW
- New 230-kV lines require a 100-ft. ROW per line
- Addition of 230-kV line to existing ROW requires 55 ft. of ROW
- Existing 230-kV lines have a 50-ft. ROW on each side of the centerline
- 150 ft. of spacing is needed between all lines
- All double 500-kV circuits require two new transmission lines (two circuits cannot share a common structure)

Based on these assumptions and the presence or absence of existing ROWs, transmission line corridors with widths varying between 55 ft. and 460 ft. were used in the analysis. The impact areas for transmission lines were calculated from the conceptual site layout boundary. Where transmission line corridors overlapped with other corridors or features, the impacts were calculated only for the feature with the greatest land disturbance potential. For example, when transmission lines overlapped with the reservoir, the reservoir impacts were assumed to have a greater ground disturbance, so the area of the reservoir was included in the impact tables while the area of the transmission lines was not. This method eliminates double counting impacts for all project elements and allows a total site impact to be calculated by simply adding onsite, offsite, reservoir, and transmission line impacts together.

The onsite, reservoir, offsite, and transmission line impacts were then calculated using a geographic information system (GIS) analysis of existing data. This information is summarized in Table 1.4-1. For a full list of data sources, please refer to Appendix A. Data management tasks were completed using Microsoft Access Geodatabases and Environmental Systems Research Institute (ESRI) ArcGIS software.

TABLE 1.4-1
Summary Information of Impacts for Analyzed Alternative Sites

Impact Areas	LNP acres	Dixie 1 acres	Highlands acres	Putnam 3 acres
Onsite Impact Areas[a]	660	2,160	2,160	2,160
Transmission Line Corridor Areas	9,395	13,452	6,725	6,212
Offsite Impact Areas	341	850	515	333
Total Impact Areas	10,396	16,462	9,400	8,705

[a] Reservoirs will not be needed at the LNP site and therefore are not included in the Onsite Impact Areas.

2.0 Project Purpose and Need

This section summarizes the project purpose and need. This information is also included in the ER and the LNP SCA (PEF, 2008), as well as the Florida Public Service Commission (FPSC) final order determining the need for the project, issued on August 12, 2008 (FPSC, 2008a).

2.1 Basic Project Purpose and Water Dependency

The proposed project is the development of new baseload generating capacity to supply electricity to PEF's service area using advanced technology to produce reliable generation that is located proximate to its major customer base and that minimizes overall impacts to the environment. Generating reliable capacity is the basis for the evaluation of the water-dependent nature of the project. While electric power generation frequently requires water for condenser cooling and other processes, basic electric power generation is not necessarily a water-dependent activity under USACE's guidelines. PEF will therefore need to rebut the presumption that there is a less environmentally damaging practicable alternative that will meet its project purpose.

While the basic purpose of the project may not be water dependent, several elements of the proposed project are water dependent. The same need for water exists for any of the potential alternative baseload electric generation technologies that could meet the project purpose, including natural gas-fired and coal-fired plants. The primary water-dependent element is the need for water to cool the power plant condensers. Effective condenser cooling, especially in warm climates, is dependent upon water rather than other alternative cooling methods. As described in detail in ER Subsection 9.4.1.1.3, dry cooling systems that do not rely on water are not practicable from a cost, technology, or logistical perspective for the following reasons:

- Dry cooling has high capital, operation, and maintenance costs. The U.S. Environmental Protection Agency (EPA) has rejected dry cooling as a best technology available (BTA) under the CWA, stating that "dry cooling carries costs that are sufficient to pose a barrier to entry to the marketplace for some projected new facilities" (EPA, 2001a). In that analysis, the EPA found the cost of dry cooling to be more than three times the cost of wet cooling.
- Dry cooling is inefficient. Efficiencies of dry cooling are lowest in the summer when demand for electricity is at peak levels.
- Dry cooling would require replacement power, estimated at 1 to 4 percent of a plant's total electrical output, to generate the same amount of electricity (ER Subsection 9.4.1.1.3). This additional generating capacity would require either a larger plant size (not realistic as nuclear plants are not scalable) or replacing the power supply with a carbon dioxide (CO_2) emitting technology that would increase associated environmental impacts.

Without an adequate and consistently reliable cooling water source, the proposed project could not reasonably be built. The project as proposed has minimized the need for cooling water to the maximum extent practicable by using requirements of the federal CWA Section 316(b) Phase I Rule governing CWIS for proposed new power plants. Use of a closed-cycle cooling tower system will minimize cooling water use.

Another water-dependent element of the proposed project is disposal of LNP wastewater (blowdown and other process water). As described in ER Subsection 9.4.2.1.3 and ER Table 9.4-5, a review of wastewater disposal alternatives showed that discharge of LNP wastewater into the existing CREC discharge canal was the preferred alternative with the least impact to the aquatic environment.

An additional water-dependent element of the proposed project is the construction of a barge slip in the upper portion of the CFBC. This will allow ocean-going barges to transport heavy equipment to a dedicated heavy haul road to the construction site. This will eliminate the cost and potential environmental and socioeconomic impacts associated with land transport of these materials. The design of the barge slip is also intended to minimize impacts to the aquatic environment.

2.2 Overall Project Purpose

The overall purpose of the proposed project is to meet the public's need for reliable increased electrical baseload capacity in PEF's service area by generating reliable electric power. This purpose provides the basis for determining the practicability and geographic scope of alternatives.

The project is proposed to meet the demonstrated and approved need for reliable baseload power. The choice of nuclear energy to produce the electric energy for the PEF service area was approved by the FPSC in August 2008. Testimony provided on behalf of PEF before the FPSC demonstrated that nuclear fuel is the lowest cost fuel source available and represents the most cost-effective source of power to PEF's customers (Crisp, 2008; FPSC, 2008a). Nuclear energy will also support the 2006 Florida Energy Act requirement that PEF take into account the following:

1. Florida's need to improve the balance of fuel diversity
2. Reduce Florida's dependence on fuel oil and natural gas
3. Reduce air emission compliance costs
4. Contribute to the long-term stability of the electric grid

Nuclear energy was determined to be more cost-effective than other baseload generating options, including coal, natural gas, and oil (Crisp, 2008). This testimony also noted that future environmental costs associated with carbon capture or abatement costs, and recent regulatory decisions to forego coal as an option supported the selection of nuclear technology. Several coal projects have recently been denied by the FPSC or withdrawn by the applicants, and Florida's Governor Charlie Crist opposes coal and will not approve new coal plants (Isaac, 2007; Brown, 2008; Grom, 2009).

More information concerning the design selection process is presented in ER Section 9 and in Subsection 3.2.2 of this document.

2.3 Project Need

The new nuclear baseload generation planned at the LNP site is necessary to ensure that PEF meets the expected reliability and reserve margin needs of its service territory. Pursuing additional nuclear generation will also help PEF maintain a balanced and diverse fuel supply and provide a significant source of non-carbon-emitting baseload generation. A detailed discussion on the need for power is included in ER Chapter 8.

3.0 Alternatives

3.1 Development of Alternatives

PEF must provide sufficient information and data for the USACE to reasonably evaluate, differentiate, and compare the relative impacts of each practicable alternative on the overall environment and, in particular, on the aquatic environment. The level of analysis should be commensurate with the level of project impacts. This section describes the applicable guidelines and presumptions for the LNP project pursuant to Section 404 of the CWA that state:

> "Where the activity associated with a discharge proposed for a special aquatic site, such as wetlands, does not require access or proximity to or siting within the special aquatic site in question to fulfill its basic purpose (that is, is not water dependent), practicable alternatives that do not involve special aquatic sites are presumed to be available, unless clearly demonstrated otherwise.
>
> "In addition, where a discharge is proposed for a special aquatic site, all practicable alternatives to the proposed discharge that do not involve a discharge into a special aquatic site are presumed to have less adverse impact on the aquatic ecosystem, unless clearly demonstrated otherwise."

Four conditions must be satisfied to make a determination that a proposed discharge of dredge or fill material complies with the 40 CFR 230 and Section 404(b)(1) guidelines. These conditions and a discussion of compliance with these conditions follow.

- Except as provided under Section 404(b)(2), no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge that would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences.
- No discharge of dredged or fill material shall be permitted if it contributes to violation of any applicable state water quality standard; violates any applicable toxic effluent standard; or adversely impacts listed species, their critical habitat, or any marine sanctuary.
- Except as provided under Section 404(b)(2), no discharge of dredged or fill material shall be permitted that will cause or contribute to significant degradation of the waters of the United States.
- Except as provided under Section 404(b)(2), no discharge of dredged or fill material shall be permitted unless appropriate and practicable steps have been taken that will minimize potential adverse impacts of the discharge on the aquatic ecosystem.
- Additionally, an evaluation of the public interest review (PIR) set forth at 33 CFR 320.4(a) is conducted after the Section 404(b)(1) establishes the LEDPA. The review

factors used in this LEDPA analysis are based on 40 CFR 230.10 and 33 CFR 320 and are presented in Section 4.0.

3.2 Sequenced Search for Less Environmentally Damaging Alternatives

This section identifies alternatives to the proposed action (construction and operation of the proposed LNP) in three ways: identifies the impact of the no-action alternative, reviews possible energy resources as alternatives to the proposed action, and describes the process for identification of the four alternative sites and one proposed site.

3.2.1 No-Action Alternative

In the no-action alternative scenario, the proposed project is not licensed or constructed. This scenario is described in ER Section 9.1. The no-action alternative would result in no facility being built, restricting PEF's ability to maintain state-mandated electrical generating reserve margins and supply lower-cost power to PEF's customers. Based on projected Florida power needs and PEF's statutory responsibilities to provide reliable supplies of electricity in its service area, the no-action alternative is not practicable and does not meet the stated project purpose. This conclusion is confirmed in the FPSC's final order determining the need for the LNP (FPSC, 2008a).

3.2.2 Alternative Power Generation Designs

Alternative power generation designs or technologies must be evaluated with respect to their ability to meet the overall purpose of the project to provide baseload power. Baseload power is electricity that is available most of the time on a continuous basis and is only subject to infrequent shutdown or maintenance outages (U.S. Department of Energy [DOE]/Energy Information Administration [EIA], 2000).

The proposed project is a carbon-neutral, baseload generating facility, which would add fuel diversity to PEF's generating system. The project seeks to avoid carbon emissions from new electrical generating facilities, in line with Florida's goal to reduce carbon emissions during the expected life of the project (State of Florida, 2007). This design also adds to the fuel diversity for electrical generation, thereby preventing an over reliance on any particular fuel source, including fuels like natural gas that are subject to price volatility and supply interruption. Any alternative must meet these same project purposes to be considered a practicable alternative.

All baseload electrical generating alternatives also would require electrical transmission to provide the electricity to PEF's customers. Thus, the potential impacts of electrical transmission lines must be considered for each generating alternative.

Alternatives that do not require new power generating capacity, such as energy conservation and demand-side management (DSM), were considered by PEF and described in ER Subsection 9.2.1 of the alternatives analysis and by the FPSC during the LNP need determination proceedings. Such programs, however, cannot offset the need for additional generation to meet PEF's customer demands for electrical power. PEF provides 16 energy conservation (or DSM) programs and over 100 individual measures. These DSM programs include seven residential programs, seven commercial/industrial programs, a qualifying

facilities (cogeneration and small power production) program, and a research and development program. PEF has offered DSM programs to its customers since 1981. PEF has recently implemented 39 additional energy conservation (or DSM) measures approved by the FPSC.

PEF anticipates that the implementation of these new DSM measures will significantly increase the DSM penetration in the future and result in avoiding the construction of an additional 512-megawatt (MW) electrical generating facility on PEF's system. In utility comparisons, PEF is ranked third in the nation for load management peak demand reduction, with a 17 percent reduction of peak load, and ranked fourth in the nation for energy efficiency megawatt hours (MWh) saved for utilities with 1.5 million customers or higher, based on DOE 2006 data. PEF also ranks third in the nation for least cost per MWh saved at $18.63 per MWh, which is roughly 100 percent more efficient than California utility costs. PEF's consistent efforts to identify and implement cost-effective peak load reduction and energy efficiency measures have placed PEF well ahead of other utilities in the country. The combined efforts and enhancements will produce 527-winter-MW peak demand and 418-MW reduction from energy efficiency through 2014. When added to the existing programs, this represents a reduction of over 2,400 MW of electrical generating capacity (Masiello, 2007a; Masiello, 2007b).

PEF evaluated its existing and planned DSM programs to demonstrate that those programs will not mitigate or otherwise offset the need for LNP. As presented in testimony before the FPSC, PEF evaluated additional DSM programs as it evaluated the need for the project (Crisp, 2008). Despite the 2,400-MW decrease in peak demand already achieved by PEF's DSM programs, that evaluation concluded that DSM programs cannot offset the need for additional generating units to meet the demands of PEF's customers for additional electrical power. This evaluation of potential DSM programs to offset the need for the project was reviewed and accepted by the FPSC in its Need Determination Proceeding (FPSC, 2008a).

Although DSM programs show great potential for reducing peak-load usage, they do not satisfy the baseload need that will be satisfied by the LNP. Therefore, these were not considered practicable alternatives that meet the overall purpose of the LNP project.

In the Final Order Granting Petition for Determination of Need for Proposed Nuclear Power Plants, FPSC states the following (FPSC, 2008a):

> "Based on the record, we [FPSC] find that there are no renewable energy sources or technologies or conservation measures reasonably available to PEF that might mitigate the need for Levy Units 1 and 2."

Non-nuclear generation alternatives considered for meeting the projected electric energy needs of the PEF service area included the following: wind, geothermal, hydropower, solar power photovoltaic (PV) cells and solar thermal, municipal solid wastes (MSW), wood waste/biomass, energy crops, integrated gasification-combined cycle (IGCC), wave, petroleum, natural gas, and coal, as well as any reasonable combination of these alternatives. Each electrical generating alternative is described and evaluated in greater detail in Subsections 9.2.2 and 9.2.3 of the ER. The following section summarizes and adds to that description and evaluation.

Because the availability of the resource is intermittent in Florida, based upon wind resource maps of Florida published by the DOE National Renewable Energy Laboratory (NREL) Web

site, wind by itself is not considered a firm source of baseload capacity. Potential land use impacts from an onshore wind power generating facility could be significant. It was estimated that to produce the 2,200 megawatt electric (MWe) of LNP baseload output, approximately 1,600 acres of land would be needed. This does not include the need for additional transmission lines for wind-generated electricity. Wind generation is also not considered "dispatchable," meaning that the generator can control output to match load and economic requirements. With the inability of wind energy to generate baseload power in Florida or PEF's service area, a wind power generating facility alone is not a practicable alternative that meets the overall purpose of nuclear generation.

Based on the known geothermal regions of the United States as published on the DOE Idaho National Laboratory Web site, Florida is not a candidate for geothermal energy and could not produce the proposed 2,200 MWe of baseload energy. Therefore, a geothermal energy source is not available and a geothermal power generating facility is not a practicable alternative that meets the overall purpose of nuclear generation.

A hydropower generating facility is estimated to require flooding more than 2.20 million acres of land to produce a baseload capacity of 2,200 MWe, resulting in a large impact on land use. In addition, operation of a hydropower generating facility would alter aquatic habitats, potentially impacting aquatic species. No hydropower units are planned because there is no feasible location nor adequate resource, as Florida's flat terrain does not lend itself to hydroelectric power. Therefore, a hydropower generating facility is not considered a practicable alternative that meets the overall purpose of nuclear generation.

Solar power generating facilities produce electric power by converting the sun's energy into high-temperature heat using various mirror configurations. Environmental impacts of solar power generating facilities can vary based on the technology used and the site-specific conditions. Land use and aesthetics are the primary environmental impacts of solar power. Land requirements for each of the individual solar energy technologies are large, requiring from 2.5 to 12 acres/MWe. Concentrating solar power generating facilities can be sized for "village" power (10 kilowatts electric [kWe]) or grid-connected applications (up to 250 MWe or greater). While concentrating solar power technologies currently offer the lowest cost solar electricity for large-scale power generation, these technologies are still in the demonstration phase of development and cannot be considered reliable or competitive with baseload fossil fuel- or nuclear-based technologies.

Another method for capturing the sun's energy is through the use of PV cells. On average in Florida, solar energy can produce 4.5 to 5.5 kilowatt hours per square meter per day and can achieve slightly higher production in the summer. This value is highly dependent on the time of year, weather conditions, and obstacles that may block the sun. Currently, PV solar power is not competitive with other methods of producing electricity for the open wholesale electricity market. Based on the lack of information regarding large-scale systems able to produce the proposed 2,200-MWe baseload capacity and the large land area footprint needed for construction, "flat-plate" PV cell generating facilities are non-competitive with a baseload nuclear power generating facility.

The United States has approximately 89 operational MSW power generating facilities, generating approximately 28 MWe per MSW power generating facility. Taken altogether, these MSW facilities would not meet the proposed 2,200-MWe baseload capacity needed to meet the project purpose. The initial capital costs for MSW power generating facilities are

greater than those of comparable steam turbine technology at wood waste power generating facilities, because of the need for specialized waste separation and handling equipment. It is estimated that construction impacts from an MSW power generating facility would be similar to those from a coal power generating facility. Additionally, MSW power generating facilities have the same or greater operational impacts, including impacts on the aquatic environment, air, and waste disposal. Burning MSW produces nitrogen oxides (NO_x), sulphur dioxide (SO_2), and trace amounts of toxic pollutants, such as mercury compounds and dioxins. For these reasons, MSW is not considered a practicable alternative to nuclear generation.

The use of wood waste to generate electricity is largely limited to those states with significant wood resources. However, the largest wood waste power generating facilities are 40 to 50 MWe in size, which would not meet the proposed 2,200-MWe baseload capacity. Construction of a wood waste power generating facility would have similar environmental impacts to that of a coal power generating facility. Biomass fuel can be used to co-fire with a coal power generating facility, decreasing costs. However, this is only cost effective if biomass fuels are obtained at prices equal to or less than coal prices. Because of the lack of resources and size of current wood waste power generating facilities, wood waste and biomass power generating facilities are non-competitive with a baseload nuclear power generating facility. Therefore, a biomass-fueled electrical generating facility is not considered a practicable alternative that meets the overall purpose of the project.

Several other concepts for fueling electric generators exist, including burning energy crops, converting crops to a liquid fuel such as ethanol (ethanol is primarily used as a gasoline additive), and gasifying energy crops, including wood waste. None of these technologies have progressed to the point of being competitive on a large scale or of being reliable enough to replace a baseload capacity of 2,200 MWe. Florida already imports ethanol for its ethanol fueling stations. It does not have the resources to use ethanol as an electricity generating source; therefore, a power generating facility fueled by energy crops is not competitive with a baseload nuclear power generating facility. A generating facility using energy crops, therefore, is not considered a practicable alternative that meets the overall purpose of the project.

IGCC is an emerging, advanced technology for generating electricity with coal that combines modern coal gasification technology with both gas turbine and steam turbine power generation. The technology is substantially cleaner than conventional pulverized coal power generating facilities because major pollutants, including CO_2 and other greenhouse gases, can be removed from the gas stream prior to combustion; however, IGCC technology still has insufficient operating experience for widespread expansion into commercial-scale utility applications. Further, even if carbon emissions are removed from the gas stream, there is no proven or demonstrated means to sequester those gases in underground formations or other repositories. Because IGCC technology currently is not cost effective and requires further research of and demonstration to achieve an acceptable level of reliability, an IGCC power generating facility is a non-competitive alternative to a nuclear power generating facility at the LNP site. In addition, the State of Florida has recently discouraged a permit application for a coal-fired IGCC in the state due to the absence of the ability to capture and sequester the carbon emissions. It is unlikely that Florida would approve a new 2,200-MW baseload coal-fired IGCC electrical generating facility, without substantial, costly, and unproven controls for carbon emissions. Therefore, a coal-fired

IGCC electrical generating facility is not considered a practicable alternative that meets the overall purpose of the project.

In addition to land-based renewable energy, there is a potential for developing near-shore tidal-, and wave-energy capture facilities just a few miles off-shore along the southern and eastern coastline of Florida. However, most wave-energy technologies involve off-shore electrical generation requiring the transmission of power to shore-based electrical grids. Along with the new transmission requirements and associated costs, this technology is still in the demonstration phase of development and cannot be considered reliable or competitive with baseload fossil fuel- or nuclear-based technologies.

Having eliminated these power generation designs, the only remaining power generating design alternatives are oil-fired, natural gas-fired, and coal-fired steam electric generating facilities. Each of these types of facilities require cooling water for condenser cooling and other processes, and a means of disposing of the wastewater. As such, in addition to the considerations that follow, these generation alternatives would also need to be located near water bodies that can supply these important water needs. Each of these generating facilities would also have comparable requirements for electricity transmission.

Petroleum costs have risen significantly, increasing by approximately 90 percent from 2002 to 2006 and by 51 percent from 2004 to 2005. In the *Generic Environmental Impact Statement* (GEIS), NRC staff estimated that construction of a 1,000-MWe oil power generating facility would require approximately 120 acres of land (NRC, 1996). Operation of these facilities would have environmental impacts, including impacts on the water resources for cooling and other operation needs, the aquatic environment, and the air, which would be similar to those from a coal-powered generating facility. Power generating facilities fueled by oil have one of the largest carbon footprints of all the power generating systems analyzed. Conventional oil power generating facilities result in emissions of greater than 650 grams of CO_2 equivalent per kilowatt hour (gCO2eq/kWh). This is approximately 130 times higher than the carbon footprint of a nuclear power generating facility (approximately 5 gCO2eq/kWh). Oil-fired power generation has experienced a significant decline since the early 1970s. Increases in world oil prices have forced utilities to use less expensive fuels; however, oil-fired power generation is still important in certain regions of the United States. Because of rising fuel costs and environmental concerns, oil power generating facilities were not considered a practicable alternative that meets the overall purpose of the LNP project.

Florida's utilities continue to project a substantial increase in natural gas-fired generation. Natural gas-fired generation, currently reported by the FPSC at 38.8 percent of Florida's total statewide energy consumption, is expected to increase to 54.4 percent by 2017. Most environmental impacts of constructing and operating natural gas-fired plants would be similar to those of other large central generating stations, including impacts to water resources for cooling, air emissions, and impacts to wetlands. Land-use requirements for gas-fired plants are smaller, requiring 110 acres for a 1,000-MWe plant. Based on the well-known technology, fuel availability, and generally understood environmental impacts associated with constructing and operating a natural gas power generating facility, it was considered a competitive alternative to the LNP. However, in a December 2008 evaluation, *Review of Ten-Year Site Plans (TYSPs) for Florida's Electric Utilities*, the FPSC expressed concern about Florida's increasing reliance on natural gas-fired generation and consequent fuel costs that continue to rise and experience volatile swings, as well as potential supply disruptions caused by severe storms and hurricanes (FPSC, 2008b).

The FPSC also considered a natural gas-fired alternative during the State of Florida's need determination proceeding for the LNP. The FPSC concluded the use of natural gas to meet PEF's future need for electricity would increase PEF's reliance on natural gas to 56 percent by 2018. The LNP would allow PEF to maintain a balanced fuel supply and the resulting less volatile fuel costs (FPSC, 2008b). Due to these concerns, natural gas as a source of power production was considered unreliable for a large-scale project, given the recent unpredictability of cost and supply. In addition, recent generation additions in Florida and by PEF have largely used natural gas as a fuel source, increasing potential fuel cost swings and furthering the need to look at options that increase fuel diversity and dependence. Natural gas plants are also a source of carbon emissions, which may be subject to future regulation resulting in additional costs for electricity. These costs for carbon emissions were also considered by the FPSC in its Final Order Determining Need for the LNP (FPSC, 2008a). Therefore, a natural gas-fired electrical generating facility is not considered a practicable alternative that meets the overall purpose of the LNP project to provide reliable, carbon-free electrical generating capacity.

Coal-fired power generating facilities accounted for approximately 52 percent of the United States electric utility industry's total generation in 2000. In 2007, coal power generating facilities supplied about 38 percent of Florida's electricity (FPSC, 2008b). The impacts of constructing and operating a 1,000-MWe coal plant at a greenfield site can be substantial, particularly if it is sited in a rural area with considerable natural habitat. An estimated 1,700 acres would be needed for such a plant, and this could amount to the loss of about 3 square miles of natural habitat and/or agricultural land for the plant site alone. Low-cost coal reserves are plentiful, and coal power generating facilities are able to produce the baseload capacity needed for the LNP site; therefore, coal power generating facilities were considered a competitive alternative to a nuclear power generating facility. A coal-fired electrical generating facility would have impacts to natural resources comparable to or greater than a baseload nuclear fueled facility, including demands for cooling water, impacts to wetlands, and emissions of regulated air pollutants, such as SO_2, NO_x, particulate matter, mercury, and other constituents. However, further evaluation of coal as a source of power production was considered environmentally unacceptable due to the production of carbon-derived gases and their potential contribution to global warming. In addition, the State of Florida has recently denied licenses for proposed coal-fired power projects in the state, judging the overall impacts (including climate change) as too high relative to other potential energy sources. It is unlikely that Florida would approve a new 2,200-MW baseload coal-fired electrical generating facility without substantial, costly, and unproven controls for carbon emissions. Therefore, a coal-fired electrical generating facility is not considered a practicable alternative that meets the overall purpose of the LNP project.

The nuclear power option was considered the most cost effective and least environmentally damaging of the evaluated alternatives and the most reliable long-term source to satisfy the projected electric energy needs of the PEF service area, and to meet the basic and overall purpose of the project. Wetland impacts associated with the LNP development are anticipated to be similar, if not less than, the other alternatives considered. As noted in PEF's 2009 TYSP, "The nuclear units were identified as the most cost-effective option to meet the need, taking into account the need to improve fuel diversity, reduce Florida's dependence on fuel oil and natural gas, reduce current and potential future air emission compliance costs, and contribute to the long-term stability of the electric grid" (PEF, 2009). Given concerns in Florida and the rest of the United States about climate change and carbon

emissions, the LNP will serve another important need by reducing carbon emissions in the state. When operational, the LNP will not produce the significant amount of carbon associated with a comparable coal-fired generating plant.

3.2.3 Alternative Sites

This section of the LEDPA document describes the technical evaluation process followed in the EFS for selection of alternative sites. In addition, this section describes the process used in the supplemental analysis undertaken to resolve wetland acreage discrepancies.

3.2.3.1 Evaluation of Florida Sites

Having eliminated other power generating alternatives, PEF initially evaluated a region of interest (ROI) based on its service territory to identify those areas that could best meet specified environmental and non-environmental criteria for the siting, licensing, permitting, and operation of two nuclear power electric generating units. The EPRI Siting Guide (EPRI, 2002) provided the basic framework for PEF's alternatives selection process (PEF, 2007).

In accordance with the EPRI Siting Guide, the site selection process involved sequential application of exclusionary, avoidance, and suitability criteria evaluations and technical screening by application of scoring and associated weighting factors applied to the suitability criteria. The exclusionary, avoidance, and suitability criteria address a full range of considerations important in nuclear power facility siting, including health and safety, environmental, socioeconomic and land use, and engineering and cost aspects.

The evaluation and site selection process involved a series of activities starting with identification of an ROI or a geographic area within which a site must be located. The PEF service territory covers approximately 20,000 square miles and includes the densely populated areas around Orlando, Clearwater, and St. Petersburg (PEF, 2007). For the purpose of the siting study, PEF expanded the ROI by one additional county around the periphery of its service territory in Florida to identify sites within a reasonable distance of the service territory and allow additional flexibility in considering siting tradeoffs (PEF, 2007).

The ROI was screened using exclusionary criteria to identify the "candidate areas" by eliminating areas in which it is not feasible to site a nuclear facility because of regulatory, institutional, facility design, or environmental constraints. Further screening was performed using avoidance criteria to identify more favorable areas, thus reducing the areas remaining under consideration to an adequate and reasonable number of "potential sites" for continued evaluation.

Additional geographic and aerial information was compiled for siting areas that met the previously listed criteria, and potential sites were identified. Potential sites were defined as areas approximately 6,000 acres in size (PEF, 2007). The convention is used that a representative site size for a 2-unit nuclear power plant, including exclusion zone, ancillary features, construction laydown areas, security zones, and a cooling water storage reservoir, is 2,000 acres. A site area of 6,000 acres (three times the nominal area requirement) provides a consistent basis for comparison of sites while also providing flexibility for locating plant components within the evaluated area. This flexibility allows for the refinement of detailed plant locations as more detailed information is developed on the site (such as land

availability and environmental and geotechnical considerations), while avoiding the need to re-evaluate the site as locational refinements are made.

The potential sites that were reviewed and evaluated included 19 greenfield sites and 1 location with an existing operating nuclear power plant. The 20 sites were initially chosen based on identifying locations favorable for a nuclear power plant. The factors considered were distance from transmission load centers, distance from highly populated areas, distance from industrial areas, location relevant to a potential existing cooling water source, topographic features, and location relative to identified endangered species critical habitats. The number of sites was further reduced to eight candidate sites (Taylor, Levy 2, Levy 3, Lafayette, Crystal River, Dixie 1, Highlands, Putnam 3) using a set of nine screening criteria that included consideration of water availability, wetlands, ecological sensitivity, flooding, population, hazardous land uses, rail and transmission access, and land acquisition potential.

The candidate site list was further screened using a set of 34 suitability criteria grouped into four categories, with features in each category relevant to specific aspects of facility development. The features were weighted and scored to provide a relative comparison of the candidate sites. The multiple features of the suitability criteria were combined into one composite rating for each of the candidate sites. The four categories follow:

- Health and safety
- Environmental
- Land use and socioeconomics
- Engineering and cost related

The results of this evaluation reduced the candidate site list to a fewer number of more highly favorable "alternative sites." The technical evaluation process identified Crystal River, Dixie 1, Highlands, Levy 2, and Putnam 3 as the alternative sites.

At the conclusion of the technical evaluation process, the technically favorable sites underwent final evaluation and verification to ensure compliance and compatibility with PEF's business strategies. In this evaluation, tradeoffs in business requirements and ways to differentiate the sites were considered, thereby ensuring the optimal site was chosen. ER Tables 9.3-2, 9.3-4, 9.3-5, 9.3-6, and 9.3.7 provide the criteria and results of the site selection process. Details of the alternative sites evaluated and the overall site selection process is provided in greater detail in the EFS (PEF, 2007). This document has been made available to the USACE.

The two components of this final step included a list of strategic and transmission deliverability considerations. Strategic considerations address existing nuclear site advantages, proximity to load, NRC considerations, local and state government support, business planning, and public support. Transmission deliverability considerations for each site included direct connection costs and system upgrade costs.

3.2.3.2 Supplemental Analysis

Several criteria used in the EFS to evaluate prospective nuclear power plant sites were based on the extent of wetlands present at each site. As described previously, ratings for these criteria were based on the number of acres of wetlands found within a 6,000-acre circle around the site centerpoint. The data source for wetlands acreages was the U.S. Fish and

Wildlife Service (USFWS) NWI mapping system (USFWS, 1992). Data extraction was accomplished using a mapping tool available on the NWI website that is designed to provide wetlands acreages within a user-specified geographic area.

In the process of responding to RAIs on the LNP COLA, it was discovered that the NWI mapping tool did not report all wetlands within the specified geographic area, resulting in inaccurate enumeration of the wetland acreages. A supplemental analysis examined the effects, if any, of the errors in wetlands acreages on the original site analyses and resulting decisions in the EFS. This Supplemental Analysis was included as part of responses to RAIs 9.3-6, 9.3-9, 9.3-10, and 9.3-11 in letter NPD-NRC-2009-242, which clarified PEF's site selection process as presented in the ER and included:

- Corrected data for wetlands at each site considered
- An analysis of effects of corrected wetlands acreages on site ratings and site selection process results, taking into account the corrected wetlands acreages

The Supplemental Analysis demonstrated that if the correct wetlands data had been used in the EFS, the same five alternative sites identified in the EFS would have been identified for more detailed study and selection of the proposed site. Specific results for each screening phase of the analysis are reported as follows in this section.

3.2.3.2.1 Evaluation of Potential Sites and Identification of Candidate Sites [EFS Section 5.0]

With regard to the top eight sites identified in EFS Section 5.2, only one change resulted from the revised analysis: Liberty 1 replaced Hillsborough. However, Liberty 1 was still deferred as unsuitable from a transmission perspective. The site did not rank high enough in overall ratings, compared with the top six sites, to offset its significant disadvantages. The rationale for additions and deferrals of sites did not change with the revised analysis, so the same final eight sites (Taylor, Levy 2, Levy 3, Lafayette, Crystal River, Dixie 1, Highlands, and Putnam 3) were carried forward.

3.2.3.2.2 Evaluation of Candidate Sites and Identification of Alternative Sites [EFS Section 6.0]

The identity and order of the top five sites (Crystal River, Putnam 3, Levy 2, Taylor and Dixie 1) did not change from those reported in EFS Section 6.2 as a result of the revised analysis. Among the bottom two sites, Lafayette moved ahead of Highlands by a small margin compared with results described in EFS Section 6.2.

As described in EFS Section 6.2, the selection of sites for detailed evaluation was based on the analysis of the general siting criteria results in conjunction with information obtained via aerial site reconnaissance. The reasons for deferring the Taylor, Levy 3, and Lafayette sites remained unchanged. Accordingly, the corrected wetlands data do not affect the identity of the five sites selected for detailed analysis, as described in EFS Section 6.2.

3.2.3.3 Selection of Proposed Site

The evaluation of strategic considerations determined that the Levy 2 site demonstrated an advantage over the Crystal River site because of a location that yields a reduced vulnerability to the likelihood of a significant generation loss from a single event in a geographical location. Like Crystal River, Levy 2 makeup water is taken from the Gulf of Mexico and, therefore, is a reliable source for long-term consumption. Levy 2 is within the PEF transmission footprint, with no significant impact to other grids and no significant exposure to other critical assets.

The preliminary transmission study (Navigant Consulting, 2006) results concluded that the Levy 2 site would experience slightly higher transmission upgrade costs than the Crystal River site, which had the lowest cost. Levy 2, Crystal River, and Dixie 1 were comparable in transmission costs, with Highlands and Putnam 3 demonstrating significantly higher costs.

Based on these results, the Levy 2 site was the "proposed site" for preparation of the PEF COLA in Florida.

Because the EFS siting process allows for optimization of sites as the process is executed and additional information is gathered, the Levy 2 site was optimized during the siting process with slight relocation to become the LNP site. The LNP site was the proposed site location as ultimately acquired and analyzed in the ER.

Many of the criteria evaluated in the EFS consider information for the general site area and are not influenced by the precise site location. However, some of the criteria evaluated in the EFS are based on a centerpoint location for the site, and the corresponding evaluations may result in slightly different ratings for different site locations. Therefore, the LNP site (proposed site) has been re-evaluated for all siting criteria to illustrate the effect of using this precise point location throughout the siting study. This re-evaluation was included as part of the response to RAI 9.3-7in letter NPD-NRC-2009-242. Results of the re-evaluation indicted that, had the LNP site been evaluated in lieu of the Levy 2 site, the LNP site would have been selected as one of the final five sites for further evaluation and ultimately selected as the proposed site.

As described in Section 1.4, five sites were selected as the alternative sites with the LNP defined as the preferred site for the proposed action. The Crystal River site is considered not-practicable because it does not meet the purpose and need of this project for reasons described in the following paragraphs.

A qualitative analysis of risk factors for reliable power production and supply (for example, vulnerability to single-event failures) was conducted for each of the five sites. It was determined that adding two nuclear units to the existing units at the Crystal River site would result in the concentration of a large fraction of PEF's total generation capacity at one site, which could be subject to disruption by a single weather event, such as a hurricane, tornado, or storm surge flooding. Other types of single event failures (such as security threats) could disrupt power generating capability for the Crystal River site or transmission of power from the site. Vulnerability of the Crystal River site to such events extends to the transmission lines because connections for the new units would be collocated with existing transmission lines near the Crystal River site. The loss of total generation at Crystal River would cause a large scale impact on the PEF service area as well as the entire state; therefore, a qualitative reliability analysis of the sites was conducted to determine their relative suitability, compared with Crystal River, in mitigating this concern.

Two initiating weather events were considered in this reliability analysis: storm surge flooding and hurricane or tornado wind damage. The potential for flooding was considered greatest at near-coastal and lower elevation sites, with sites farther inland and with higher elevations ranked higher (as described in Section 4.1.5). The reliability analysis also considered the effects of tornadoes. The design of nuclear power plants for tornado resistance is not intended to prevent all damage to the enclosing structures but to ensure public safety.

For outages initiated by a single weather event, the greater the distance from Crystal River, the less likely a single-event outage will occur. While any separation from Crystal River would decrease the risk that all units would be taken offline by a single event, additional distance would provide additional risk mitigation. Both the Highlands and Putnam 3 sites are located relatively far from the coast and are therefore expected to provide significant protection relative to the storm surge risk, compared with the Crystal River site. Of the two sites, Highlands is considered more favorable because of its higher elevation, and the potential for tidal run-up from the Atlantic Ocean on the St. Johns River at the Putnam 3 site.

Both the Dixie 1 and LNP sites are located farther from the coast than the Crystal River site. The elevation at the LNP site is greater than at the Dixie 1 site, offering the LNP site additional protection from storm surge flooding. Comparatively, the Crystal River site has a lower reliability/greater vulnerability rating, because adding two nuclear units to the existing units at the CREC would result in the concentration of a large fraction of PEF's total generation capacity in Florida at one site. PEF's generating capacity within the State of Florida is approximately 9,362 MW. Approximately 57 percent of PEF's total generating capacity will be represented by the LNP (2,200 MW) and the generating capacity at the CREC (3,148 MW). Disruption of the Crystal River site by a single weather event, such as a hurricane, tornado, or storm surge flooding, would result in the loss of power to many PEF service area customers.

Figures were prepared for the four remaining sites at three different scales to show the site, pipeline and transportation corridor, and transmission extents for each site as follows:

- LNP site, located near the CFBC/Gulf of Mexico (the preferred site)
  Figures 3.2.3-1 through 3.2.3-3
- Dixie 1 site, located near the Suwannee River
  Figures 3.2.3-4 through 3.2.3-6
- Highlands site, located near the Kissimmee River
  Figures 3.2.3-7 through 3.2.3-9
- Putnam 3 site, located near the St. Johns River
  Figures 3.2.3-10 through 3.2.3-12

4.0 Evaluation of Potential Impacts

The alternative sites were analyzed and the scores were compared to determine the LEDPA site. In this section, each site's potential impacts on the physical, chemical, biological, and human use characteristics of the aquatic environment are considered.

4.1 Anticipated Changes to the Physical/Chemical Characteristics of the Aquatic Environment

PEF has identified review factors from 40 CFR 230.10 that have been taken into account to determine the impact on the physical and chemical characteristics of the aquatic environment for the alternative sites. These review factors are described in the following sections.

4.1.1 Substrate

Substrate impacts for this 404(b) analysis are relative to the discharge of dredged or fill material into the aquatic environment, including wetlands. For all four sites, the majority of fill activities will take place as part of the onsite impacts and road construction activities (see Table 4.1.6.1-1). The majority of impacts in the transmission line corridors are assumed to be clearing and are further described and included in Section 4.1.6.1. The quantification of these areas is also described in Section 4.1.6.1. It is assumed that for wetland impacts associated with all activities except the transmission lines, the wetlands would be filled and all wetland function would be lost.

It is expected that fill material would be similar to Florida Department of Transportation (FDOT) clean fill. It is assumed that the fill material would be of similar type for all alternative sites and all sites would therefore have similar impacts with regard to the type of fill (substrate) used as part of fill activities. Additional impacts to the aquatic environment are expected to be similar because best management practices (BMPs) will be used for erosion and sediment control as part of the construction process, which is described further in Section 4.1.3. For any material that is disposed of offsite, which is not part of the construction activities described previously, it is expected that the disposal area would be located in the uplands in accordance with applicable regulations. Therefore, no additional impacts to wetlands or the aquatic environment would occur.

Additional potential impacts on wetlands and wetland substrates are addressed in Subsection 4.2.1.1 of this document, and ER Subsections 4.2.1.5 and 5.2.1.5.

4.1.2 Currents, Circulation, or Drainage Patterns

Cooling water will be required at each of the alternative sites to fulfill the overall project purpose. Cooling water intake and discharge effects on current patterns and circulation would vary, depending upon the volumes of water required, the body of water from which the water is withdrawn, and the site of discharge.

The EFS was conducted prior to the decision to collocate the LNP and CREC discharges (PEF, 2007). This collocation avoids the need to establish a new outfall location and reduces the potential for impact.

For the Dixie 1, Highlands, and Putnam 3 sites, the source of water and discharge sites would be the Suwannee River, the Kissimmee River, and the St. Johns River, respectively. Use of freshwater would allow more cycles of concentration in cooling towers than brackish or marine waters and would require a lower overall volume of cooling water needs. However, withdrawal and discharge in confined riverine systems would have a much greater relative impact on currents and circulation than would be expected at a site using marine waters. Impacts on drainage patterns are expected to reflect the activities that occur in the floodplains and wetlands, and these impacts are described in Sections 4.1.5 and 4.1.6 of this document.

As described in ER Subsection 5.2.1.3, intake from the CFBC would cause a very slight increase in current and should improve water quality in the upper reaches of the CFBC. Potential changes are also described in Technical Memorandum 338884-TMEM-079: *Estimated Salinity Changes in the Cross Florida Barge Canal and Old Withlacoochee River Channels after Levy Nuclear Plant Intake Operation* (CH2M HILL, 2009a). Modeling has also demonstrated that the addition of the LNP discharge at the CREC would result in no significant changes to existing conditions at the CREC (CH2M HILL, 2009b).

4.1.2.1 Shore Erosion and Accretion

Erosion and accretion are naturally occurring phenomena, existing without human disturbance in dynamic equilibrium. However, the ever-increasing amount of construction has accelerated the erosion processes in many coastal areas and caused the accretion and the shoaling of sand in many others. In addition, predicting erosion and accretion of sand beaches and shorelines in estuaries and along rivers is important for managing development and identifying potential relationships between biological productivity and beach or shoreline changes.

No long-term effects to naturally occurring erosion and accretion patterns would be expected with any of the alternatives considered. The construction and operation activities at all four sites would be managed to avoid and minimize potential impacts to naturally occurring erosion and accretion patterns on aquatic systems.

4.1.2.2 Baseflow

Because water flow at the sites varies, particularly during periods of low flow, water supply availability differs at the four alternative sites. Because of its proximity to the Gulf of Mexico, the LNP site has an abundant water supply available from the ocean, and reservoir construction is not anticipated at this site. The Suwannee River is the water supply for the Dixie 1 site, and reservoir construction would be necessary. Although Lake Okeechobee is located near the Highlands site, the Kissimmee River would be the water supply source for the Highlands site and reservoir construction will be necessary. The water supply for the Putnam 3 site is the St. Johns River. Although the river is relatively large, reservoir construction is assumed to be necessary.

The local conditions at the Dixie 1, Highlands, and Putnam 3 sites would require additional engineering costs to develop water supply capabilities, specifically to construct reservoirs to

address water supply limitations or low-flow constraints. Because the topography in the vicinity of the three sites does not provide natural drainage to develop reservoirs easily, reservoirs would have to be constructed. The conceptual reservoirs included in this analysis have been calculated to provide storage of 90 days for plant operation. It is assumed that the reservoirs could be filled when river flows are relatively large and this storage used during periods of drought when withdrawal from the rivers would be limited. If drought conditions last longer than 90 days, withdrawals would need to occur for continued plant operation. This would likely decrease baseflows in these systems during these times and could have potentially large effects on the aquatic ecosystem. It is assumed that the sites requiring a reservoir would have similar large effects on the aquatic ecosystem and that the LNP site would have no impacts on baseflow, since its water source is the Gulf of Mexico. If withdrawal permit requirements are in place such that withdrawal during drought periods is not possible, plant operations would have to cease after the 90-day storage of the reservoir is expended. In this scenario, the impacts on the aquatic environment would be limited for the alternative sites, but operations would not be possible. The river sources with the larger baseflows (as estimated by the 20th percentile of the daily average discharge) could be withdrawn from for a longer period of time and would be less affected by drought. These impacts are considered in Section 4.3.1 Municipal and Private Water Supplies, Water Conservation.

4.1.3 Suspended Particulates/Turbidity

There are no expected long-term effects of suspended particulates or turbidity on wetlands, canals, or other water bodies associated with any of the sites considered. Sedimentation during construction of site facilities would be minimized by conducting work in accordance with an approved erosion and sediment control plan. Site construction and operation activities would be managed to avoid and minimize potential impacts of particulates and turbidity on aquatic systems. Specifically, increased suspended particles and turbidity resulting from construction of a CWIS would be minimized by following accepted construction techniques and BMPs.

4.1.4 Water Quality (Temperature, Salinity Patterns, and other Parameters)

To reduce impacts from source water consumption, sites would employ closed-loop cooling tower based heat dissipation systems rather than once-through cooling systems. The reason for this approach is to minimize the environmental impacts (thermal impacts) that would result from withdrawing abundant amounts of water for cooling and discharging it back as heated water into the source water.

Because of increased cycles of concentration in the circulating cooling water systems anticipated for sites using freshwater (Dixie 1, Highland, Putnam 3), these sites would be expected to have a larger increase in the relative concentration of salts, as reflected in conductivity, than the LNP alternative.

As described previously, and in ER Subsection 5.2.1.3, intake from the CFBC will cause a very slight increase in salinity. However, it will also improve flow in the dead-end canal, which will improve water quality in the upper reaches of the CFBC. These potential changes are described in Technical Memorandum 338884-TMEM-079, *Estimated Salinity Changes in the Cross Florida Barge Canal and Old Withlacoochee River Channels after Levy Nuclear Plant Intake Operation* (CH2M HILL, 2009a). Also, modeling has demonstrated that discharge from

the LNP will result in no significant changes to existing salinity conditions at or near the CREC (CH2M HILL, 2009b).

Normal water fluctuations would not be substantially altered for any of the alternative sites considered. Development of the project at any of the four alternative sites would require compliance with applicable state regulations designed to ensure that offsite runoff is not increased after construction and to maintain normal hydroperiods. The method for addressing water level fluctuations at the LNP site is included in the Environmental Resource Permit (ERP) application included as Appendix 10.4 to the SCA (PEF, 2008) and in ER Subsection 5.2.1.

The state regulatory agency for water quality regulation in Florida is the FDEP. As required by the CWA, FDEP develops and maintains a listing of all impaired waters in the state that details the pollutants exceeding water quality standards and the potential sources of each pollutant. This list is referred to as the 303(d) list.

Section 303(d) of the CWA and EPA's Water Quality Planning and Management Regulations (40 CFR 130) require states to develop total maximum daily loads (TMDLs) for waterbodies exceeding water quality standards. TMDLs represent the total pollutant loading that a waterbody can receive without violating water quality standards. The TMDL process establishes the allowable loadings of pollutants for a waterbody based on the relationship between pollution sources and instream water quality conditions. By following the TMDL process, states can establish water quality based controls to reduce pollution from both point and non-point sources to restore and maintain the quality of their water resources (EPA, 2008).

Figures 4.1.4-1 through 4.1.4-4 show the amount of area within the four sites located in areas designated as impaired waters. Table 4.1.4-1 provides information about the 303(d) designated impaired water for site areas, onsite areas, reservoir impact areas, and offsite corridors at the four alternative sites.

TABLE 4.1.4-1
303(d) Designated Impaired Waters Information within Site Areas, Onsite Impact Areas, Reservoir Impact Areas, and Offsite Corridors[1]

Areas (acres)	LNP	Dixie 1	Highlands	Putnam 3
Site Areas				
Area within 303(d) Designated Impaired Waters	3,690	2,579	2,458	1,059
Onsite Impact Areas				
Area within 303(d) Designated Impaired Waters	482.8	429.1	101.3	20.3
Reservoir Impact Areas				
Area within 303(d) Designated Impaired Waters	NA	88.4	1,295.3	3.9
Offsite Corridors				
Area within 303(d) Designated Impaired Waters	86.4	279.2	0	27.2

Source: FDEP Watershed Assessment Section database, 2009 (see Appendix A).

Waterbodies occurring near LNP site elements are impaired for exceeding the fecal coliform standard. The remaining sites have similar causes of impairment (fecal coliform, mercury, nutrients, and lead).

Under the Florida Watershed Restoration Act, TMDLs must be developed for all waters that do not meet their designated uses due to human impacts and, consequently, are defined as "impaired." The primary sources of these human-induced impairments are pollutants in urban stormwater, agricultural runoff, and permitted industrial and municipal wastewater treatment plants. (Florida Stormwater Association and FDEP, 2009)

The LNP site, located in the Waccasassa watershed, and the Dixie 1 site, located in the Lower Suwannee watershed, are situated within the Suwannee Basin. This basin is considered a FDEP priority area with basin management action plan (BMAP) activities in progress. BMAPs represent a set of strategies for restoring impaired waters by reducing pollutant loadings to meet the allowable facilities established in a TMDL (FDEP, 2009). The Highlands site in the Fisheating Creek Basin (tributary of Lake Okeechobee) is part of the FDEP Northwest Lake Okeechobee planning unit, which is currently undergoing restoration supporting TMDL implementation (includes resource assessment plans and non-BMAP TMDL implementation). The Putnam 3 site, in the Etonia Creek watershed, is located within the Lower St. Johns River Basin. Much of the area within the Lower St. Johns Basin has a BMAP adoption pending or has already adopted a BMAP; however, portions of the basin are expecting to initiate BMAP activities in 2010.

Placement of transmission lines and offsite corridors (pipelines, access roads, transportation) often results in multiple stream and waterbody crossings. Routing and construction of new transmission and offsite corridors are often flexible; therefore, impacts that cannot be avoided through siting can often be lessened through planning and design. Some measures that can be built into the project include implementation of an erosion control plan, development of a construction schedule to minimize disturbances to existing habitats and land uses, development of a sedimentation control plan, restriction of corridor width, and minimizing clearing when possible.

4.1.5 Flood Hazards and Floodplain Values

Flood hazard areas are defined by FEMA as areas prone to flooding and include such areas as dam break flooding and 100-year floodplains. Flood hazard areas are determined using statistical analyses of records of river flow, storm tides, and rainfall; information obtained through consultation with the community; floodplain topographic surveys; and hydrologic and hydraulic analyses. These include those areas subject to flooding from rivers and streams, along coastal areas and lake shores, or shallow flooding areas (FEMA, 2006).

According to the FEMA's Flood Insurance Rate Map (FIRM) data, some portion of each of the four site areas is located within the 100-year floodplain. As a result, construction of the reactor and appurtenant facilities at the four alternative sites would require some ground elevation mitigation to ensure that structures (reactor, cooling towers, and appurtenant facilities) were located above the 100-year floodplain. Figures 4.1.5-1 through 4.1.5-4 show the area within the four alternative sites located in areas designated as FEMA 100-year floodplains. Table 4.1.5-1 provides 100-year floodplain information for site areas, onsite areas, reservoir impact areas, transmission corridors, and offsite corridors at the four alternative sites. Construction activities in the transmission corridors would be predominantly related to vegetation clearing with some fill activities. To account for the

differences in floodplain impacts in this analysis for the transmission corridors, the weighting was reduced to a quarter of the weight for the other areas where the large majority of activities would be fill related (see Table 5.0-2).

TABLE 4.1.5-1
100-year Floodplain within Site Areas, Onsite Impact Areas, Transmission Corridors, and Offsite Corridors[a]

Areas	LNP	Dixie 1	Highlands[a]	Putnam 3
	acres	acres	acres	acres
Site Areas				
Area within 100-year Floodplain (% of site area)[b]	3,200 (53%)	1,637 (27%)	5,965 (99%)	1,025 (17%)
Onsite Impact Areas[c]				
Area within 100-year Floodplain (% of impact area)[d]	415.9 (63%)	550.3 (25%)	2,160 (100%)	468.7 (22%)
Transmission Corridors				
Area within 100-year Floodplain (% of impact area)[d]	2,846.2 (30%)	4,112.1 (31%)	1,749.8 (26%)	952 (15%)
Offsite Corridors				
Area within 100-year Floodplain (% of impact area)[d]	195.9 (57%)	111.3 (13%)	436.7 (85%)	26.1 (8%)
Total Area Impacted	3,458.0	4773.7	4,346.5	1,446.8

Notes:
NA = Not applicable. Reservoirs will not be needed at the LNP Site.
[a] Highland transmission line impacts are underrepresented because digital data do not exist for Okeechobee County.
[b] Percent of site areas are based on a site area of 6,000 acres.
[c] Onsite impact areas include reservoirs if needed.
[d] Percent of impact areas are based on acreages found in Table 1.4-1.

Source: Florida Geographic Data Library (FGDL) FEMA Flood Insurance Rate Map (FIRM) database, 2009; FEMA Flood Hazard Areas, 2009 (see Appendix A).

The elevation at the LNP site varies from 25 ft. to 60 ft. and the area is relatively flat. The nearest water body is Lake Rousseau at an elevation of approximately 33 ft. Much of the LNP site area is located within a 100-year flood zone (see Figure 4.1.5-1). As described in ER Subsection 4.1.1.1.2.1, after grading, the land around the reactors and cooling towers will be raised to elevation 50 ft., while the switchyard and construction laydown areas in the periphery around the main plant building will be raised to 47 ft. Because the ground elevation at the main reactors and the cooling towers will be raised 8 ft. above the existing grade, these structures will be above the 100-year floodplain.

The Dixie 1 site, located on the Suwannee River, is at an elevation of about 25 ft. and portions of the site area are located within the FEMA 100-year floodplain zone (see Figure 4.1.5-2). The elevation at the Dixie 1 site varies from 25 ft. to 35 ft. and the area is relatively flat. The Suwannee River has a normal flow depth of about 4 ft. and a 10-ft. flood stage (PEF, 2007). The river elevation is tidally influenced by the Gulf of Mexico and, therefore, is susceptible to hurricane surge flooding (see ER Subsection 9.3.2.1.6).

The elevation at the Highlands site is about 25 ft. and Lake Okeechobee, the closest water body, is at an elevation of 14 ft. The elevation at the Highlands site varies from 25 ft. to 30 ft. and the area is relatively flat. The site is located near isolated marsh lands west of the

Kissimmee River and most of the site area is located in the FEMA 100-year floodplain (see Figure 4.1.5-3). Offsite feature impacts on Figure 4.1.5-3 are incomplete because there is no FEMA digital FIRM (DFIRM) data for Okeechobee County. Almost half of the transportation corridor and a small part of the blowdown pipeline corridor extend into Okeechobee County.

The Putnam 3 site is at an elevation of 30 ft. and located near the St. Johns River, which is normally at 10 ft. (PEF, 2007). The elevation at the Putnam 3 site varies from 30 ft. to 100 ft. The Putnam 3 site has the greatest elevation difference of the four sites. In addition to portions of the Putnam 3 site being located in the FEMA 100-year flood zone (see Figure 4.1.5-4), the site also has the potential for tidal run-up from the Atlantic Ocean on the St. Johns River (see ER Subsection 9.3.2.1.6).

Figures 4.1.5-5 through 4.1.5-8 show the topography within the four alternative site areas. Although the general costs and impacts associated with site grading would be low because the four sites are relatively flat, these costs could increase if the facility structures were constructed to make sure they were outside the 100-year floodplain and protected from potential flooding impacts.

4.1.6 Special Aquatic Sites

This section describes the types, number, and location of special aquatic sites on or near the four sites and how the potential impacts were considered in the site alternatives evaluation process.

A review was conducted to evaluate the presence and potential impacts to special aquatic sites at the four sites. All of the sites may be considered to have some proximity to sanctuaries, refuges, and/or endangered species habitat. As shown in Table 4.1.6-1, each of the sites contained the wetlands category of special aquatic sites. While vegetated shallows are not directly associated with any of the sites or corridors, they are known to occur in the vicinity of the coastal site (LNP) and may also be present at sites that could require river access (Dixie 1, Highlands, and Putnam 3). Riffle and pool complexes are only associated with the Suwannee River in the vicinity of the Dixie 1 site. Coral reefs and mudflats are not present at any of the sites.

The presence of special aquatic sites within the site areas and within the likely infrastructure corridors is specified in Table 4.1.6-1. The transmission systems for all alternative sites would have incidental impacts to sanctuaries and wetlands as quantified in Section 4.1.6.1. The specially designated aquatic sites within the transportation corridor (rail and heavy haul road) extents of each alternative site are shown on Figures 4.1.6-1 to 4.1.6-4.

TABLE 4.1.6-1
Special Aquatic Sites Present within Onsite Areas, Reservoir Impact Areas, and Offsite Corridors

Special Aquatic Resource	LNP	Dixie 1	Highlands	Putnam 3
Wetlands	Yes	Yes	Yes	Yes
Vegetated Shallows	No	No	No	No
Riffle/Pool Complexes	No	Yes	No	No

Source: U.S. Geological Survey (USGS) Land Use Land Cover Grids, 2009d; National Hydrology High Resolution Dataset, 2009e (see Appendix A).

In addition to these special aquatic sites, the State of Florida has designated certain waters within the state as Outstanding Florida Waters (OFW). Section 403.061(27), Florida Statutes, grants the FDEP the power to "establish rules which provide for a special category of water bodies within the state, to be referred to as Outstanding Florida Waters, which water bodies shall be worthy of special protection because of their natural attributes." In general, the FDEP cannot issue permits for direct pollutant discharges to OFW that would lower ambient (existing) water quality or for indirect discharges that would significantly degrade the OFW. Permits for new dredging and filling (ERP permits) in OFW must be clearly in the public interest. The only designated OFW that might have placed restrictions on development of the proposed nuclear units is the Dixie 1 site on the Suwannee River. The locations of these OFW within the transportation corridor extents of the alternative sites are also shown on Figures 4.1.6-1 to 4.1.6-4.

4.1.6.1 Wetlands

The presence of wetlands in the vicinity of the site areas was investigated using FLUCCS land-use data and onsite wetland delineations for the LNP site, as well as FLUCCS data for all areas where delineation data do not exist. FLUCCS wetlands were identified within the Dixie, Highlands, and Putnam 3 site areas, as well as the transmission line corridors for the LNP site. FLUCCS wetlands in the onsite impact areas, reservoir impact areas, transmission corridors, and offsite corridors (pipeline, access road, and transportation [rail and heavy haul road]) for each of the four sites are shown on Figures 4.1.6.1-1 through 4.1.6.1-4.

Wetlands at the LNP site and the LNP blowdown corridor have been delineated in the field and large portions have been verified by USACE personnel. There is a discrepancy between the field-delineated wetlands and the wetlands identified using the FLUCCS data for the LNP site. At the LNP site, 2,967.8 acres of wetlands have been delineated, while the FLUCCS data have 1,666.7 acres for the same area. Therefore, it is problematic to compare the field-delineated wetlands at the LNP site with the FLUCCS-identified wetlands at the other alternate sites. Therefore in this analysis, the FLUCCS data are used for all sites, including LNP, to allow for a direct comparison of sites. NWI data were not used in this analysis since these data are usually more generic than the FLUCCS data, while FLUCCS data were developed specifically to characterize Florida land cover and land-use classes. Because the photo-interpretation is completed on a regional basis by each Water Management District, FLUCCS classifications are more closely tailored to Florida sites and often more accurate than the NWI, which is a national classification system. The FLUCCS wetland definition is tailored to the limitations imposed upon image analysis, which must classify wetlands according to evidence recorded by remotely sensed images.

Since this analysis uses the FLUCCS data on the LNP site to directly compare all alternative sites, an evaluation was performed to ensure the propriety of the use of FLUCCS data in this analysis for all four sites. FLUCCS classifications provided in Table 4.1.6.1-1 are based on aerial photo-interpretation of dominant land cover and land-use types, and these classifications are subject to the limitations of photo-interpretation. The areal extent of wetlands identified through photo-interpretation will generally differ by some degree from the extent identified through field delineations.

The accuracy of photo-interpreted FLUCCS mapping is affected by several factors, including the quality and season of the aerial photographs; size and pattern of individual land-use polygons (a typical minimum mapping unit is 0.5 acre, and reticulate or intergraded systems may be clustered under a single classification); degree of site disturbance; and use of supplemental materials (soils data and historical maps) in the classification effort. Agricultural and silvicultural practices such as planting, bedding, and site drainage can obscure wetland indicators on aerial photographs and result in an underestimation of the actual wetland extent, as with the LNP site. Areas that were identified as uplands in the FLUCCS data, but as wetlands during the field delineation, were primarily categorized as tree plantations (FLUCCS Code 4400). For sites with large areas of tree plantations, the amount of wetlands present may be underestimated in the FLUCCS data.

The FLUCCS Level II data indicate that almost 50 percent of the LNP site area (6,000-acre circle) is used for tree plantations. The Dixie 1 and Putnam 3 sites have 88 and 47 percent, respectively, of the same area used for tree plantations. Since these sites have been disturbed in the same manner as the LNP site, it is expected that these sites may have a more extensive wetland area than the FLUCCS photo-interpretation may suggest. The Highlands site is largely cropland and pastureland (76 percent). These cropland and pastureland areas have been intensively manipulated by human interaction for several decades based on historical aerial photographs. While the land uses at the Highlands site are different than those at the LNP site, the Highlands site has been disturbed on a similar scale and time frame as the LNP site. Therefore, it is likely that the Highlands site has wetland indicators that are obscured on aerial photographs, resulting in an underestimation of the actual wetland extent in the FLUCCS data.

Based on a review of historical aerial photographs (see Appendix E), it is likely that the actual extent of wetlands for each of the sites exceeds the FLUCCS estimate. Each site has been disturbed through agricultural and/or silvicultural practices. Historical aerial photographs (dating between 1943 and 1953) show a greater area of wetlands on all four alternate sites than is evident in contemporary aerial photographs. Additionally, the area of hydric soils (based on the Natural Resource Conservation Service (NRCS) County Soil Surveys) was calculated for each alternative site. Hydric soils maps are not expected to correspond directly with wetland maps but can be a useful tool in a desktop estimation of potential wetland areas. Table 4.1.6.1-1 depicts the area of hydric soils underlying each site, compared with the area of wetland using photo-interpreted FLUCCS.

TABLE 4.1.6.1-1
Hydric Soils and Wetlands within Site Areas

Site	Hydric Soils (acres)	FLUCCS Wetlands (acres)
LNP	1,888 (31%)	1,913 (32%)
Dixie 1	715 (12%)	636 (11%)
Highlands	5,255 (88%)	1,102 (18%)
Putnam 3	1,618 (27%)	1,404 (23%)

The extent of mapped hydric soils for the areas identified on the historical aerial photographs of the LNP, Dixie, and Putnam sites (see Appendix E) ranges from 12 to 31 percent and corresponds closely to the areal extent of FLUCCS wetlands. In contrast, nearly 90 percent of the Highlands site is underlain by hydric soils compared with 18 percent FLUCCS wetlands within the Site Area identified on the historical aerial photographs of the site (areas displayed as yellow circles in Appendix E). This large discrepancy between the mapped hydric soils and the mapped wetlands for the Highlands site is likely due to the extensive ditching onsite for agricultural purposes. While some hydric soil areas may no longer retain wetland functions, other areas would likely revert back to wetlands if the agricultural activities cease.

Since all sites have experienced significant human alteration and historical photographs show larger areas of wetlands than are currently present, it is assumed that the FLUCCS data would likely underestimate the actual wetlands for all sites. This analysis uses the best available data to relatively rank these four sites in relation to each other. While the actual amount of wetlands may be difficult to determine from the FLUCCS data alone, the use of FLUCCS data in a relative analysis is appropriate.

The total acreages, wetland acreages, and the percentage of wetlands within the site areas; onsite impact areas including reservoir impact areas; transmission corridors; and offsite corridors (pipeline, access road, and transportation [rail and heavy haul road]) are summarized and presented in Table 4.1.6.1-2. Detailed tables listing the FLUCCS Level 3 data for the onsite impact areas, reservoir impact areas, reservoir impact areas, transmission corridors, and offsite corridors are provided in Appendix C. In addition, wetlands information determined as part of the land-use classifications compiled from 2009 FLUCCS data is described in Subsection 4.2.8.

Section 4.1.1 of this document estimated the direct impacts from filling wetlands for all areas except the Transmission Line corridors. The impacts from clearing and fill are very different types of impacts. Detailed plans for the alternative sites are not available to calculate these types of impacts, but these can be estimated by assuming a percentage of clearing and fill impacts (Hambrick, 2010). Detailed locations for all elements related to the transmission lines, such as tower locations, tower pads, and service roads, are not currently known. This analysis is therefore based on an estimated corridor width, which is based on the size of transmission line as described in Section 1.4 of this document. The ROW corridor areas were multiplied by a factor to estimate the clearing and fill impacts related to the transmission lines, since a smaller area than the entire ROW corridor will be impacted by clearing and fill activities. The primary activities related to fill impacts are towers and pad structures. A typical pad is 120 feet by 140 feet, which is approximately 0.4 acre. Assuming a tower

spacing of 1,300 feet and a ROW width of 220 feet, the fill impact would be approximately 6 percent of the ROW corridor. Any vegetation clearing in wetland areas would use restrictive clearing techniques; it is assumed that approximately 20 percent of wetlands in the actual ROW would require clearing. This analysis calculates the amount of wetlands in the corridors for the transmission lines. Since the actual impacts will be a smaller area within this corridor (both clearing and fill), the amount of wetlands in the corridor were multiplied by 6 percent for fill impacts and 20 percent for clearing impacts to better estimate these types of impacts (For raw and adjusted data, see Appendix C). The rankings described in Table 5.0-1 are based on modified impacts for the transmission lines only. Table 4.1.6.1-2 lists the impact by type for the types of impacts.

TABLE 4.1.6.1-2
Alternative Sites Wetland Information

Areas	LNP[a,b] acres	Dixie 1[a] acres	Highlands[a] acres	Putnam 3[a] acres
Site Areas (% of site area)[c]	1,913 (32%)	636 (11%)	1,102 (18%)	1,404 (23%)
Transmission Line Corridors	1,633	2,200	606	716
Impact Areas				
Onsite Impact Areas[c] (% of impact area)[d]	210 (32%)	166 (8%)	263 (12%)	565 (26%)
Offsite Corridors (% of impact area)[d]	52 (15%)	45 (5%)	23 (4%)	6 (2%)
Transmission Line Corridors Fill impacts acreage multiplied by 6% (% of impact area) [d]	98 (1%)	132 (1%)	36 (1%)	43 (1%)
Sub-Total Fill Impacts	360	343	322	614
Transmission Line Corridors clearing impacts acreage multiplied by 20% (% of impact area) [d]	327 (3%)	440 (3%)	121 (2%)	143 (2%)
Total Impacts	687	783	443	757

Notes:
[a] Source: Florida Land Use Cover and Forms Classification System (FLUCCS) database, 2009 (see Appendix A).
[b] Wetland Acreages for the LNP site are consistent with the LNP Wetland Mitigation plan submitted April 2010. However to allow for comparisons in this analysis, variances in how the onsite versus offsite features were defined exist between these two documents. Additionally this analysis uses both temporary and permanent impacts at the LNP site, whereas the mitigation plan uses permanent impacts only.
[c] Onsite impact areas include reservoirs if needed.
[d] Percent of Impact Areas are based on acreages found in Table 1.4-1

The Highlands site had the lowest projected overall FLUCCS wetlands acreage impact. Overall FLUCCS wetlands impacts associated with the LNP and Putnam 3 sites were generally similar. Highest overall wetlands acreage impacts were associated with the Dixie 1 site.

Upland impacts and habitat fragmentation would be expected to be proportional to transmission line length and would be highest for the Dixie 1, Putnam 3, and Highlands sites.

The wetlands on the LNP site do not represent Aquatic Resources of National Importance (ARNI). The wetlands on the LNP site are not the kind that will support long-term fish habitat or aquatic insect communities. In addition, these wetlands do not serve as water

sources for municipal or private water supplies, support recreational or commercial fisheries, or support water-related recreation. As described in Section 4.1.6.1, they also do not support a unique or diverse wildlife population. In addition, the design of the LNP, which uses the proximal CFBC as a makeup source and uses a common corridor for pipelines and a heavy haul road, would avoid and minimize potential impacts.

Site-specific information collected for the LNP site shows that natural wetland functions have diminished. As described in ER Subsection 2.4.1.1.1, the natural functional values of onsite wetlands, such as surface water retention, nutrient cycling, and wildlife habitat, have been altered and diminished over several decades of silviculture operations on the LNP property. Wetland soils have been disturbed through bedding, road construction, and compaction. Cypress trees have been logged and slash pine planted within wetland boundaries. Average scores for onsite wetlands based on the Uniform Wetland Assessment Methodology were in the moderate range (approximately 0.5 out of 1) based on the Wetland Mitigation Plan (Biological Research Associates, Inc. [BRA], 2009). No unique or rare habitats or habitats with priority for protection were identified onsite, including onsite wetlands (ER Subsection 2.4.1.1.5.1). The proposed LNP Wetland Mitigation Plan has been designed to create high functioning wetlands to compensate for unavoidable wetland impacts and to cover compensation for potential floodplain loss associated with the proposed project.

4.1.6.2 Vegetated Shallows

Marine vegetated shallows (seagrass beds) were located in the near-shore waters of the Gulf of Mexico at the LNP site. These seagrass beds would be potentially impacted by pipeline construction activities if off-shore cooling water intake and/or blowdown and ancillary facility waste streams discharge locations were selected. The decision to place the LNP CWIS at the head of the CFBC results in avoidance of construction impacts to seagrass beds along the 9-mile path of a potential off-shore intake pipeline. The decision to route the LNP blowdown lines across the CFBC near the Route 19 bridge crossing to the CREC discharge canal, rather than along a similar off-shore route, also avoided potential construction impacts to seagrass beds from construction of an off-shore wastewater discharge pipeline.

The location of the proposed crossing of the CFBC by the two cooling tower blowdown pipelines is a soft sediment bottom that is void of seagrass beds. Therefore, no adverse impacts to vegetated shallows are projected to occur at the LNP site.

The addition of LNP wastewater to the existing CREC facility discharges will increase the volume of discharge into the Gulf of Mexico via the CREC discharge canal by only 4 to 5 percent. The temperature of the CREC discharge will likely remain the same or be reduced slightly by the addition of LNP wastewater. The addition of LNP wastewater to the CREC discharge will not affect any of the flora or fauna in the adjacent Gulf of Mexico, including seagrass (Blancher, 2009).

4.1.6.3 Riffle and Pool Complexes

The Dixie 1 site is the only site located far enough upstream on a freshwater river where riffles and pool complexes may exist. The hard bottom, deep-water riffle substrates and adjacent deep pools in the Suwannee River that may be present adjacent to the site have been designated by the USFWS as Critical Habitat for the Gulf sturgeon and may be used as spawning sites and rearing habitat for sturgeon juveniles. No site-specific habitat or

fisheries field studies have been conducted at this site; therefore, the presence or absence of sturgeon spawning and rearing areas at the Dixie 1 site remains speculative. It is assumed that none of the alternative sites would impact riffle and pool complex habitats.

4.1.7 Habitat for Fish and Other Aquatic Organisms

Potential impacts to aquatic organisms associated with each of the alternative sites were considered in the EFS (PEF, 2007). Each site is unique, and while some differences between the sites were noted, none was considered to be a strong differentiator. The location of the major surface waterbodies (based on FLUCCS data) within the site areas of each site are presented in Figures 4.1.7-1 through 4.1.7-4.

Additional information developed after the EFS was conducted affects the evaluations presented in that document. In the EFS, the Highlands site was rated slightly higher on this factor than the other four sites based on the absence of the shortnose sturgeon (*Acipenser brevirostrum)* and Gulf sturgeon (*Acipenser oxyrinchus desotoi*). Currently, it is understood that the Gulf sturgeon species is only present in the vicinity of the Dixie 1 site. Also, the EFS was conducted prior to PEF's decision to collocate the LNP and CREC discharges at the CREC. This collocation avoids the need to establish a new off-shore or coastal outfall location and reduces the potential for impact to fish, crustaceans (*Crustacea spp.*), mollusks, and other aquatic organisms.

The number of waterbody crossings provides a measure of potential impacts to aquatic habitats and are shown in Appendix C. Stream and open waterbody crossings are expected to occur along the transmission and the offsite corridors for the four alternative sites. The construction of the transmission corridors for the LNP site are expected to result in 7 stream crossings and 138 open water crossings. The offsite corridors for the LNP site are expected to cross seven streams and two open waterbodies. The transmission and offsite corridors associated with the Dixie 1 site are expected to result in 13 stream crossings, 140 open water crossings, 2 stream crossings, and 1 open water crossing respectively. The transmission corridors needed for the Highlands site are expected to cross 4 streams and 37 open waterbodies; offsite corridors are anticipated to cross 10 streams and 2 open waterbodies. The construction of the transmission corridors for the Putnam 3 site will result in 7 stream crossings and 94 open water crossings, while the construction of the offsite corridors is expected to require no stream crossing and only 2 open water crossings.

On December 18, 2001, the EPA promulgated the *National Pollutant Discharge Elimination System (NPDES): Regulations Addressing CWIS for New Facilities* (USEPA, 2001b) under Section 316(b) of the CWA. These regulations establish national technology-based performance requirements applicable to the location, design, construction, and capacity of CWIS. This rule establishes the BTA for minimizing adverse environmental impact associated with the use of CWIS on aquatic organisms. In NUREG-1437, the NRC concludes that with cooling towers and appropriate intake design, potential adverse impacts caused by entrainment and impingement are minor and do not significantly disrupt existing populations. The proposed project has been designed to meet or exceed all 316(b) requirements.

As described in the SCA and presented in additional detail in a supplemental 316(b) analysis (CH2M HILL, 2009c), the LNP site, like the other three alternative sites, would not adversely affect recreational or commercial fisheries.

4.1.8 Wildlife Habitat

Potential impacts to non-aquatic species were also considered (PEF, 2007). For all alternative sites, wildlife habitat function would be affected through loss of forested-dependent species and replacement by species adapted to open and disturbed habitats and ecosystem transition zones. The alternative sites have different habitat types currently, but there are no known unique features that would cause one site to have greater impacts to wildlife habitats than the others. Section 4.1.6.1, Wetlands, described the impacts to the wetland habitats and presents information on the relative loss of this type of habitat for species caused by filling and clearing.

In addition the FLUCCS Level II cover types that would most likely be used as habitat for all areas other than the transmission corridors are presented in Table 4.1.8-1. Table 4.1.8-1 shows the varied habitat types that are present for each of the sites that would be impacted by construction activities. While each of the sites offers different habitat types, the LNP, Dixie 1, and Highlands sites have similar amounts of wetland impacts. The Dixie site has a large number of uplands that would be impacted while the Putnam 3 site has the largest amount of impacts to most habitat types. Therefore, the LNP and Highlands sites received the most favorable ranking with the Putnam 3 site receiving the lowest ranking.

TABLE 4.1.8-1
FLUCCS Level II Cover Types

FLUCCS Level II	Description	LNP	Dixie 1	Highlands	Putnam 3
4100	Upland coniferous forests	6.4	5.9	3.3	35.7
4200	Upland hardwood forests	0	21.6	6.3	0
4300	Upland hardwood forests	7.9	146.6	0	14.8
5100	Streams and waterways	1.1	2.2	6.9	0.3
6100	Wetland hardwood forests	25.5	14.4	4.4	228.0
6200	Wetland coniferous forests	170.1	1.5	0	102.0
6300	Wetland forested mixed	22.1	10.7	0	165.7
6400	Vegetated non-forested wetlands	44.7	185.1	281.4	112.9
Total		277.9	387.9	302.3	659.2

4.1.9 Endangered or Threatened Species

The potential presence of protected species, both terrestrial and aquatic, is an important evaluation criterion for LEDPA selection. State and federally listed protected terrestrial and aquatic species for each of the four alternative sites were identified using Florida Natural Areas Inventory (FNAI) data. An FNAI Element Occurrences search was conducted and all species appeared within the 6,000-acre area but none were found within the project impact or reservoir impact areas. The species identified in the 2009 FNAI Element Occurrences search of the site areas are presented in Table 4.1.9-1. Additionally, no FNAI Element Occurrences were identified for the sites in Dixie and Putnam counties. State and federally listed protected terrestrial and aquatic species that have the potential to occur in the counties and, therefore, within the vicinity of the four alternative sites, are shown in Tables 4.1.9-2 through 4.1.9-5. Figure 4.1.9-1 presents a four-panel figure with each panel depicting the FNAI element occurrence data identified within the site area of the four alternative sites.

The general locations of FNAI element occurrences within the site area of the LNP and Highlands sites are shown on Figures 4.1.9-2 and 4.1.9-3, respectively.

TABLE 4.1.9-1
FNAI Element Occurrences within Project Site Areas, Onsite Impact Areas, and Reservoir Impact Areas

Species Common Name (Scientific Name) (Federal Status)	LNP	Dixie 1	Highlands	Putnam 3
Godfrey's Swampprivet (*Forestiera godfreyi*) (Not listed)	X			
Pinewoods Dainties (*Phyllanthus leibmannianus ssp. platylepis)* (Not listed)	X			
Florida Sandhill Crane (*Grus canadensis pratensis)* (Not listed)	X			
Gopher Tortoise (*Gopherus polyphemus)* (Not listed)	X			
Bald Eagle (*Haliaeetus leucocephalus*) (Proposed for Species of Special Concern)				
West Indian (Florida) Manatee Aggregation Site (*Trichechus manatus*) (Endangered)				
Great Egret (*Ardea alba*) (Not listed)			X	

Source: Florida Natural Areas Inventory (FNAI) Element Occurrence, 2009 (see Appendix A).

Twelve federally listed protected species occur in Levy County. Because of the historical use of the LNP site for silviculture and recent silvicultural activities, the site does not support a high degree of biodiversity. The predominant wildlife species are those that tolerate a mono-specific pine tree habitat, such as deer, turkey, and wild hogs. More specialized species, including most listed species, are not likely to use the site (Durbin, 2009). Manatees use the CFBC; however, it is not ideal habitat because of its shallow depth, lack of accessible vegetation, and steep straight banks. Potential impacts of the LNP CWIS on manatees will be minimized by the CWIS design and its location at the upper end of the CFBC. State- and federally listed protected terrestrial and aquatic species that have the potential to occur in Levy County and, therefore, within the vicinity of the LNP site, are shown in Table 4.1.9-2.

TABLE 4.1.9-2
State and Federal Threatened and Endangered Species Potentially Occurring in Levy County

Common Name	Scientific Name	State Status	Federal Status
Amphibians			
Gopher Frog	*Rana capito*	Species of Special Concern	Not listed
Reptiles			
American alligator	*Alligator mississippiensis*	Species of Special Concern	Treated as Threatened
Green Sea Turtle	*Chelonia mydas*	Endangered	Endangered
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered	Endangered
Loggerhead Sea Turtle	*Caretta caretta*	Threatened	Threatened
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	Endangered	Endangered
Alligator Snapping Turtle	*Macrochelys temminckii*	Species of Special Concern	Not listed
Gopher Tortoise	*Gopherus polyphemus*	Threatened	Not listed

TABLE 4.1.9-2
State and Federal Threatened and Endangered Species Potentially Occurring in Levy County

Common Name	Scientific Name	State Status	Federal Status
Florida Pine Snake	*Pituophis melanoleucus mugitus*	Species of Special Concern	Not listed
Suwannee Cooter	*Pseudemys concinna suwanniensis*	Species of Special Concern	Not listed
Eastern Indigo Snake	*Drymarchon couperi*	Threatened	Threatened
Short-tailed Snake	*Stilosoma extenuatum*	Threatened	Not listed
Fish			
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	Species of Special Concern	Threatened
Suwannee Bass	*Micropterus notius*	Species of Special Concern	Not listed
Birds			
Scott's Seaside Sparrow	*Ammodramus maritimus peninsulae*	Species of Special Concern	Not listed
Florida Scrub-jay	*Aphelocoma coerulescens*	Threatened	Threatened
Limpkin	*Aramus guarauna*	Species of Special Concern	Not listed
Florida Burrowing Owl	*Athene cunicularia floridana*	Species of Special Concern	Not listed
Piping Plover	*Charadrius melodus*	Threatened	Threatened
Marian's Marsh Wren	*Cistothorus palustris marianae*	Species of Special Concern	Not listed
Little Blue Heron	*Egretta caerulea*	Species of Special Concern	Not listed
Snowy Egret	*Egretta thula*	Species of Special Concern	Not listed
Tricolored Heron	*Egretta tricolor*	Species of Special Concern	Not listed
White Ibis	*Eudocimus albus*	Species of Special Concern	Not listed
Southeastern American Kestrel	*Falco sparverius paulus*	Threatened	Not listed
Florida Sandhill Crane	*Grus canadensis pratensis*	Threatened	Not listed
American Oystercatcher	*Haematopus palliatus*	Species of Special Concern	Not listed
Bald Eagle	*Haliaeetus leucocephalus*	Not listed	Proposed for Species of Special Concern
Wood Stork	*Mycteria americana*	Endangered	Endangered
Brown Pelican	*Pelecanus occidentalis*	Species of Special Concern	Not Listed
Red-cockaded Woodpecker	*Picoides borealis*	Species of Special Concern	Endangered
Roseate Spoonbill	*Platalea ajaja*	Species of Special Concern	Not listed
Osprey	*Pandion haliaetus*	Species of Special Concern	Not listed
Black Skimmer	*Rynchops niger*	Species of Special Concern	Not listed
Least Tern	*Sterna antillarum*	Threatened	Not listed
Mammals			
West Indian (Florida) Manatee	*Trichechus manatus*	Endangered	Endangered
Florida Mouse	*Podomys floridanus*	Species of Special Concern	Not listed

TABLE 4.1.9-2
State and Federal Threatened and Endangered Species Potentially Occurring in Levy County

Common Name	Scientific Name	State Status	Federal Status
Salt Marsh Vole	*Microtus pennsylvanicus dukecampelli*	Endangered	Endangered
Sherman's Fox Squirrel	*Sciurus niger shermani*	Species of Special Concern	Not listed
Florida Black Bear	*Ursus americanus floridanus*	Threatened	Not listed
Plants			
Pinewood Dainties	*Phyllanthus leibmannianus ssp. platylepis*	Endangered	Not listed
Variable-leaved Indian Plantain	*Arnoglossum diversifolium*	Threatened	Not listed
Chapman's Sedge	*Carex chapmanii*	Endangered	Not listed
Godfrey's Spleenwort	*Forestiera godfreyi*	Endangered	Not listed
Wood Spurge	*Euphorbia commutata*	Endangered	Not listed
Corkwood	*Leitneria floridana*	Threatened	Not listed
Tampa Vervain	*Gladularia tampensis*	Endangered	Not listed
Florida Hasteola	*Hasteola robertiorum*	Endangered	Not listed
Pinnate-lobed Coneflower	*Rudbeckia triloba var. pinnatiloba*	Endangered	Not listed
Pinkroot	*Spigelia loganioides*	Endangered	Not listed
Giant Orchid	*Pteroglossaspis ecristata*	Threatened	Not listed

Source: Florida Natural Areas Inventory (FNAI), 2009a

A total of 10 federally listed threatened and endangered species are documented as occurring in Dixie County. Six federally listed protected aquatic species are found in the county. State- and federally-listed protected terrestrial and aquatic species that have the potential to occur in Dixie County and, therefore, within the vicinity of the Dixie 1 site, are shown in Table 4.1.9-3.

TABLE 4.1.9-3
State and Federal Threatened and Endangered Species Potentially Occurring in Dixie County

Common Name	Scientific Name	State Status	Federal Status
Amphibians			
Gopher Frog	*Rana capito*	Species of Special Concern	Not listed
Reptiles			
American alligator	*Alligator mississippiensis*	Species of Special Concern	Treated as Threatened
Green Sea Turtle	*Chelonia mydas*	Endangered	Endangered
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered	Endangered
Loggerhead Sea Turtle	*Caretta caretta*	Threatened	Threatened
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	Endangered	Endangered
Alligator Snapping Turtle	*Macrochelys temminckii*	Species of Special Concern	Not listed
Gopher Tortoise	*Gopherus polyphemus*	Threatened	Not listed

TABLE 4.1.9-3
State and Federal Threatened and Endangered Species Potentially Occurring in Dixie County

Common Name	Scientific Name	State Status	Federal Status
Florida Pine Snake	*Pituophis melanoleucus mugitus*	Species of Special Concern	Not listed
Suwannee Cooter	*Pseudemys concinna suwanniensis*	Species of Special Concern	Not listed
Eastern Indigo Snake	*Drymarchon couperi*	Threatened	Threatened
Fish			
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	Species of Special Concern	Threatened
Suwannee Bass	*Micropterus notius*	Species of Special Concern	Not listed
Birds			
Scott's Seaside Sparrow	*Ammodramus maritimus peninsulae*	Species of Special Concern	Not listed
Limpkin	*Aramus guarauna*	Species of Special Concern	Not listed
Florida Burrowing Owl	*Athene cunicularia floridana*	Species of Special Concern	Not listed
Piping Plover	*Charadrius melodus*	Threatened	Threatened
Marian's Marsh Wren	*Cistothorus palustris marianae*	Species of Special Concern	Not listed
Little Blue Heron	*Egretta caerulea*	Species of Special Concern	Not listed
Snowy Egret	*Egretta thula*	Species of Special Concern	Not listed
Tricolored Heron	*Egretta tricolor*	Species of Special Concern	Not listed
White Ibis	*Eudocimus albus*	Species of Special Concern	Not listed
Southeastern American Kestrel	*Falco sparverius paulus*	Threatened	Not listed
American Oystercatcher	*Haematopus palliatus*	Species of Special Concern	Not listed
Bald Eagle	*Haliaeetus leucocephalus*	Not listed	Proposed for Species of Special Concern
Wood Stork	*Mycteria americana*	Endangered	Endangered
Brown Pelican	*Pelecanus occidentalis*	Species of Special Concern	Not Listed
Red-cockaded Woodpecker	*Picoides borealis*	Species of Special Concern	Endangered
Osprey	*Pandion haliaetus*	Species of Special Concern	Not listed
Black Skimmer	*Rynchops niger*	Species of Special Concern	Not listed
Least Tern	*Sterna antillarum*	Threatened	Not listed
Mammals			
West Indian (Florida) Manatee	*Trichechus manatus*	Endangered	Endangered
Florida Mouse	*Podomys floridanus*	Species of Special Concern	Not listed
Sherman's Fox Squirrel	*Sciurus niger shermani*	Species of Special Concern	Not listed
Florida Black Bear	*Ursus americanus floridanus*	Threatened	Not listed

TABLE 4.1.9-3
State and Federal Threatened and Endangered Species Potentially Occurring in Dixie County

Common Name	Scientific Name	State Status	Federal Status
Plants			
Pinewood Dainties	*Phyllanthus leibmannianus ssp. platylepis*	Endangered	Not listed
Incised Groove-bur	*Agrimonia incisa*	Endangered	Not listed
Godfrey's Swampprivet	*Forestiera godfreyi*	Endangered	Not listed
Buckthorn	*Sideroxylon lycioides*	Endangered	Not listed
Corkwood	*Leitneria floridana*	Threatened	Not listed

Source: Florida Natural Areas Inventory (FNAI), 2009c

As indicated in Tables 4.1.9-2 and 4.1.9-3, the Gulf sturgeon is present in Levy, and Dixie Counties. Since suitable habitat for the Gulf sturgeon is not present near the LNP site, it is not expected to be a concern for these sites. The Gulf sturgeon is believed to occur only in the vicinity of the Dixie 1 site because it is present in the Suwannee River. The Dixie 1 site is located on the river in an area designated as Critical Habitat for the protected Gulf sturgeon. The deep water and pool and riffle habitat present at the Dixie 1 site may result in use of the riffle hard bottom vicinity for sturgeon spawning.

While it is unknown to what extent the portion of the river adjacent to the Dixie 1 site, if any, is used as an actual spawning area, it is known that adult sturgeon pass by the site on their way to proven upstream spawning grounds and that juvenile sturgeon must pass by the site during out-migrations to the Gulf of Mexico. The placement of a CWIS in this portion of the Suwannee River would require detailed sampling of adult and juvenile sturgeon to allow for minimization of construction and operational impacts and the use of a Ristroph-type continuously operated fish return system in a BTA-designed CWIS would likely be required to assure minimization of impacts to migrating sturgeon. In addition, the Suwannee River has been recognized as an OFW and a body of water warranting special protection.

In the Highlands site vicinity, there are 28 federally listed protected species, including 19 listed as endangered. Florida's Central Highlands ridge is considered to be one of the state's most unique and diverse ecosystems and supports a high number of endangered and threatened terrestrial species. State- and federally-listed protected terrestrial and aquatic species that have the potential to occur in Highlands County and, therefore, within the vicinity of the Highlands site, are shown in Table 4.1.9-4.

TABLE 4.1.9-4
State and Federal Threatened and Endangered Species Potentially Occurring in Highlands County

Common Name	Scientific Name	State Status	Federal Status
Amphibians			
Gopher Frog	*Rana capito*	Species of Special Concern	Not listed
Reptiles			
American alligator	*Alligator mississippiensis*	Species of Special Concern	Treated as Threatened
Blue-tailed Mole Skink	*Eumeces egregious lividus*	Threatened	Threatened
Sand Skink	*Neoseps reynoldsi*	Threatened	Threatened
Gopher Tortoise	*Gopherus polyphemus*	Threatened	Not listed

TABLE 4.1.9-4
State and Federal Threatened and Endangered Species Potentially Occurring in Highlands County

Common Name	Scientific Name	State Status	Federal Status
Florida Pine Snake	*Pituophis melanoleucus mugitus*	Species of Special Concern	Not listed
Eastern Indigo Snake	*Drymarchon couperi*	Threatened	Threatened
Short-tailed Snake	*Stilosoma extenuatum*	Threatened	Not listed
Birds			
Florida Grasshopper Sparrow	*Ammodramus savannarum floridanus*	Endangered	Endangered
Florida Scrub-jay	*Aphelocoma coerulescens*	Threatened	Threatened
Limpkin	*Aramus guarauna*	Species of Special Concern	Not listed
Florida Burrowing Owl	*Athene cunicularia floridana*	Species of Special Concern	Not listed
Crested Caracara	*Caracara cheriway*	Threatened	Threatened
Little Blue Heron	*Egretta caerulea*	Species of Special Concern	Not listed
Snowy Egret	*Egretta thula*	Species of Special Concern	Not listed
Tricolored Heron	*Egretta tricolor*	Species of Special Concern	Not listed
White Ibis	*Eudocimus albus*	Species of Special Concern	Not listed
Southeastern American Kestrel	*Falco sparverius paulus*	Threatened	Not listed
Florida Sandhill Crane	*Grus canadensis pratensis*	Threatened	Not listed
Bald Eagle	*Haliaeetus leucocephalus*	Not listed	Proposed for Species of Special Concern
Wood Stork	*Mycteria americana*	Endangered	Endangered
Red-cockaded Woodpecker	*Picoides borealis*	Species of Special Concern	Endangered
Osprey	*Pandion haliaetus*	Species of Special Concern	Not listed
Least Tern	*Sterna antillarum*	Threatened	Not listed
Mammals			
Florida Mouse	*Podomys floridanus*	Species of Special Concern	Not listed
Florida Panther	*Puma concolor coryi*	Endangered	Endangered
Sherman's Fox Squirrel	*Sciurus niger shermani*	Species of Special Concern	Not listed
Florida Black Bear	*Ursus americanus floridanus*	Threatened	Not listed
Plants			
Florida Bonamia	*Bonamia grandiflora*	Endangered	Threatened
Ashe's Savory	*Calaminntha ashei*	Threatened	Not listed
Many-flowered Grasspink	*Calopogon multiflorus*	Endangered	Not listed
Sand Butterfly Pea	*Centrosema arenicola*	Endangered	Not listed
Pygmy Fringe Tree	*Chionanthus pygmaeus*	Endangered	Endangered
Perforate Reindeer Lichen	*Cladonia perforata*	Endangered	Endangered
Scrub Pigeon-wing	*Clitoria fragrans*	Endangered	Threatened
Short-leaved Rosemary	*Conradina brevifolia*	Endangered	Endangered

TABLE 4.1.9-4
State and Federal Threatened and Endangered Species Potentially Occurring in Highlands County

Common Name	Scientific Name	State Status	Federal Status
Avon Park Rabbit-bells	*Crotalaria avonensis*	Endangered	Endangered
Garrett's Scrub Balm	*Dicerandra christmanii*	Endangered	Endangered
Scrub Mint	*Dicerandra frutescens*	Endangered	Endangered
Spoon-leaved Sundew	*Drosera intermedia*	Threatened	Not listed
Spurred Neottia	*Eltroplectris calcarata*	Endangered	Not listed
Scrub Buckwheat	*Eriogonum longifolium var. gnaphalifolium*	Endangered	Threatened
Wedge-leaved Button-snakeroot	*Eryngium cuneifolium*	Endangered	Endangered
Hartwrightia	*Hartwrightia floridana*	Threatened	Not listed
Highlands Scrub Hypericum	*Hypericum cumicola*	Endangered	Endangered
Edison's Ascyrum	*Hypericum edisonianum*	Endangered	Not listed
Thick-leaved Water-willow	*Justica crassifolia*	Endangered	Not listed
Nodding Pinweed	*Lechea cernua*	Threatened	Not listed
Pin Pinweed	*Lechea divaricata*	Endangered	Not listed
Florida Blazing Star	*Liatris ohlingerae*	Endangered	Not listed
Narrowleaf Naiad	*Najas filifolia*	Threatened	Not listed
Britton's Beargrass	*Nolina brittoniana*	Endangered	Endangered
Cutthroat Grass	*Panicum abscissum*	Endangered	Not listed
Paper-like Nailwort	*Paronychia chartacea ssp. chartacea*	Endangered	Threatened
Yellow Fringeless Orchid	*Platanthera integra*	Endangered	Not listed
Lewton's Polygala	*Polygala lewtonii*	Endangered	Endangered
Florida Jointweed	*Polygonella basiramia*	Endangered	Endangered
Small's Jointweed	*Polygonella myriophylla*	Endangered	Endangered
Scrub Plum	*Prunus geniculata*	Endangered	Endangered
Giant Orchid	*Pteroglossaspis ecristata*	Threatened	Not listed
Scrub Bluestem	*Schizachyrium niveum*	Endangered	Not listed
Scrub Stylisma	*Stylisma abdita*	Endangered	Not listed
Carter's Warea	*Warea carteri*	Endangered	Endangered
Redmargin Zephyrlily	*Zephyranthes simpsonii*	Threatened	Not listed
Scrub Ziziphus	*Ziziphus celata*	Endangered	Endangered

Source: Florida Natural Areas Inventory (FNAI), 2009d

Nine federally listed protected species occur in Putnam County. Two federally listed protected aquatic species are known to occur in the St. Johns River adjacent to the site: the endangered West Indian (Florida) manatee and the endangered shortnose sturgeon (*Acipenser brevirostrum*). The habitat of the shortnose sturgeon includes the St. Johns River in Putnam County. State- and federally listed protected terrestrial and aquatic species that have the potential to occur in Putnam County and, therefore, within the vicinity of the Putnam 3 site, are shown in Table 4.1.9-5.

TABLE 4.1.9-5
State and Federal Threatened and Endangered Species Potentially Occurring in Putnam County

Common Name	Scientific Name	State Status	Federal Status
Amphibians			
Gopher Frog	*Rana capito*	Species of Special Concern	Not listed
Decapods			
Black Creek Crayfish	*Procambarus pictus*	**Species of Special Concern**	Not listed
Reptiles			
American alligator	*Alligator mississippiensis*	Species of Special Concern	Treated as Threatened
Gopher Tortoise	*Gopherus polyphemus*	Threatened	Not listed
Florida Pine Snake	*Pituophis melanoleucus mugitus*	Species of Special Concern	Not listed
Eastern Indigo Snake	*Drymarchon couperi*	Threatened	Threatened
Short-tailed Snake	*Stilosoma extenuatum*	Threatened	Not listed
Sand Skink	*Neoseps reynoldsi*	Threatened	Threatened
Fish			
Shortnose Sturgeon	*Acipenser brevirostrum*	Endangered	Endangered
Atlantic Sturgeon	*Acipenser oxyrinchus oxyrinchus*	Species of Special Concern	Candidate Species
Tessellated Darter	*Etheostoma olmstedi*	Species of Special Concern	Not listed
Bluenose Shiner	*Pteronotropis welaka*	Species of Special Concern	Not listed
Birds			
Florida Scrub-jay	*Aphelocoma coerulescens*	Threatened	Threatened
Limpkin	*Aramus guarauna*	Species of Special Concern	Not listed
Little Blue Heron	*Egretta caerulea*	Species of Special Concern	Not listed
Snowy Egret	*Egretta thula*	Species of Special Concern	Not listed
Tricolored Heron	*Egretta tricolor*	Species of Special Concern	Not listed
White Ibis	*Eudocimus albus*	Species of Special Concern	Not listed
Southeastern American Kestrel	*Falco sparverius paulus*	Threatened	Not listed
Florida Sandhill Crane	*Grus canadensis pratensis*	Threatened	Not listed
Bald Eagle	*Haliaeetus leucocephalus*	Not listed	Proposed for Species of Special Concern
Wood Stork	*Mycteria americana*	Endangered	Endangered
Red-cockaded Woodpecker	*Picoides borealis*	Species of Special Concern	Endangered
Osprey	*Pandion haliaetus*	Species of Special Concern	Not listed
Mammals			
West Indian (Florida) Manatee	*Trichechus manatus*	Endangered	Endangered
Florida Mouse	*Podomys floridanus*	Species of Special Concern	Not listed

TABLE 4.1.9-5
State and Federal Threatened and Endangered Species Potentially Occurring in Putnam County

Common Name	Scientific Name	State Status	Federal Status
Sherman's Fox Squirrel	*Sciurus niger shermani*	Species of Special Concern	Not listed
Florida Black Bear	*Ursus americanus floridanus*	Threatened	Not listed
Plants			
Pine-woods Bluestem	*Andropogon arctatus*	Threatened	Not listed
Variable-leaved Indian-plantain	*Arnoglossum diversifolium*	Threatened	Not listed
Purple Honeycomb-head	*Balduina atropurpurea*	Endangered	Not listed
Bartram's Ixia	*Calydorea coelestina*	Endangered	Not listed
Chapman's Sedge	*Carex chapmanii*	Endangered	Not listed
Etonia Rosemary	*Conradina etonia*	Endangered	Endangered
Florida Toothache Grass	*Ctenium floridanum*	Endangered	Not listed
Spoon-leaved Sundew	*Drosera intermedia*	Threatened	Not listed
Hartwrightia	*Hartwrightia floridana*	Threatened	Not listed
Lake-side Sunflower	*Helianthus carnosus*	Endangered	Not listed
Florida Spiny-pod	*Matalea floridana*	Endangered	Not listed
Pondspice	*Litsea aestivalis*	Endangered	Not listed
Large-leaved Grass-of-parnassus	*Parnassia grandifolia*	Endangered	Not listed
Florida Mountain-mint	*Pycnanthemum floridanum*	Threatened	Not listed
Giant Orchid	*Pteroglossaspis ecristata*	Threatened	Not listed
Buckthorn	*Sideroxylon lycioides*	Endangered	Not listed
Chaffseed	*Schwalbea americana*	Endangered	Endangered
Florida Willow	*Salix floridana*	Endangered	Not listed
Scrub Stylisma	*Stylisma abdita*	Endangered	Not listed

Source: Florida Natural Areas Inventory (FNAI), 2009e

4.1.9.1 Sanctuaries, Refuges, and Endangered Species Habitat

Florida Ecological Greenways Network and Critical Linkages are the most important areas for protecting large connected landscapes in Florida. Critical linkages represent the areas that are most important for linking existing conservation areas and protecting wildlife corridors for wide-ranging species, such as the Florida panther and Florida black bear, as these species are threatened by imminent development pressure. No designated habitat linkages were shown in the database as intersecting the four sites.

Strategic Habitat and Conservation Areas are important to flora, fauna, and natural communities as determined by the Florida Fish and Wildlife Conservation Commission (FWC). The areas identify the particular species of wildlife predicted to occur for that location. The only site intersecting the Strategic Habitat Conservation Areas dataset was the Highlands site. This site contains Audubon's Crested Caracara and the Mottled Duck (*Anas fulvigula*). Again, in a few areas these two species habitats are predicted to overlap. No Strategic Habitat and Conservation Areas exist at the LNP, Dixie 1, or Putnam 3 sites.

The CWA requires that the surface waters of each state be classified according to designated uses. Florida has five classes with associated designated uses, which are arranged in order of degree of protection required. The top two most-protected classifications are as follows:

- Class I Potable Water Supplies: Fourteen general areas throughout the state include impoundments and associated tributaries and certain lakes, rivers, or portions of rivers used as a drinking water supply.
- Class II Shellfish Propagation or Harvesting: Generally coastal waters where commercial shellfish harvesting occurs.

None of the four sites intersect the boundaries of these two highest protected categories. The commercial shellfishing area, approximately 20 nautical miles north of the LNP site near the Cedar Keys National Wildlife Refuge, is the closest Class II water to any site.

Endangered species are addressed in Subsection 4.2.4 of this document.

4.1.10 Biological Availability of Possible Contaminants in Dredge or Fill Material

Per Section 404(b)(1) guidelines, the fill used at any of the alternative sites will be free of petroleum products and hazardous substances as well as free from chemical, biological, and other pollutants. The source of fill material to be placed in wetlands and streams has not been clearly defined for any of the alternative sites.

Dredged or fill materials associated with this project will not be hazardous and will not adversely impact special aquatic sites. All site work will employ BMPs. Samples have been collected from the CFBC in the project vicinity and subjected to Toxicity Characteristic Leaching Procedure (TCLP) analysis. Results from each of the three sediment samples were "undetected" for all analytes tested and are considered non-hazardous (CH2M HILL, 2009d).

4.1.11 Municipal and Private Water Supplies, Water Conservation

As described previously, the water metric evaluated for each of the four alternative sites is the ability of a primary water source to provide adequate cooling water for a 2-unit nuclear power generating facility with cooling towers without significant permitting issues or operational restrictions. The closed-cycle cooling system cooling water supply requirements for the proposed 2-unit nuclear power generating facility is approximately 94 cubic feet per second (cfs) (PEF, 2007).

Groundwater was considered an unavailable and/or unreliable source for the large quantities of cooling water because of the consumptive water use pressures on Florida aquifers in the vicinity of the alternative sites and the uncertainty of future groundwater supplies and groundwater regulations. In addition, permitting large groundwater withdrawals for industrial use is considered to be generally inconsistent with state policy. Consequently, the existing freshwater rivers or Gulf of Mexico were considered viable water supply sources. Water usage in all source waters is governed by individual WMDs in Florida and approval for proposed water usage is required by the respective WMD. It will be necessary to meet with the appropriate agencies to obtain preliminary confirmation of available water and to define requirements for obtaining final approval of any proposed water use (ER Subsection 9.3.3.1.3).

The LNP site uses groundwater for other than power generation cooling water cooling needs, and the site plan in this analysis includes the facilities associated with the withdrawals. ER Subsection 5.2.2.3 describes the potential effects on groundwater from the operation of LNP as localized and states that, with proper mitigation, such withdrawals should have limited impacts on the ability of other users to withdraw water. As part of the "Conditions of Certification, adopted by the Final Order on Certification for the Progress Energy Levy Nuclear Power Plant Units 1 & 2," dated August 26, 2009, PEF will develop an Aquifer Performance Testing (APT) plan and an Environmental Monitoring Plan (EMP) for the proposed LNP raw water well field. The purpose of the APT plan is to measure the actual aquifer parameters in the wellfield to verify and, if necessary, revise the District Wide Regulation Model, Version 2 (DWRM2) Telescopic Mesh Refinement (TMR) wellfield effects model to incorporate field measured values. The EMP provides a framework for monitoring the hydrology and ecology of wetlands in the vicinity of the LNP wellfield that could potentially be affected by groundwater drawdowns resulting from operation of the LNP raw water wellfield. These required actions from the Conditions of Certification will ensure that the actual field conditions are understood at the wellfield location and that nearby wetlands are monitored to evaluate any potential impacts from the groundwater withdrawals (from letter NPD-NRC-2009-242). The proposed groundwater pumping is not expected to affect wetlands adversely in the vicinity of the project; however, wetlands will be monitored for potential adverse impacts. In accordance with the Conditions of Certification, wetlands and other surface waters will not be adversely impacted as a result of the authorized consumptive water use. If unacceptable adverse impacts occur, PEF will mitigate the adverse impacts or other action will be taken (Conditions of Certification, Part XXVIII, §§ A.9.g, B.11, and B.12). In addition, Condition XXVIIA.3 states "If adverse impacts are detected or predicted through the Environmental Monitoring as specified in Condition A.2. or through aquifer performance testing or groundwater modeling as specified in Conditions A.4.a. and A.4.b. below, Licensee shall either mitigate such adverse impacts in accordance with a plan submitted by the Licensee and approved by the District or, by selecting and implementing an Alternate Water Supply project in accordance with the following schedule:…." Therefore, the groundwater withdrawals will either have no effects or the effects will be mitigated as indicated. The other alternative sites do not use groundwater for any needs.

Water resource caution areas (WRCAs) are areas that have critical water supply problems or are projected to have critical water supply problems within the next 20 years. Reuse of reclaimed water from domestic wastewater treatment facilities is required within these WRCAs, unless such reuse is not economically, environmentally, or technically feasible. The Putnam 3 site is entirely within a WRCA, one that the St. Johns Water Management District (SJRWMD) considers a potential priority WRCA. The Highlands site also is located in a WRCA. The LNP and Dixie 1 sites are not located in a WRCA.

As described previously, impacts on hydrology and consumptive water use will be primarily associated with water withdrawal from the main source of water. The LNP site will withdraw water from the CFBC with an unlimited open connection to the Gulf of Mexico to supply cooling water for the proposed reactors. Access to the CFBC to draw a volumetrically unrestricted water supply from the Gulf of Mexico was a major advantage of the LNP site. The CWIS for the LNP site can be constructed in the upper portion of the CFBC, an area shown by recent aquatic studies to be of relatively limited ecological quality, and the increased flow of salt water from the Gulf of Mexico via the CFBC as induced by the

CWIS is anticipated to improve water quality conditions in the upper portions of the CFBC and increase aquatic diversity in the area. Because the Gulf of Mexico is a substantial body of water that is not subject to extreme changes in volume, cooling water availability will not be an issue for the LNP site (ER Subsection 3.3.1).

The primary water supply for the Dixie 1 site is the Suwannee River. The Suwannee River has been identified by the federal government and the States of Florida and Georgia as "an ecosystem in need of protection," and the FDEP has classified the waterway as an OFW. Regulatory complexities are associated with minimum river flow levels set by the Suwannee River Water Management District (SRWMD) on the Suwannee River (PEF, 2007). In addition, the Suwannee River is considered one of the largest and most ecologically unique blackwater river systems in the southeastern United States (ER Subsection 9.3.3.2.3). Water supplies for a facility at the Dixie 1 site will also likely need to account for regulatory complexities associated with minimum flow levels set by the SRWMD on the Suwannee River (PEF, 2007).

The SRWMD recently completed minimum flow levels (mfl) for the Suwannee River in areas potentially relevant to the Dixie 1 site. Based on the data, sufficient water is potentially available to accommodate two nuclear units without causing an mfl violation. The data do not consider existing water consumption or available capacity; however, they do indicate that on a gross scale, the proposed nuclear power generating facility could potentially be accommodated. The SRWMD would determine the actual post-mfl yield available for consumption; however, it is likely that the site would require construction of a reservoir (size unknown at this time) because of potential water use issues. The reservoir would likely affect site development and pumping distances.

The primary water source for the Highlands site is the Kissimmee River. It is likely that the construction of a large off-stream reservoir would be required to meet the water requirements for the proposed nuclear power generating facility (ER Subsection 9.3.3.3.3). Water access difficulties are anticipated at the Highlands site because there is a planned restoration project for the Kissimmee River to convert the channelized C-38 canal back to a large portion of the original Kissimmee River bed and create approximately 27,000 acres of wetlands. While not necessarily an unavoidable obstacle to obtaining cooling water for the site, such water use would have to be coordinated with the USACE and the South Florida Water Management District (SFWMD) and be consistent with each agency's efforts to implement the Comprehensive Everglades Restoration Plan (CERP) and the Kissimmee River Restoration Plan. Additionally, the SFWMD is a party to an intergovernmental agreement with the Seminole Tribe regarding water entitlements to the Brighton Reservation south of the Highlands site in Glades County. Also, the area incorporating the Highlands site is part of a Critical Water Supply Problem Area under SFWMD Rule 40E-23.021(2), Florida Administrative Code (F.A.C.). The anticipated difficulties in obtaining water allocation approvals and the unknown future impacts of the two area restoration programs on water supply and CWIS location were factors in ranking the Highlands site.

Water access difficulties could also occur at the Putnam 3 site in light of the regulatory unknowns associated with the St. Johns River. The St. Johns River Alliance in coordination with the SJRWMD and FDEP is developing a $4.6 billion restoration plan for the entire river. Some of this money will be used to purchase thousands of acres of land along the river for conservation purposes.

For this project, U.S. Geological Survey (USGS) gage stations along the Suwannee River, Kissimmee River, and St. Johns River were reviewed to assess water availability for the Dixie 1, Highlands, and Putnam 3 sites, respectively. The 20th percentile of the daily average discharge (mgd) was used to evaluate the water availability in these three rivers. The LNP site uses the Gulf of Mexico for cooling water.

As indicated earlier, the Suwannee River is the receiving waterbody from the Dixie 1 site. Recent river flow rates have been near 12,000 cfs, and under these flow rates, the Suwannee River is capable of reducing impacts resulting from nuclear power plant effluent. The 20th percentile of the daily average discharge for the period of record (July 1999 – July 2009) for the Suwannee River at the nearest USGS gage station (02323592 on Suwannee River above Gopher River near Suwannee, Florida) is approximately 1,604 mgd (USGS, 2009a).

The USGS has three gage stations along the Kissimmee River, two of which measure instream river flow parameter. However, in 2009 these two gage stations began recording river stream flow. The nearest USGS gage station for the Kissimmee River in the vicinity of the Highlands site started recording Kissimmee River instream flow in June 2009. The 20th percentile of the daily average discharge for the period of record (October 1948 – September 1964) for the Kissimmee River at the nearest USGS gage station (02272500 Kissimmee River at U.S. Highway 98 at Fort Basinger, Florida) is approximately 217 mgd (USGS, 2009b).

The main source of water for the Putnam 3 site would be the St. Johns River. The 20th percentile of the daily average discharge for the period of record (February 1993 – September 2008) for the St. Johns River at the nearest USGS gage station (02244040 St. Johns River at Buffalo Bluff near Satsuma, Florida) is approximately 802 mgd (USGS, 2009c).

As described previously, groundwater is the primary water supply source for potable water needs because public water is usually unavailable in the relatively remote portions of the four counties. However, public drinking water supply users are located downstream from the Highlands and Putnam 3 sites, although these counties also obtain drinking water from groundwater. The Okeechobee Utility Authority is permitted to operate a public water supply facility about 11 miles southeast of the Highlands site that withdraws water from the northern bank of Lake Okeechobee for a public potable water source. In addition, there are 292 public water supply utilities that serve about 88 percent of the population downstream from the Putnam 3 site within the SJRWMD, including both small municipalities and the Jacksonville, Florida, metropolitan area, which is about 45 miles north of the Putnam 3 site (PEF, 2007).

Table 4.1.11-1 presents information about distances to the nearest potable well from the centerpoint of LNP Units 1 and 2 at the site area for each alternative site and the number of potable wells within the site area, onsite impact area, reservoir impact area, transmission line corridor, and offsite corridor for each alternative site. The locations of the potable wells within the site areas and within the transportation corridor (rail and heavy haul roads) extents are presented on Figures 4.1.11-1 through 4.1.11-8.

TABLE 4.1.11-1
Potable Well Information for Alternative Sites

	LNP	Dixie 1	Highlands	Putnam 3
Site Areas				
Distance[a] to nearest potable well (miles)	1.3	0.8	2.6	1.5
Number of potable wells	2	1	0	1
On-site Impact Areas				
Number of potable wells	0	0	0	0
Reservoir Impact Areas				
Number of potable wells	0	0	0	0
Transmission Line Corridors				
Number of potable wells	0	0	0	0
Off-site Corridors				
Number of potable wells	0	9[b]	0	0

Notes:
[a] All distances measured from centerpoint of Units 1 and 2
[b] Wells within major transportation (heavy haul road or rail) corridors

Source: FGDL Florida Department of Health (FDOH) database, 2009; Suwannee River Water Management District (SRWMD) database, 2009; St. Johns River Water Management District (SJRWMD) database, 2009; St. South Florida Water Management District (SFWMD) database, 2009 (see Appendix C).

4.1.12 Recreation and Commercial Fisheries

The Magnuson-Stevens Fishery Conservation and Management Act is the primary law governing marine fisheries management in United States federal waters. The Act was first enacted in 1976 and amended in 1996. The 1996 amendments focused on rebuilding depleted fisheries, protecting essential fish habitat, and reducing by catch. The increased volume of cooling water necessary to operate the new reactors at the four sites could result in increased rates of entrainment and impingement, which could have the potential to affect commercial and recreational fisheries stocks. However, impingement and entrainment would be expected to be minimal assuming low flow velocities of the proposed closed cycle plant.

All sites will have some recreational fishing in the vicinity; however, the Highlands site would require the construction of a large off-stream reservoir west of the Lower Kissimmee River. Water flow from the Lower Kissimmee River and its tributaries enters Lake Okeechobee. Since Lake Okeechobee supports commercial and sport fishing, impacts may occur to this specific resource. There is a warm-water fish production resource, specifically a fish hatchery, downstream from the Putnam 3 site that could be affected (PEF, 2007).

4.1.13 Other Water-Related Recreation

A limited number of other water-related impacts are anticipated at the four alternative sites. A number of boat launches, public and private parks, and resorts are located in the vicinity of the LNP site that could be impacted by construction and operation of a nuclear facility at these sites (PEF, 2007). In addition, the Dixie 1 site is located in an area considered a pristine

aquatic area, and development is highly dispersed. This surrounding vicinity of the Dixie 1 site is frequently visited and used as a recreational area, and much of the economy of the region is dependent on this aquatic and terrestrial ecotourism. There are also some large tracts of federal- and state-owned lands located along the Suwannee River in the vicinity of the Dixie 1 site that could be impacted by construction and operation of a nuclear facility at this site (PEF, 2007). Lake Okeechobee is downstream of the Highlands site. Because recreational resources are located in the vicinity of all sites, it is assumed that impacts would be similar for each site.

4.1.14 Aesthetics of the Aquatic Ecosystem

Many impacts on land use at a nuclear power plant site and in the site neighborhood arise from construction and operation of the plant, transmission lines, and transportation corridors. These land-use impacts can be mitigated by appropriate designs and practices. Aesthetic impacts can be reduced by selecting sites where existing topography and forests can be used for screening station structures from nearby scenic, historical, or recreational resources. Restoration of natural vegetation, creative landscaping, and the integration of structures with the environment can mitigate adverse visual impacts.

Land-use plans adopted by federal, state, regional, or local agencies would be examined, and any conflict between these plans and use of a potential site would need to be resolved by consultation with the appropriate agencies. For a potential site on land devoted to specialty crop production where changes in land use might result in market dislocations, a detailed investigation should be provided to demonstrate that potential impacts have been identified. The potential aesthetic impact of nuclear power stations at sites near natural-resource-oriented public use areas is of concern, and evaluation of such sites is dependent on consideration of specific station design layout (NRC, 1998).

For the LNP, vegetation will serve as a visual screen or buffer from surrounding land uses so construction and operational activities of the site will not be visible to area residences or individuals pursuing water-based activities on the CFBC, Old Withlacoochee River, and Gulf of Mexico. Construction of facilities near the CFBC will temporarily be visible to water users. Aesthetic considerations for the aquatic environment at the LNP site relate to protecting threatened and endangered species, avoiding intrusion of salt water from the canal into fresh groundwater tables (if the level was significantly changed), and avoiding impact on shellfish harvesting at the coast.

The Dixie 1 site on the Suwannee River would have minimal impact on the river minimum flow levels; however, the aesthetic considerations are generally associated with the effects on wetlands and aquatic life in the Suwannee River. Ecotourism is an important consideration for the Suwannee River watershed and the Dixie 1 site area. Consequently, site development would require detailed planning/implementation to make the nuclear site transparent to the river environment (PEF, 2007).

The aesthetic considerations related to the aquatic ecosystem at the Highlands site is considerably complicated because the SFWMD plans to convert the C-38 Kissimmee Canal back to a meandering river and construct large reservoirs (more than 10,000 acres) for flood control (PEF, 2007). These reservoirs could likely be used by power plants when river flows are low and then be refilled by diverting water from the Kissimmee River when river flows are excessive. However, based on the lower volumetric flow rates and anticipated increase

in water management controls, diverting these flows from the river for the purpose of cooling water supply may be difficult to accomplish. Using these reservoirs could result in additional aesthetic and permitting challenges.

The Putnam 3 site on the St. Johns River would be expected to have a minimal impact on minimum flow levels; however, because of the low flow velocity in the St. Johns River, the affect on water quality could pose an aesthetic consideration. In addition, the St. Johns River is undergoing a broad restoration and cleanup program that could result in additional aesthetic and permitting challenges.

4.1.15 Parks, National and Historic Monuments, National Seashores, Wild and Scenic Rivers, Wilderness Areas, and Research Sites

Many lands managed by the state or federal government are located in the vicinity of the four alternative sites. For the LNP site, large public ownerships in Levy County include Cedar Keys National Wildlife Refuge (NWR), Goethe State Forest, Manatee Springs State Park, and Cedar Key Scrub State Preserve The CFBC, near the LNP site, is a protected green belt corridor surrounded by a public park system (PEF, 2007).

In the vicinity of the Dixie 1 site, large public ownerships in Dixie County include the Lower Suwannee National Wildlife Refuge and Nature Coast State Trail. For the Highlands site, the Brighton Indian Reservation, Highlands Hammock, and Lake June Scrub State Parks, as well as 18 county parks and 95 lakes, are located in Highlands County. The St. Johns River, near the Putnam 3 site, is 1 of only 14 rivers designated as an American Heritage River (top fishing spots covering 70 square miles of river and lakes). In addition, large public ownerships in Putnam County include the Ocala National Forest (portions) and the Ravines Garden State Park (PEF, 2007).

For this analysis, dedicated lands are defined as lands that are owned by a state or federal agency or managed for specific conservation goals. Dedicated lands are therefore those lands that are tribal lands, federal lands, national parks or projects, national wildlife refuges, all State of Florida managed lands, other public or private managed lands, and WMD-owned lands. Table 4.1.15-1 presents information about the dedicated lands located within the site areas of the four alternative sites. A portion of one dedicated land is located within the LNP site area, the Goethe State Forest, which is owned by the State of Florida. The dedicated lands nearest the other three alternative sites are located outside the 6,000-acre site area. The locations of the dedicated lands within the pipeline and transportation corridor extents of each alternative site are presented on Figures 4.1.15-1 through 4.1.15-4.

TABLE 4.1.15-1
Dedicated Lands Information for Alternative Site Areas

Site Areas	LNP	Dixie 1	Highlands	Putnam 3
Approximate Distance[a] to Nearest Dedicated Land (miles)	1.6	2.0	2.1	4.2
Number of Dedicated Lands within Site Area	1	0	0	0

Notes:

[a] All distances measured from centerpoint of Units 1 and 2.

Source: FGDL Florida Natural Areas Inventory database, 2009; Florida Greenways and Trails Council, 2006; Florida Fish and Wildlife Conservation Commission (FWC), 2007; National Park Service and Land and Water Conservation (LWCF), the Urban Park and Recreation Recovery (UPARR), Florida Division of Recreation and Parks (FDRP), 2006; U.S. Fish and Wildlife Service, 2007 (see Appendix A).

4.1.16 Indirect and Cumulative Impacts

NEPA defines secondary impacts as, "those impacts that are caused by the proposed action or alternatives and are later in time or farther removed in distance but are still reasonably foreseeable. Cumulative impacts result from the incremental impact of the proposed action or alternatives when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (Council on Environmental Quality [CEQ], 1997).

Examples of secondary impacts include growth-inducing effects or changes in land-use patterns that cause changes in air, water, or other natural systems. The proposed project is in response to predicted growth and is not expected to result in significant growth-inducing effects. Population growth is generally affected by other economic conditions, regardless of the proposed action. While all alternative sites except LNP will need to be re-zoned, the land use at the sites is conducive to the construction of the new units. Necessary infrastructure such as roads, railways, and line corridors, though not currently in place, will be constructed using BMPs to protect surrounding areas. The expansion of the transmission lines will convert existing land cover as a result of ROW clearing. Forested land will be converted to herbaceous or successional communities, and forested wetlands will be converted to low-growing wetland habitats. PEF will use all applicable BMPs to protect sensitive areas, including wetlands and streams, when constructing or expanding a ROW.

Some aquatic habitats and associated wetlands will be permanently affected by construction; however, no detrimental effect on water quality of surrounding wetlands, groundwater, and surface water is expected. PEF will be required to mitigate for unavoidable losses of wetland and streams. Future projects are more likely to have a greater impact on freshwater resources, which are more limited than salt water resources, such that the cumulative impacts associated with the LNP site are expected to be less than the other three sites. Land clearing associated with site construction is not expected to result in any detrimental habitat fragmentation, since onsite impacts are centered on the nuclear units, and transmission line corridors have been located along existing ROWs. No changes in community dynamics or loss of neighborhoods or community character should occur as a result of the proposed project.

4.2 Public Interest Review Factor Evaluation

In addition to the review factors included in Section 4.1 from 40 CFR 230, PEF also evaluated the sites using public interest review factors found in 33 CFR 320 to determine the impact to non-aquatic resources. The following review factors are described in this section:

- Traffic/transportation patterns
- Energy consumption/generation
- Navigation
- Safety
- Air quality
- Noise
- Historic properties
- Land-use classification
- Economics
- Prime and unique farmland
- Food and fiber production
- Mineral needs
- Considerations of private property

4.2.1 Traffic/Transportation Patterns

All sites are located near suitable roads, which provide main access to the area; however, some construction of access roads may be required at the LNP, Dixie 1, Highlands, and Putnam 3 sites. The effect on transportation on local roads during construction and operation activities at any of the sites is anticipated to be minor. Mitigation measures for the Dixie 1, Highlands, and Putnam 3 sites are described in ER Section 9.3 and in ER Subsections 4.2.2 and 5.2.2 for the LNP site.

With the exception of the plant site itself, areas currently accessible to the public will remain accessible. No new public roads will be constructed outside of the site area. The access road into the site will be improved to facilitate construction of the facility and access for operation. Significant changes to traffic patterns are not anticipated.

For most sites, both railroad and barge access could be available but may not be practical because of the need to construct supporting infrastructure. Distances from the centerpoint of Units 1 and 2 of the four alternative sites to the nearest rail line, barge access, highway, and airport are provided in Table 4.2.1-1.

For most alternative sites, both railroad and barge access could be available but may not be practical because of the need to construct supporting infrastructure.

TABLE 4.2.1-1
Transportation Information in Vicinity of Site Areas

	LNP	Dixie 1	Highlands	Putnam 3
Rail				
Nearest Rail Line	FNOR	FNOR	CSXT	CSXT
Distance to Nearest Rail Line (miles)	NA	25.9	8.4	3.0
Barge Access				
Nearest Barge Access	CFBC	Suwannee River	Kissimmee River	St. Johns River, Florida
Distance to Nearest Barge Access (miles)	3.4	NA	NA	NA
Highway				
Nearest Highway	U.S. 19	U.S. 19	U.S. 98	U.S. 17
Distance to Nearest Highway (miles)	1.3	4.3	11.0	1.0
Airport				
Nearest Airport	Gainesville Regional	Gainesville Regional	Southwest Florida International	St. Augustine
Distance to Nearest Airport (mi.)	47.4	46.4	63.2	22.6

Notes:
CFBC = Cross Florida Barge Canal
CSXT = CX Transportation
FNOR = Florida Northern Railroad
NA = not applicable
Source: FGDL, Florida Department of Transportation (FDOT) database, 2009; Federal Aviation Authority (FAA) database, 2009; U.S. Department of Transportation Bureau of Transportation Statistics (BTS), 2009 (see Appendix A).

4.2.2 Energy Consumption/Generation

The need for power in Florida is based on PEF's TYSP and an Integrated Resource Plan (IRP), as well as FPSC's affirmative order determining the LNP is needed to meet the needs for additional electricity by PEF's customers. The TYSP is an annual report to the FPSC of PEF's resource plan containing a 10-year forecast of loads and generating capacity. The report process accounts for conservation, load management, and other demand-side options, along with new utility-owned generating plants, non-utility generation, and other supply-side options, to identify the resource plan that will be most cost effective for the ratepayers consistent with the provision of adequate, reliable service.

The FPSC has concluded that there is a need for new baseload capacity in the state. Florida has a well-defined, systematic, and comprehensive resource-planning program that adequately reviews resources and growing demand for additional baseload. The Florida IRP process gives the NRC the assurance that the need for power is real and that the benefits of satisfying that need would be realized.

Within PEF's service territory, 2,184 MW for summer net capacity and 2,240 MW for winter net capacity are identified as "planned, prospective, or committed project" (see ER Tables 8.1-6 and 8.1-7). This growing demand for new capacity shows benefits to be derived from the LNP. Given concerns in Florida about climate change and carbon emissions, the

LNP will serve another important need by reducing carbon emissions in the state. The LNP will displace significant amounts of carbon as soon as the plant becomes operational, compared with a coal-fired generating plant. These conclusions were also confirmed by the FPSC's Final Order, dated August 12, 2008, determining the need for the LNP as the most cost-effective option to meet that need (FPSC, 2008a). A detailed description on the need for power is provided in ER Chapter 8.0.

4.2.3 Navigation

No adverse impacts to river and ocean navigation are anticipated for the four alternative sites.

4.2.4 Safety

No significant health or safety impacts from reactor construction and operation have been identified or are expected at the four alternative sites.

4.2.5 Air Quality

None of the sites are believed to have significant potential for negative topographic effects on long-term dispersion of air emissions. While the potential exists at all four sites for adverse impacts caused by drift from cooling towers on surrounding vegetation, including crops, ornamental vegetation, natural plant communities, and soils, these impacts are not expected to be significant. In addition, based on the new reactor design and the actions that will be taken to comply with permit requirements for emissions, these potential impacts will be minimized with the use of drift eliminators on the cooling towers (PEF, 2007).

Adverse or discernible impacts on ambient air quality for any regulated air pollutant are not expected at the four alternative sites. Operation of the nuclear plant cooling towers will not cause discernible impacts on any natural resources, including surface waters or wetlands.

Given concerns in the state about climate change and carbon emissions, the addition of a nuclear power facility at any of the alternative sites provides an important environmental benefit by reducing carbon emissions in the state. When a plant becomes operational, the nuclear facility will add needed power in the state without depleting significant amounts of finite fossil fuels and generating significant amounts of air pollutant emissions, compared with a coal-fired generating plant (ER Chapter 8 and Section 9.3). For example, the estimated CO_2 emissions from a natural gas-fired combined-cycle generating facility capable of generating the same amount of electricity as a nuclear facility proposed at any of the four alternative sites is approximately 6.4 million tons per year. For comparison, the estimated CO_2 emissions from the proposed nuclear facility at one of the alternative sites, which will result from periodic testing of the facility's diesel-powered emergency equipment, is only 618 tons per year (State of Florida, 2009a).

4.2.6 Noise

Temporary increases in noise levels are expected during construction. During site preparation, construction activities such as clearing and grading activities will have localized noise and air quality effects. Construction noise will occur during construction activities and while installing equipment (such as turbines, generators, pumps, transformers, and switchyard equipment). As a result, background noise levels on or near the site will increase in the short term but will primarily be limited to daytime hours. The

level of perceptible noise at any given location will depend on the intensity of the construction activities; meteorological conditions, including temperature, humidity, and wind speed; the distance from the site; and the amount of noise absorbing vegetation between the source of the noise and the observer. Noise during construction is not expected to significantly impact offsite areas, including the locations of the nearest residences and recreational areas that are in the general proximity of the four sites.

While there will be an increase in ambient noise in the immediate vicinity of the cooling towers and the CWIS when fully operational, these noise impacts are expected to be minimal and limited primarily to onsite locations. Noise-related impacts on people, buildings, roads, and recreation areas from operation of the plant and appurtenant facilities, including impacts from increased worker and other vehicular traffic in the area, are not expected to warrant mitigation measures.

In addition, noise levels will be controlled by following Occupational Safety and Health Administration (OSHA) regulations, federal noise pollution control regulations, and applicable local noise ordinances. The construction and operation of the plant and appurtenant facilities is not expected to pose a significant adverse environmental consequence related to noise at any of the four alternative sites.

4.2.7 Historic Properties

The National Historic Preservation Act (NHPA) requires projects subject to federal permitting to be evaluated with respect to their potential impact to historic and archaeological sites listed in, or eligible for listing in, the National Register of Historic Places (NRP). The Area of Potential Effect (APE) for a project is determined in consultation with the State Historic Preservation Office (SHPO).

The LNP, Dixie 1, Highlands, and Putnam 3 sites were evaluated for historic sites. Each site was mapped with a 10-mile radius from the site area centerpoint and compared with the NRP's database, both on their website and in their plots on Google Earth. The Florida Geographic Data Library (FGDL) was also searched for possible historic site information. Table 4.2.7-1 lists the number of historic sites within a 10-mile radius of each of the five alternative sites.

TABLE 4.2.7-1
Historic Sites within 10-Mile Radius of Alternative Sites

	LNP	Dixie 1	Highlands	Putnam 3
National Register of Historic Places	2	1	0	2
State Historic Resource Groups	12	4	0	2
State Historic Cemeteries	13	8	0	2
State Historic Structures	213	17	4	89

Sources: National Register of Historic Places (NRHP) database, November 2009; FGDL, April 2009 (see Appendix A).

An initial NRHP database search identified cultural resources in the vicinity of the LNP, Dixie 1, and Putnam 3 sites. No NRHP sites were identified in the Highlands site vicinity. While there are properties listed in the National Register, eligible for listing in the National Register, or potentially eligible for listing in the National Register within a 10-mile radius of

the other three sites, none of these properties will be directly or indirectly impacted by construction activities or newly constructed structures.

The known NRHP sites include the following: the Dunnellon Boomtown Historic District in the LNP site vicinity; the City of Hawkinsville (shipwreck) in the Suwannee River in the vicinity of the Dixie 1 site; and the Bostwick School, Tenney Hall, and Groveland Hotel in the Putnam 3 site vicinity.

No coordination has occurred to date with the Florida SHPO regarding potential siting of new reactors at the Dixie 1, Highlands, and Putnam 3 sites. However, consultation with the SHPO and further investigation would be required before siting a new nuclear power generating facility at these locations. Consultation with the SHPO would occur if any historic, cultural, or archeological resources were identified. Appropriate mitigation measures would be put in place before construction and operation.

New South Associates conducted a Phase 1 Cultural Resource Assessment Survey of the archaeology APE in July and December 2007 to assess the potential effects of the proposed undertaking on any archaeological resources within the LNP site. PEF also evaluated whether any historic standing structures were located on or in the vicinity of the LNP site. The survey results were submitted to SHPO, and although standing structures and archaeological sites were identified at the LNP site, the SHPO concurred by letter dated June 26, 2008, that none were eligible for listing in the NRHP (Florida Department of State, 2008).

4.2.8 Land-Use Classification

Existing land use and land cover at the LNP, Dixie 1, Highlands, and Putnam 3 sites were initially classified into more than 70 categories using 2009 FLUCCS codes, which included similar land-use and land-cover types. FLUCCS codes are land-use and land-cover categorization and classification sources. The current land-use and land-cover categories within the onsite areas, reservoir areas, transmission lines, and offsite impact areas (other corridors) at the alternative sites were evaluated. The FLUCCS Level 2 and Level 3 land-use and land-cover codes were mapped for the four alternative sites. The FLUCCS Level 2 and FLUCCS Level 3 land-use codes for the site extent and the transportation extent are depicted on Figures 4.2.8-1 through 4.2.8-18. A detailed listing of the FLUCCS Level 3 codes for each land-use cover and category at the four alternative sites is provided in Appendix B.

The four alternative sites are currently being used for rural and agricultural purposes. A change in zoning will be required for three of the alternatives sites to accommodate a new facility. The LNP site has been zoned for power generation.

The LNP site consists of mixed forest land, agricultural (that is, silviculture), mixed forest lands, evergreen forest land, and forested wetlands within the site boundaries (see ER Figures 2.2-2 and 2.2-3 and ER Subsection 2.2.1.1). PEF filed applications with Levy County for a comprehensive plan amendment and special exception zoning approval for the LNP site. Levy County approved those applications (Levy County Development Department, 2008). In addition, the LNP is consistent with the Levy County Comprehensive Plan and land development regulations (LDRs), the Strategic Regional Policy Plan of the Withlacoochee Regional Planning Council, and the State Comprehensive Plan contained in Chapter 187, Florida Statutes (State of Florida, 2009b).

The Dixie 1 site is generally remote and rural agrarian, characterized by planted timberland and/or scrub vegetation. Land uses in the Lower Suwannee River Basin generally include agriculture, commercial forestry, and low-density residential development. Agricultural land use is generally not compatible with a nuclear power plant site. In addition, several subdivisions are located along the river. The more intensive residential developments on the river are found along higher areas and natural river levees (PEF, 2007).

The Highlands site is considered remote and rural; land use is mostly agricultural, for example, orchards and cattle. Future land use is agricultural, although Highlands County is eager to identify and embrace industry if it results in more jobs (PEF, 2007). However, as previously noted, agricultural land uses are generally not compatible with a nuclear power generating facility; therefore, both land-use and zoning changes would be required (ER Subsection 9.3.3.4.1).

The Putnam 3 site is considered to be primarily upland forest with nearby low-density residential areas. Land use in the St. John's River Basin generally includes agriculture, commercial forestry, and low-density residential development. Agricultural land use is generally not compatible with a nuclear power plant site.

Land-use classification acreages and percentages were tabulated for the onsite areas, reservoir areas, transmission lines, and offsite impact areas (other corridors) at the four alternative sites. A summary of the total Level 1 land-use and land-cover categorization and classification codes is provided in Tables 4.2.8-1 through 4.2.8-5.

The land-use and land-cover Level 1 codes within the site areas are provided in Table 4.2.8-1. The LNP and Putnam 3 sites have the greatest amount of wetlands within the overall 6,000-acre site areas. The major land uses within the Putnam 3 site area are a combination of upland forested, urban, and wetlands uses. The LNP and Dixie 1 sites consist mainly of upland forests and wetlands uses.

TABLE 4.2.8-1
Land-Use Class (FLUCCS) within Site Areas

Site Areas (acres)	LNP	Dixie 1	Highlands	Putnam 3
Urban & Built Environment (% of area)	6 (<1%)	0 (0%)	7 (<1%)	1,296 (22%)
Agriculture (% of area)	543 (9%)	15 (<1%)	4,730 (79%)	18 (<1%)
Rangeland (% of area)	71 (1%)	39 (<1%)	0 (0%)	104 (2%)
Upland Forested (% of area)	3,399 (57%)	5,306 (88%)	0 (0%)	2,981 (50%)
Water (% of area)	1 (<1%)	4 (<1%)	56 (1%)	8 (<1%)
Wetlands (% of area)[a]	1,913 (32%)	636 (11%)	1,102 (18%)	1,404 (23%)
Barren Lands (% of area)	0 (0%)	0 (0%)	105 (2%)	113 (2%)
Transportation, Communication and Utilities (% of area)	67 (1%)	0 (0%)	0 (0%)	75 (1%)

Notes:

[a] Values for wetlands are based on FLUCCS information and were not modified as they were in Table 4.1.6.1-1.

Source: Florida Land Use Cover and Forms Classification System (FLUCCS) database, 2009 (see Appendix B).

FLUCCS land-use and land-cover Level 1 codes within the onsite impact areas are provided in Table 4.2.8-2. The LNP and Putnam 3 sites were identified as having the largest amount of upland forested areas. Additionally, both of these sites were identified as having portions of

the wetlands in the onsite impacted area classified as high-quality wetlands. The onsite impact area at the Highlands site is classified mostly as agricultural use. Small portions of the Putnam 3 onsite impact area are classified as upland non-forested and transportation, communication, and utility uses; no other alternative sites have those uses.

TABLE 4.2.8-2
Land-Use Class (FLUCCS) within Onsite Impact Areas

Onsite Impact Areas (acres)	LNP	Dixie 1	Highlands	Putnam 3
Urban and Built Environment (% of area)	0 (0%)	0 (0%)	0 (0%)	276.2 (41.8%)
Agriculture (% of area)	150.9 (22.9%)	0 (0%)	640 (97%)	0 (0%)
Rangeland (% of area)	0 (0%)	0 (0%)	0 (0%)	25 (3.8%)
Upland Forested (% of area)	298.7 (45.3%)	638.2 (96.7%)	0 (0%)	273.9 (41.5%)
Water (% of area)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Wetlands (% of area)	210.1 (31.8%)	22.1 (3.3%)	20.3 (3.1%)	77 (11.7%)
Barren Lands (% of area)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Transportation, Communication, and Utilities (% of area)	0 (0%)	0 (0%)	0 (0%)	8.3 (1.3%)

The FLUCCS Level 1 land-use and land-cover classification codes within the reservoir impact areas are presented in Table 4.2.8-3. As previously described, because of the availability of an abundant water supply from the Gulf of Mexico available to the LNP site, reservoir construction is not anticipated at this site. Reservoirs will be needed by the other three sites to ensure adequate water supply for cooling water during low-flow conditions.

TABLE 4.2.8-3
Land Use Class (FLUCCS) within Reservoir Impact Areas

Reservoir Impact Areas (acres)	LNP	Dixie 1	Highlands	Putnam 3
Urban and Built Environment (% of area)	NA	0 (0%)	0 (0%)	268.1 (17.9%)
Agriculture(% of area)	NA	0 (0%)	1,257.5 (83.8%)	0 (0%)
Rangeland(% of area)	NA	25.1 (1.7%)	0 (0%)	11.6 (<1%)
Upland Forested(% of area)	NA	1,328.5 (88.6%)	0 (0%)	719.6 (48%)
Water (% of area)	NA	2.1 (<1%)	0 (0%)	0 (0%)
Wetlands (% of area)	NA	144.2 (9.6%)	242.4 (16.2%)	487.3 (32.5%)
Barren Lands (% of area)	NA	0 (0%)	0 (0%)	0 (0%)
Transportation, Communication, and Utilities (% of area)	NA	0 (0%)	0 (0%)	13.3 (<1%)

The FLUCCS Level 1 land-use classification information within the transmission line corridors is specified in Table 4.2.8-4. The transmission corridors for the Dixie 1 site would potentially have the largest impacts, including the greatest amount of FLUCCS high-quality wetlands, while the Putnam 3 site transmission corridors would be expected to have the least overall impacts. The transmission corridors for the Highlands site will have the largest

impact on land with agriculture uses. Barren land is the use that is least impacted by the transmission corridors associated with the four alternative sites.

TABLE 4.2.8-4
Land-Use Class (FLUCCS) within Transmission Corridors

Transmission Corridors (acres)	LNP	Dixie 1	Highlands	Putnam 3
Urban and Built Environment (% of area)	1,836.7 (19.5%)	2,458.4 (18.3%)	1,782 26.5(%)	1,575.2 (25.4%)
Agriculture (% of area)	1,792.1 (19.1%)	2,188.2 (16.3%)	3,083.6 (45.9%)	845.5 (13.6%)
Rangeland (% of area)	167 (1.8%)	245.7 (1.8%)	430.3 (6.4%)	202.2 (3.3%)
Upland Forested (% of area)	1,798.8 (19.1%)	3,384.7 (25.2%)	345.7 (5.1%)	2,175.3 (35%)
Water (% of area)	95 (1%)	126 (<1%)	29 (<1%)	101.3 (1.6%)
Wetlands (% of area)	1,633 (17.4%)	2,199.7 (16.4%)	606.5 (9%)	715.7 (11.5%)
Barren Lands (% of area)	9 (<1%)	17.4 (<1%)	4 (<1%)	16.1 (<1%)
Transportation, Communication, and Utilities (% of area)	2,063.7 (22%)	2,832 21(%)	444.1 (6.6%)	580.9 (9.4%)

The FLUCCS Level 1 land-use classification information within the offsite corridors (other corridors) is provided in Table 4.2.8-5. The offsite corridors of the Highlands site will have the largest impact on land with agriculture uses. Similar to transmission corridors, barren land use is the least impacted land use by the offsite corridors associated with the alternative sites.

TABLE 4.2.8-5
Land-Use Class (FLUCCS) within Offsite Corridors

Offsite Corridors (acres)	LNP	Dixie 1	Highlands	Putnam 3
Urban and Built Environment (% of area)	52.6 (15.4%)	96 (11.3%)	18.8 (3.7%)	70 (20.9%)
Agriculture (% of area)	35.2 (10.3%)	178.6 (21%)	434.7 (84.4%)	17.5 (5.3%)
Rangeland (% of area)	1.9 (<1%)	34.3 (4%)	7.4 (1.4%)	7.6 (2.3%)
Upland Forested (% of area)	185 (54.3%)	491.5 (57.8%)	9.6 (1.9%)	183.7 (55.2%)
Water (% of area)	3.2 (<1%)	2.7 (<1%)	9 (1.7%)	1.7 (<1%)
Wetlands (% of area)*	52.3 (15.4%)	45.3 (5.3%)	23 (4.5%)	44.2 (13.3%)
Barren Lands (% of area)	0 (0%)	0 (0%)	12.5 (2.4%)	4.5 (1.4%)
Transportation, Communication and Utilities (% of area)	10.8 (3.2%)	1.9 (<1%)	0 (0%)	5 (1.5%)

4.2.9 Economics

As part of its request to the FPSC for a need determination for the LNP, PEF evaluated the LNP against other electrical generation supply options, narrowed down to natural gas generation, on a cumulative present value revenue requirements (CPVRR) basis, under traditional electrical production cost analysis over an expanded 60-year study period. This 60-year optimization study period included 10 years prior to commercial operation of the

LNP, when work to site, permit, design, and construct the units will be accomplished. It also included 50 years of commercial operation, which accounts for the 40-year expected useful life based on the initial license and half of the expected 20-year license extension for the two proposed nuclear units.

Using PEF's current cost estimate and the additional Florida statutory factors that must be considered when the FPSC evaluates the cost effectiveness of nuclear generation to the extent it can be quantified, including the advent of greenhouse gas emission costs, PEF's generation resource plan, including LNP, was more cost effective on a CPVRR basis than a natural gas generation reference plan in the majority of the CPVRR scenarios, even without the additional 10 years of commercial operation of the two nuclear units in the model. Accordingly, PEF proposed and the FPSC determined that LNP is the most cost-effective source of power to meet PEF's future energy needs under Florida Statute, Section 403.5 19(4)(b)3.

The LNP offers a number of benefits that PEF cannot obtain with other alternatives, including advanced nuclear generation technology, high efficiency, and environmental benefits using the lowest cost fuel source available to PEF. The advanced technology of the Westinghouse AP1000 nuclear reactor design that is being evaluated uses passive safety system designs and engineering simplicity that was not available in prior nuclear power plant designs. The AP1000 has significantly less cable, pipe, valves, pumps, and other equipment than the generation of reactors currently operating. This means relatively lower construction and operation costs for the Westinghouse AP1000 nuclear reactor than plants currently operating. The more efficient design of the Westinghouse AP1000 nuclear reactor means greater reliability is expected compared with the nuclear plants currently operating (Crisp, 2008).

Transmission connection costs would range from $560 to $725 million at the northwestern sites (Dixie 1 and LNP), and would exceed $1 billion at the Putnam 3 site ($1.013 billion) and Highlands site ($1.370 billion). Much of the additional cost at the Putnam 3 and Highland sites results from the need to upgrade the transmission grid outside the PEF service territory to address contingencies that could occur when power from a new 2-unit nuclear plant is injected into the system (ER Subsection 9.3.2.1.6). Additional costs would be incurred for the sites that require the creation of a new reservoir. Assuming a 1,291-acre reservoir that is 10 ft. deep and $8 per cubic yard for construction costs, the reservoir construction cost is estimated at $167 million.

4.2.9.1 Property Values

Property and land values surrounding the alternative sites are anticipated to increase in the four counties with the presence of a nearby nuclear facility (PEF, 2007).

4.2.9.2 Tax Revenues

Post-construction property tax revenues in the counties in which the new plants and appurtenant facilities are constructed would likely increase, based on the increase in property value resulting from the construction of high-value nuclear facilities. Also, increases in sales tax revenue would be expected from construction at the four sites resulting from the local purchase of construction materials or goods and services by temporary construction workers. It is anticipated that construction of the plant and appurtenant facilities would result in little changes to income tax revenues in those

geographic areas of the four alternative sites because most workers at the sites are expected to come from within Florida.

4.2.9.3 Employment

The impact on area employment from construction and operation of the proposed nuclear power generating facility at the four sites is considered equal, because the sites are located near or within reasonable proximity of population centers and densely populated areas. The overall population levels for the four sites in 2010, when construction startup is anticipated, are sufficiently large that the impact on study area employment from construction of two new units would be low at each site. In general, each alternative site is within reasonable commuting distance from at least one large city or metropolitan area. Each study area appears to have sufficient population centers within commuting distance and/or has experienced tremendous growth since 1990, such that its public services sector would be able to absorb the population in migration associated with plant construction with minimal impact (PEF, 2007).

4.2.10 Prime and Unique Farmland

No prime or unique farmlands occur within the site areas, onsite impact areas, reservoir impact areas, and offsite corridors of the alternative sites. Therefore, no adverse environmental impacts are anticipated for prime and unique farmlands at the four alternative sites.

4.2.11 Food and Fiber Production

All of the sites examined have been previously disturbed via farming and/or are in the process of being logged. Except for the Highlands site, which is largely farmland (sod and dairy farming), all of the sites exhibit land cover typical of open forested pineland, with some farmland or cropland being present. There is considerable existing farming activity on and near the Highlands site (dairy and cattle) (PEF, 2007). Impacts were estimated by calculating the area of FLUCCS codes for farm or cropland as shown in Appendix B.

4.2.12 Mineral Needs

No mineral rights have been leased and there are no outstanding mineral rights that could result in the production of minerals at the LNP site. The other three sites are not known to have mineral resources of economic significance.

4.2.13 Considerations of Private Property

PEF's business objectives for the new units mandated an aggressive schedule for plant development, which could not accommodate significant delays (for example, condemnation process for project sites under eminent domain) in obtaining access to land for a new site. Accordingly, a land availability analysis was conducted through a third-party real estate agent. The agent identified parcels of adequate size at each of the sites and made initial contact with the landowners to arrange for access for onsite geotechnical investigation and to assess the potential for sale of the properties (ER Subsection 9.3.2.1.6).

Land was available at the LNP, Highlands, and Putnam 3 sites. At the Highlands site, however, coordination of a water supply strategy with ongoing water resources plans of regional WMDs would likely have precluded development of new units on the schedule

required. Construction at the Dixie 1 site would have required land to be purchased and improved, which could not have been accomplished within PEF's time frame (PEF, 2007). The Dixie 1 site ranked lower because land could not be readily acquired.

The impacts associated with land acquisition are based on the following two criteria:

1) Total number of individual property owners that would be affected

2) Number of potentially affected property owners of the 6,000-acre project site only.

This information is included in Appendix D.

4.2.13.1 Population

Table 4.2.13.1-1 includes the most recent population characteristics for each of the representative counties. The rate of population growth between 2000 and 2008 ranged from 4.3 percent for Putnam County to 14.5 percent in Levy and Highlands Counties (LNP and Highlands sites). Population impacts are based on the county population density. Population density for 2008 was lowest in Dixie County, with 21 persons per square mile, and highest in Putnam County, with 102 persons per square mile. Levy County had the second lowest population density, with 35 persons per square mile.

TABLE 4.2.13.1-1
Population Characteristics for the Alternative Sites

	LNP	Dixie 1	Highlands	Putnam 3
Representative County	Levy	Dixie	Highland	Putnam
Representative Land Area (square miles)	1,118	704	1,028	722
County Population, 2008 Estimate	39,460	14,957	100,011	73,459
County Population, percent change, April 1, 2000 to July 1, 2008	14.5%	8.2%	14.5%	4.3%
Persons Per Square Mile in County, 2008	35	21	97	102

Source: U.S. Census Bureau Quickfacts, http://quickfacts.census.gov, accessed October 2009.

4.2.13.2 Environmental Justice

Environmental justice refers to a federal executive order in which federal actions should not result in disproportionately high and adverse impacts to low-income or minority populations. Executive Order 12898 directs federal agencies to consider environmental justice by identifying and mitigating disproportionately high and adverse human health and environmental effects. Minority and low-income populations were identified using the same methodology described in ER Subsection 2.5.4 using the 2004 NRC's *Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues*.

Table 4.2.13.2-1 quantifies the number of low-income and minority block groups within 6 miles and 50 miles of each of the four sites. As shown in the table, little variation exists between the sites with respect to potential environmental justice impacts. No low-income or minority block groups central areas occur within 6 miles of the four sites; however, the border of one minority block group intersects the 6-mile boundary of the Highlands site.

The locations of the environmental justice (minority and low-income) populations within 50 miles of each site are shown on Figures 4.2.13.2-1 to 4.2.13.2-8.

TABLE 4.2.13.2-1
Environmental Justice Characteristics for the Alternative Sites

	LNP	Dixie 1	Highlands	Putnam 3
Total Block Groups within 6 miles	4	3	0 (7 intersect the 6-mile boundary)	3
Total Block Groups within 50 miles	498	225	370	810
Low-Income Block Groups within 6 miles (2000)	0	0	0	0
Low-Income Block Groups between 6 to 50 miles	46	34	58	95
Minority Block Groups within 6 miles	0	0	0 (1 intersects the 6-mile boundary)	0
Minority Block Groups between 6 to 50 miles	55	30	98	214

Source: U.S. Census Bureau, 2000.

4.2.13.3 Housing

Table 4.2.13.3-1 summarizes the housing characteristics for the four counties containing the four alternative sites and indicates whether it is part of a metropolitan or micropolitan statistical area. None of the sites are located in a metropolitan statistical area; however, two sites are in a micropolitan statistical area. A micropolitan statistical area is a geographic entity defined by the U.S. Office of Management and Budget for use by federal statistical agencies in collecting, tabulating, and publishing federal statistics. A micro area contains an urban core population of at least 10,000 (but less than 50,000). Each metro or micro area consists of one or more counties and includes the counties containing the core urban area, as well as any adjacent counties that have a high degree of social and economic integration (as measured by commuting to work) with the urban cores. Based on the housing characteristics included in Table 4.2.13.3-1, adequate temporary and permanent housing is available to accommodate potential construction and operations workers.

TABLE 4.2.13.3-1
Housing Characteristics for the Alternative Sites

	LNP	Dixie 1	Highlands	Putnam 3
County Estimated Households, 4/1/2006[a]	15,900	5,896	41,485	29,450
County Housing Units, 2007[b]	17,956	7,854	54,467	35,450
County Public Lodging Units, 2007[a]	936	187	3,687	2,033
Metropolitan or Micropolitan Statistical Area[b]	No	No	Sebring, FL Micro Area	Palatka, FL Micro Area

Sources:

[a] Florida Statistical Abstract 2007, Forty-first Edition, University of Florida Bureau of Economic and Business Research Warrington College of Business Administration.

[b] Quickfacts from the U.S. Census Bureau.

5.0 Summary of LEDPA Analysis

PEF evaluated design and site alternatives for providing service area customers with reliable baseload electrical generation. PEF considered the no-action alternative and rejected it because it did not meet the project's basic purpose or need. PEF determined that nuclear generation was the preferred and practicable design alternative based on cost, technology, logistics, and environmental considerations in light of the overall project purpose.

Section 4.0 contains impact categories based on the review factors outlined in the Section 404(b)(1) analysis in 40 CFR 230. Several of the review factors contain multiple specific criteria; the data are described in Section 4.0. A weighting system was developed for the specific criteria, with higher weights allowing select factors to have a larger influence on the determination of the LEDPA site (description of how criteria were weighted follows). Then, the sites for each specific criterion were ranked relative to each other. The scores were calculated by multiplying the rank times the weight for each specific criterion. The overall site score was the total of the individual specific criteria score, with the highest scoring site identified as the LEDPA site. The review factors and their specific criteria were combined in a decision matrix, which is presented as Table 5.0-1.

In general, the weight of each specific criterion was assigned a value of 1. Specific criteria with impacts that were the same for all alternative sites were given a weight of 0, since the score for the specific criteria would contribute equally to all four sites. When a review factor had multiple specific criteria, such as Water Quality, Water, which has two subsets of data, the specific criteria were given a weight so that their total would equal 1. In some cases, the weight of specific criteria was assigned a higher value due to their perceived importance. The weights and rationale for all specific criteria are shown in Table 5.0-2. To produce a total score for the specific criteria, the ranking was multiplied by the weight. The overall site score was determined by summing the individual specific criteria scores.

The Special Aquatic Sites review factor, which includes the Wetlands-specific criteria, was weighted the highest of all review factors. This factor accounts for 28 percent of the weighting used to determine the LEDPA score (6.25/22.3 = 28 percent, from Table 5.0-1). Additionally, the Substrate review factor evaluates direct impacts to wetlands. The combined weight of these three factors is approximately 33 percent ((6.25+1)/22.3 = 33 percent). Several other review factors also reflect potential impacts to wetlands: Currents Circulation or Drainage Patterns (one specific criterion described in text), Suspended Particulates/Turbidity, Water Quality, Habitat for Fish and Other Aquatic Organisms, Wildlife Habitat, Biological Availability of Possible Contaminants in Dredge or Fill Material, Water Source Impacts, Aesthetics of the Aquatic Ecosystem, and Indirect and Cumulative Impacts (the respective weights of these review factors are 0.33, 0, 1, 1, 1, 0, 2, 1, 1.5). The weights of these review factors combine for an additional 35 percent of the total weighting (7.83/22.3 = 35 percent) and result in wetlands being weighted either directly or indirectly by factors totaling 68 percent of the overall score used in the LEDPA determination. Weighting wetlands as a majority of the overall score is appropriate since the Section 404(b)(1) analysis guidelines focus on impacts to waters of the United States.

The site rankings for quantitative specific criteria were based on the 25th, 50th, and 75th percentile of the range of data for that specific criteria (see Appendix C). Quartiles were selected to assign values for the scoring scale for review factors that have quantitative data. Quartiles describe the spread of a distribution and can be more accurate than plots of the mean and standard deviation for datasets that are asymmetric or contain outliers (Gotelli and Anderson 2004). Since the data associated with the review factors contain only four data points and are usually asymmetric, quartiles were deemed appropriate for this analysis. Only the range of data (minimum and maximum) was used to allow four distinct subsets to be identified. If the quartiles had been based on all four data points, the effect would have been similar to an ordinal (forced) ranking. In general and where appropriate, a ranking of 4 was assigned to the site with the least environmental impacts for that specific criterion resource and a ranking of 1 was assigned to the site with the most impacts, although not all criteria received a ranking of 1 through 4. When two or more sites had similar impacts based on the quartile, they were given the same ranking.

Specific criteria were ranked using numeric values when quantitative data were associated with them (Appendix C lists the raw data that were used to rank the quantitative criteria). This process allowed the quantitative data to be ranked relative to each other on the differences between sites as opposed to an ordinal ranking where all sites would have been force ranked 1 through 4. More detailed statistical evaluation of the quantitative data was not undertaken because of the low number of sites. When specific criteria had qualitative data associated with them, the ranking was based on known information about each site (as described in Section 4.0). If all sites were determined to have similar impacts and no specific criteria could readily distinguish one site from another, all sites were given a maximum ranking with the weight set at 0. Table 5.0-3 provides the rationale for ranking of each specific criterion as presented in Table 5.0-1.

Table 5.0-1 displays the specific criteria, weighting, rank, and total score. The LEDPA site is considered to be the site with the highest overall score. In this LEDPA analysis, the LNP site had the highest overall score. The LNP site, which was the proposed site as described by the ER Chapter 9 site selection process, is also considered to be the LEDPA site and therefore is the preferred site for this project.

TABLE 5.0-1
Site Selection Decision Matrix

				Rank (based on quartiles for quant data) 4 is best 1 is worst				Consolidated Score (based on weighting) highest is best			
Review Factor	**Cumulative Weight**	**Specific Criteria**	**Weight**	**LNP**	**Dixie 1**	**Highlands**	**Putnam 3**	**LNP**	**Dixie 1**	**Highlands**	**Putnam 3**
Substrate	1	See Text for Details (wetland impacts due to fill) acres	1	4	4	4	1	4.0	4.0	4.0	1.0
Currents, Circulation, or Drainage Patterns	0.66	See Text for Details	0.33	4	2	2	2	1.3	0.7	0.7	0.7
		Shore Erosion	0	4	4	4	4	0.0	0.0	0.0	0.0
		Baseflow (need for reservoir)	0.33	4	1	1	1	1.3	0.3	0.3	0.3
Suspended Particulates	0	See Text for Details (impacts same)	0	4	4	4	4	0.0	0.0	0.0	0.0
Water Quality	1	See Text for Details	0.5	4	1	1	1	2.0	0.5	0.5	0.5
		Impaired Waterbodies (water quality) acres	0.5	3	2	1	4	1.5	1.0	0.5	2.0
Flood Hazards	1.25	Floodplain Impacts Onsite, Offsite, and Reservoir[a]	1	4	4	1	4	4.0	4.0	1.0	4.0
		Floodplain Impacts Transmission lines[a]	0.25	2	1	3	4	0.5	0.3	0.8	1.0
Special Aquatic Sites	6.25	FLUCCS Wetland Onsite and Reservoir Impacts acres	4	4	4	4	1	16.0	16.0	16.0	4.0
		FLUCCS Wetland Impacts T-Lines RAW	0	2	1	4	4	0.0	0.0	0.0	0.0
		T-Line Impacts (fill 6%)	1.5	2	1	4	4	3.0	1.5	6.0	6.0
		T-Line Impacts (clearing (20%)	0.5	2	1	4	4	1.0	0.5	2.0	2.0
		Vegetated Shallows (all same)	0	4	4	4	4	0.0	0.0	0.0	0.0
		Riffle and Pool	0.25	4	1	4	4	1.0	0.3	1.0	1.0
Habitat for Fish and Other Aquatic Organisms	1	Number Waterbody Crossing (stream and open water)	1	1	1	4	2	1.0	1.0	4.0	2.0
Wildlife Habitat	1	See Text for Details	1	4	3	4	1	4.0	3.0	4.0	1.0
Endangered or Threatened Species	3	Sanctuaries, Refuges, Endangered Species Habitat	1	4	4	1	4	4.0	4.0	1.0	4.0
		Number of FNAI Species w/in 6,000-acre Site	1	1	4	3	4	1.0	4.0	3.0	4.0
		Number of Fed T&E w/in County for Onsite	1	4	4	1	4	4.0	4.0	1.0	4.0

TABLE 5.0-1
Site Selection Decision Matrix

				Rank (based on quartiles for quant data) 4 is best 1 is worst				Consolidated Score (based on weighting) highest is best			
Review Factor	**Cumulative Weight**	**Specific Criteria**	**Weight**	**LNP**	**Dixie 1**	**Highlands**	**Putnam 3**	**LNP**	**Dixie 1**	**Highlands**	**Putnam 3**
Biological Availability of Possible Contaminants in Dredge or Fill Material	0	See Text for Details (impacts same)	0	4	4	4	4	0.0	0.0	0.0	0.0
Municipal and Private Water Supplies, Water Conservation	2.66	Water Source Impacts[b]	2	3	3	1	2	6.0	6.0	2.0	4.0
		Number of Potable Wells	0.33	4	1	4	4	1.3	0.3	1.3	1.3
		Distance to Nearest Potable Well (m.)	0.33	2	1	4	2	0.7	0.3	1.3	0.7
Recreation and Commercial Fisheries	1	Fisheries Downstream of Site	1	4	4	1	1	4.0	4.0	1.0	1.0
Other Water-Related Recreation	0	See Text for Details (impacts same)	0	4	4	4	4	0.0	0.0	0.0	0.0
Aesthetics of the Aquatic Ecosystem	1	See Text for Details	1	4	3	3	3	4.0	3.0	3.0	3.0
Parks, National and Historic Monuments, National Seashores, Wild and Scenic Rivers, Wilderness Areas, and Research Sites[b]	1	Dedicated Lands (distance to nearest) miles	1	1	1	1	4	1.0	1.0	1.0	4.0
Indirect and Cumulative Impacts	1.5	See Text for Details	1	4	1	1	1	4.0	1.0	1.0	1.0
		Aquifer Recharge	0.5	4	4	1	4	2.0	2.0	0.5	2.0
Total Weights	22.3		Total	99	77	83	89	**72.6**	**62.7**	**56.9**	**54.5**

[a] Digital data are not available for Okeechobee County; therefore, the floodplains impacts are under-reported.

[b] LNP site's rank was reduced from the maximum rank of 4 to 3 due to the use of groundwater withdrawals.

[c] Putnam 3 site's rank was reduced from the maximum rank of 4 to 3 due to the St. Johns River's being designated an American Heritage River.

TABLE 5.0-2
Summary of Weighting Rationale

Review Factor	Specific Criteria	Weight	Summary of Weighting Modification Rational
Substrate	See Text for Details	1	Weighting unmodified.
Currents, Circulation, or Drainage Patterns	See Text for Details	.33	Weighting unmodified.
	Shore Erosion	0	This criterion was assigned a weight of 0 since it was assumed that the impacts would be the same for all sites.
	Baseflow/Need for reservoir	.33	Weighting unmodified.
Suspended Particulates	See Text for Details	0	This criterion was assigned a weight of 0 since it was assumed that the impacts would be the same for all sites.
Water Quality	See Text for Details	0.5	Weighting unmodified.
	303D	0.5	Weighting unmodified.
Flood Hazards	Floodplain Impacts Onsite, offsite and Reservoir	1	Weighting increased since fill impacts will have affect on floodplain function..
	Floodplain Impacts Transmission lines	0.25	Weighting was reduced since clearing impacts are the majority of impacts associated with transmission lines and will have limited affect on floodplain function
Special Aquatic Sites	FLUCCS Wetland Impacts - Onsite, offsite and Reservoir	4	Weighting was increased due to the sensitivity of the resource.
	FLUCCS Wetland Impacts T-Lines RAW	0	This criterion was assigned a weight of 0 to avoid double counting this specific criteria since adjusted scores for clearing and fill are used in the analysis.
	FLUCCS Wetland Impacts - Transmission lines (fill impacts)	1.5	Weighting was increased from 0.25 to 1.5 since these are direct impacts. Direct impacts (fill) to transmission line corridors will occur but are spread over a larger area and generally smaller individual areas than the onsite related impacts.
	FLUCCS Wetland Impacts - Transmission lines (clearing impacts)	0.5	Weighting was increased from 0.25 to 0.5. While clearing impacts are the majority of impacts associated with transmission lines this will affect the type of wetlands.
	Vegetated Shallows	0	This criterion was assigned a weight of 0 since it was assumed that the impacts would be the same for all sites.
	Riffle and Pool	0.25	Weighting unmodified.
Habitat for Fish and Other Aquatic Organisms	Number Waterbody Crossing (stream and open water)	1	Weighting unmodified.
Wildlife Habitat	See Text for Details	1	Weighting unmodified.

TABLE 5.0-2
Summary of Weighting Rationale

Review Factor	Specific Criteria	Weight	Summary of Weighting Modification Rational
Endangered or Threatened Species	Sanctuaries, Refuges, Endangered Species Habitat	1	Weighting was increased due to the sensitivity of the resource.
	Number of FNAI species w/in 6,000 acre site	1	Weighting was increased due to the sensitivity of the resource.
	Number of Federally threatened and endangered within County for Onsite	1	Weighting was increased due to the sensitivity of the resource.
Biological Availability of Possible Contaminants in Dredge or Fill Material	See Text for Details	0	This criterion was assigned a weight of 0 since it was assumed that the impacts would be the same for all sites.
Municipal and Private Water Supplies, Water	Water Source Impacts	2	Weighting was increased due to the sensitivity of the resource.
	Number of Potable Wells	0.33	Weighting unmodified.
	Distance to Nearest Potable Well	0.33	Weighting unmodified.
Recreation and Commercial Fisheries	Fisheries Downstream of Site	1	Weighting unmodified.
Other Water-Related Recreation	See Text for Details	0	This criterion was assigned a weight of 0 since it was assumed that the impacts would be the same for all sites.
Aesthetics of the Aquatic Ecosystem	See Text for Details	1	Weighting unmodified.
Parks, National and Historic Monuments, National Seashores, Wild and Scenic Rivers, Wilderness Areas, and Research Sites	Dedicated Lands (distance to nearest)	1	Weighting unmodified.
Indirect and Cumulative Impacts	See Text for Details	1	Weighting increased due to the broad nature of category.
	Aquifer Recharge	0.5	Weighting unmodified.

TABLE 5.0-3
Summary of Ranking Rationale

Review Factor	Specific Criteria	Data Type	Summary of Ranking Rational
Substrate	Fill Activities	Quantitative	Relative ranking based on data presented in Appendix C.
Currents, Circulation, or Drainage Patterns	See Text for Details	Qualitative	Use of fresh water systems will have a greater relative impact on source and receiving water body flows than a salt water system.
	Shore Erosion	Qualitative	The ranking for each site was assigned a value of 4 since it was assumed that the impacts would be the same for all sites.
	Baseflow	Qualitative	The reservoir would be necessary for water makeup during periods of low flow but would require additional permitting. Sites that need a reservoir scored the minimum and sites that did not need a reservoir scored the maximum.
Suspended Particulates	See Text for Details	Qualitative	The ranking for each site was assigned a value of 4 since it was assumed that the impacts would be the same for all sites.
Water Quality	See Text for Details	Qualitative	The ranking for Water Quality was based on an emphasis to avoid adding concentrated salts to the aquatic environment and thereby decreasing the water quality of the waterbody. Since the LNP site use the Gulf of Mexico as the receiving water and modeling has shown that the blowdown will not significantly affect the salinity of the Gulf of Mexico, a maximum rank of 4 was given to the LNP site. The remaining three sites use freshwater receiving bodies for the blowdown, and due to increased cycles of concentration in the circulating cooling water systems, these sites would be expected to have a larger increase in the relative concentration of salts, as reflected in conductivity. Therefore, these sites were given the lowest ranking of 1.
	Impaired Waterbodies (water quality)	Quantitative	The Impaired Waterbodies rank was based both on the quantity of acres within the watershed that would be impacted by site-specific project elements and the cause of the waterbody impairment.. The Putnam 3 site had the smallest area of project elements in impaired waterbodies, and those waterbodies are impaired for exceeding the fecal coliform, lead, and mercury standards. The LNP site is the next smallest area and those waterbodies are only impaired for exceeding fecal coliform standards The remaining sites have different causes of impairment (mercury, nutrients, DO and lead) and were ranked based on the area of project elements within an impaired waterbody drainage.
Flood Hazards	Floodplain Impacts	Quantitative	Relative ranking based on data presented in Appendix C.
	Floodplain Impacts Transmission lines only	Quantitative	Relative ranking based on data presented in Appendix C.
Special Aquatic Sites	FLUCCS Wetland Onsite Impacts	Quantitative	Relative ranking based on data presented in Appendix C.

TABLE 5.0-3
Summary of Ranking Rationale

Review Factor	Specific Criteria	Data Type	Summary of Ranking Rational
	FLUCCS Wetland Transmission Line Impacts	Quantitative	Relative ranking based on data presented in Appendix C. The acreages of the transmission line corridors have been modified to better estimate the direct (fill) and clearing related impacts.
	Vegetated Shallows	Qualitative	The ranking for each site was assigned a value of 4 since it was assumed that the impacts would be the same for all sites.
	Riffle and Pool	Quantitative	Relative ranking based on data presented in Appendix C.
Habitat for Fish and Other Aquatic Organisms	Number Waterbody Crossing (stream and open water)	Quantitative	Relative ranking based on data presented in Appendix C.
Wildlife Habitat	See Text for Details	Quantitative	Sites were ranked on amount of wetland and upland habitat impacted by fill activities by onsite, offsite, and reservoir elements. Threatened and endangered species impacts are addressed in a separate factor.
Endangered or Threatened Species	Sanctuaries, Refuges, Endangered Species Habitat	Qualitative	The rankings for Sanctuaries, Refuges, and Endangered Species Habitat were based on the presence of the Crystal River NWR and potential impacts to OFWs. The only designated OFW that might have placed restrictions on development of the proposed nuclear units is the Suwannee River (the location of the Dixie 1 site). For these reasons, the maximum ranking was assigned to the LNP, Highlands and Putnam 3 sites, while the Dixie 1 site received a lower ranking.
	Number of FNAI Species w/in 6,000-acre Site	Quantitative	Relative ranking based on data presented in Appendix C.
	Number of Federally threatened and endangered within County for Onsite	Quantitative	Relative ranking based on data presented in Appendix C.
Biological Availability of Possible Contaminants in Dredge or Fill Material	See Text for Details	Qualitative	The ranking for each site was assigned a value of 4 since it was assumed that the impacts would be the same for all sites.
Municipal and Private Water Supplies, Water	Water Source Impacts	Quantitative	The ranking for Water Availability was based on the 20th percentile of the daily average discharge values of the water sources for the alternative sites. The LNP site uses the Gulf of Mexico and was given a maximum score. The remaining sites are ranked based on their 20th percentile of the daily average discharge values. The LNP score was reduced to a 3 since it includes groundwater withdrawals while the other three sites do not.
	Number of Potable Wells	Quantitative	Relative ranking based on data presented in Appendix C.
	Distance to Nearest Potable Well	Quantitative	Relative ranking based on data presented in Appendix C.

TABLE 5.0-3
Summary of Ranking Rationale

Review Factor	Specific Criteria	Data Type	Summary of Ranking Rational
Recreation and Commercial Fisheries	Fisheries Downstream of Site	Qualitative	All sites have some degree of recreational fishing in their vicinity. The ranking for Recreation and Commercial Fisheries was based on the presence of a warm-water fish hatchery downstream from the Putnam 3 site and the presence of Lake Okeechobee, which supports commercial and sport fishing, located downstream from the Highlands site. For these reasons, these two sites were given rankings of 2, while the other sites received the highest relative rankings.
Other Water-Related Recreation	See Text for Details	Qualitative	The ranking for each site was assigned a value of 4 since it was assumed that the impacts would be the same for all sites.
Aesthetics of the Aquatic Ecosystem	See Text for Details	Qualitative	Aesthetics of the Aquatic Ecosystem is based on a description in text found in Subsection 4.3.4. For the LNP, vegetation will serve as a visual screen or buffer from surrounding land uses so construction and operational activities other than those along the CFBC will not be visible to area residences or individuals. The remaining three sites are located close to rivers and were rated lower due to the potential impact that the plants could have on recreational users. The LNP site was given a maximum rank and the remaining sites were given a rank of 3.
Parks, National and Historic Monuments, National Seashores, Wild and Scenic Rivers, Wilderness Areas, and Research Sites	Dedicated Lands (distance to nearest)	Quantitative	The rank for Dedicated Lands was based on the distance to the nearest dedicated land; however, Putnam 3 site's rank was reduced from the maximum rank of 4 to 3 due to the St. Johns River's being designated an American Heritage River.
Indirect and Cumulative Impacts	See Text for Details	Qualitative	Indirect and cumulative impacts include growth-inducing effects or changes in land use patterns that cause changes in air, water, or other natural systems. All sites can be considered to have similar indirect impacts for terrestrial and air resources. However, since three of the sites will use freshwater as a makeup source, which is a critical resource in the area, they must be considered to have greater cumulative impacts than the sites that use saltwater for makeup water. Therefore the three sites that use freshwater were given a lower ranking than the LNP site.
	Aquifer Recharge	Qualitative	For the Aquifer Recharge criteria, the development of the on-site impact area is not expected to have an impact on aquifer recharge at LNP, Dixie 1, or Putnam 3 sites because no sole source aquifers are located at these sites. Therefore, these sites were given a maximum ranking. The Highlands site is located in the recharge zone for the Biscayne aquifer and would have a potential for impact; therefore, it was given the lowest ranking.

The public interest review factors described on Section 4.2 underwent a similar weighting and ranking process as the LEDPA analysis. The results for the public interest review factors are presented in Table 5.0-4. Tables describing the weighting, ranking, and raw data for the public interest review factors identified in 33 CFR 320 and described in Section 4.2, are included in Appendix D. The LNP site, the LEDPA site, scores the highest in this analysis as well which indicates it has the least amount of impact on the public interest review factors.

TABLE 5.0-4
Matrix for Public Interest Review Factors

				Rank (based on quartiles for quant data) 4 is best 1 is worst				Consolidated Score (based on weighting rankings) highest is best			
Review Factor	**Cumulative weight**	**Specific Criteria**	**Weight**	**LNP**	**Dixie 1**	**Highlands**	**Putnam**	**LNP**	**Dixie 1**	**Highlands**	**Putnam**
Traffic/Transportation Patterns	1	Transportation Distance (rail or barge) Distance (m.)	0.5	3	1	2	4	1.5	0.5	1.0	2.0
		Distance to Highway (m.)	0.5	3	2	1	4	1.5	1.0	0.5	2.0
Energy Consumption or Generation	0	See Text for Details (impacts same)	0	4	4	4	4	0.0	0.0	0.0	0.0
Navigation	0	See Text for Details (impacts same)	0	4	4	4	4	0.0	0.0	0.0	0.0
Safety	0	EAB Considerations (all same)	0	4	4	4	4	0.0	0.0	0.0	0.0
Air Quality	0	See Text for Details (impacts same)	0	4	4	4	4	0.0	0.0	0.0	0.0
Noise	0	See Text for Details (impacts same)	0	4	4	4	4	0.0	0.0	0.0	0.0
Historic Properties	1	Number of Historic/Cultural w/in 10 miles of Site	1	1	3	4	2	1.0	3.0	4.0	2.0
Land Use Classification	1	Based on Residential Land Use w/in 6,000 ac.	0.5	3	4	2	1	1.5	2.0	1.0	0.5
		Zoning	0.5	4	1	1	1	2.0	0.5	0.5	0.5
Economics	2	Transmission Line Cost (onsite costs considered to be same)	1	4	3	1	2	4.0	3.0	1.0	2.0
		Reservoir Cost	1	4	1	1	1	4.0	1.0	1.0	1.0
		Property Values	0	4	4	4	4	0.0	0.0	0.0	0.0
		Tax Revenues	0	4	4	4	4	0.0	0.0	0.0	0.0
		Employment	0	4	4	4	4	0.0	0.0	0.0	0.0
Prime Farmland Impacts	0	Prime Farmland	0	4	4	4	4	0.0	0.0	0.0	0.0
Food and Fiber Production	1	FLUCCS codes for Farm/Cropland	1	2	3	1	4	2.0	3.0	1.0	4.0

TABLE 5.0-4
Matrix for Public Interest Review Factors

				Rank (based on quartiles for quant data) 4 is best 1 is worst				Consolidated Score (based on weighting rankings) highest is best			
Review Factor	**Cumulative weight**	**Specific Criteria**	**Weight**	**LNP**	**Dixie 1**	**Highlands**	**Putnam**	**LNP**	**Dixie 1**	**Highlands**	**Putnam**
Mineral Needs	0	See Text for Details (Impacts same)	0	4	4	4	4	0.0	0.0	0.0	0.0
Considerations of Property	5	Land Acquisition - Total Number of Property Owners Affected by Entire Project Including Transmission	1	3	1	4	2	3.0	1.0	4.0	2.0
		Land Acquisition - Number of Property Owners Affects by Site	1	4	4	2	1	4.0	4.0	2.0	1.0
		Population - Persons Per Square Mile in County	1	3	4	2	1	3.0	4.0	2.0	1.0
		Environmental Justice- Minority Block Groups Between 6 -50 mi.	1	3	4	2	1	3.0	4.0	2.0	1.0
		Environmental Justice- Low Income Block Groups Between 6 -50 mi.	1	3	4	2	1	3.0	4.0	2.0	1.0
		Housing	0	4	4	4	4	0.0	0.0	0.0	0.0
							Total	**33.5**	**31.0**	**22.0**	**20.0**

6.0 Mitigation Proposed for Preferred Site

As stated in Section 4.1 of this document, the LNP COLA ER, and the State of Florida SCA, the preferred LNP site will not have adverse impacts on two of the three categories of special aquatic sites: 1) marine sanctuaries or refuges, including protected aquatic species, and 2) vegetated shallows. Impacts on these two categories of special aquatic sites were avoided by selecting locations for the LNP CWIS and blowdown pipelines that did not intersect with these areas and committing to use technologies and construction techniques that will minimize the potential for adverse impacts to occur. These are described further in Subsection 4.1.6.

While the preferred site will impact some wetlands, wetland impacts have been avoided or minimized to the extent practicable using alternative onsite locations for power plant infrastructure components and corridor infrastructure routing. Where wetland avoidance is not possible, PEF has proposed a landscape-level wetlands mitigation plan for those impacts. Note that the mitigation proposed for the preferred site (LNP) did not factor into the rankings for the LEDPA determination as presented in Section 5.0. The ranking for the LNP site was based on the data that did not take into account any potential mitigation.

None of the proposed project elements for the LNP project, namely the CWIS, barge slip, or blowdown pipeline crossing, intersect with established marine sanctuaries or refuges.

6.1 Protected Aquatic Species

Aquatic studies were conducted in the CFBC and adjacent nearshore waters of the Gulf of Mexico in 2007/2008. Evaluation of the sampling results, along with consideration of available life history, species distribution, and habitat requirements gleaned from an extensive literature search for information on special aquatic sites in the vicinity of the LNP site, have led to the conclusion that only the West Indian (Florida) manatee, an endangered species, will likely use locations in the CFBC. These study results are presented in detail in Technical Memorandum 338884-TMEM-087: *Aquatic Ecology Sampling Report* (CH2M HILL, 2009e). Construction and operation of the CWIS in the CFBC will not adversely impact manatees. While it is possible that an occasional protected species of sea turtle or fish may enter the CFBC, the limited habitat present in the canal will not support the establishment of consistent resident populations of protected sea turtles or fish species.

6.2 Vegetated Shallows

The aquatic studies conducted in the CFBC and the adjacent near-shore Gulf of Mexico indicated only very sparse patches of seagrass are located in the very lowest portions of the CFBC near the confluence of the canal with the Gulf of Mexico. No seagrass beds are located in the vicinity of any of the proposed water-dependent structures and activities, including the CWIS, barge slip, or the blowdown pipeline crossing near the U.S. Highway 19 bridge; therefore, no adverse environmental impacts to vegetated shallows will occur. Similarly,

while seagrass beds are located in the area of the Gulf of Mexico adjacent to the CREC discharge canal, the addition of the LNP discharge to the combined CREC discharge will not affect seagrasses in the area (Blancher, 2009).

6.3 Wetlands

Wetlands are common on the LNP site, along access roads, and infrastructure corridors. Prevalent wetland systems onsite are cypress swamps, cypress-hardwood mixed swamps, and freshwater marsh. As described in LNP ER Section 2.4, onsite wetlands have been significantly altered and degraded from their natural condition from decades of silvicultural activities. No USFWS-designated critical habitats were located on the LNP site and no onsite wetlands were identified as providing significant habitat for listed species.

The maximum anticipated wetlands impacts for the entire project, including the LNP site, transmission corridors, blowdown pipelines, and barge slip, are estimated to be long-term and short-term impacts, including temporary disturbance, resulting from direct dredging and filling. The actual wetlands impact will likely decrease as the routing is refined within corridors and on the Levy site (BRA, 2009; Durbin, 2009).

When making engineering decisions during site development planning activities, PEF carefully considered alternatives to impacting wetland areas and tried to locate major plant components, ancillary facilities, and infrastructure corridors to avoid or minimize impacts to wetlands to the extent possible. For example, the routes of the heavy haul road and permanent site access road are not straight but instead follow paths designed to avoid wetlands to the extent practicable (Durbin, 2009).

On April 29 , 2010, PEF submitted to FDEP the *Wetlands Mitigation Plan for the PEF Levy Nuclear Plant and Associated Transmission Lines* (PEF, 2010). The WMP identifies a series of possible scenarios from which the appropriate mitigation can be derived. Because impacts are still being refined as corridors are narrowed into actual routes, the information in the WMP is designed to demonstrate that there is available mitigation for the final degree of wetland impacts, once calculated (Durbin, 2009). The same base data were used in the WMP and this LEDPA alternatives analysis to determine the amount of wetland impacts for the LNP site; therefore, the wetland impacts in the two documents are consistent.

The alternatives analysis presents the LNP wetland impacts using different definitions of offsite and onsite than the WMP to allow for direct comparisons with the other alternative sites. For example, some impacts that the WMP includes as "onsite" have been included n the transmission line impacts. (The WMP defines all impacts occurring on the PEF-owned property as onsite, while this document defines the transmission corridor as starting at the switchyard.) This alternatives analysis includes the temporary and permanent impacts, while the WMP focuses only on the permanent impacts. Any minor inconsistencies in the two documents are due to methodological differences required as part of completing two separate analyses that have different purposes.

A primary value of the WMP is "an overall increase in ecological function provided across several thousand acres in a regionally significant location. The mitigation approach focuses primarily on enhancing and restoring ecological functions to a very large area of wetland habitat and supporting uplands, relative to the area being impacted. This landscape-level

ecosystem benefit substantially augments the value of local-scale mitigation activities detailed in the WMP." The WMP demonstrates the availability of a variety of mitigation opportunities to offset LNP impacts to wetlands (PEF, 2010). For example, mitigation for the LNP has the potential to connect a large state forest, the Goethe State Forest, to the historical floodplain of the Withlacoochee River. This connection would provide a large natural habitat corridor for wildlife that will be enhanced through mitigation activities (Durbin, 2009). Final wetland mitigation plans will be developed in consultation with the USACE and FDEP and follow applicable federal and state regulations.

A rigorous avoidance and minimization strategy was implemented throughout LNP site investigations and planning for transmission activities and will continue throughout the construction and operational phases of the project. To the extent possible, facilities were sited in uplands, and where impacts were unavoidable, higher quality wetland systems were protected. The specific actions taken to avoid or minimize encroachment into wetland areas during site planning activities include the following:

- Facilities were sited in upland areas to the extent possible; for example, the construction access road was re-routed to minimize impacts to wetlands.
- Onsite wetlands were characterized in accordance with the Uniform Mitigation Assessment Methodology, with most wetlands scoring in the low to moderate quality range. Where wetland impacts were unavoidable, higher quality wetlands were avoided in facility siting to the extent practicable. The heavy haul road, blowdown and makeup corridors, and transmission corridors were shifted east to avoid a higher quality cypress swamp and bald eagle nest. These facilities were also located together to avoid the need for multiple corridors exiting the site and to share the use of the heavy haul road as access, thus eliminating the need for a separate access road for the transmission lines.
- Over 90 percent of the new transmission lines needed to integrate the LNP to the transmission system are being collocated with, or within, existing ROWs. This minimizes the number of new ROWs and allows for the use of existing access roads.
- PEF is proposing to collocate all four 500-kV transmission lines in one corridor, reducing the number of new ROW exiting the LNP site, and to utilize the heavy haul road to serve all four transmission lines.
- Wetlands will be protected throughout construction and operation through the use of BMPs, such as swamp mats to avoid soil compaction and silt fencing to reduce sedimentation. Groundwater and wetland monitoring will be conducted in the vicinity of the plant site to detect adverse impacts from the project to the remaining systems and quickly take corrective action, if necessary.

6.4 Controls

The use of BTA in the design of the proposed CWIS means very low (less than 0.5 foot per second [fps]) through-screen velocities and even lower (less than 0.25 fps) intake approach velocities will minimize the potential for impingement of protected species of turtles and fish reaching the location of the CWIS in the upper end of the CFBC. Manatees are present in the CFBC and were observed in the CFBC during the aquatic field studies conducted in

2007/2008. This protected aquatic mammal will not be adversely impacted by the operation of the CWIS, since the bar screens protecting the entrance to the CWIS forebay are 4-inch center diameter in width, small enough to prevent even very young manatees from entering the CWIS. The very low approach velocities of less than 0.25 fps at the bar screens will allow manatees encountering the bar screens to simply swim away. Under the proposed State Conditions of Certification, the final CWIS design is subject to FWCC review for protection of manatees.

The construction of the CWIS, the barge slip, and the blowdown pipeline crossing will require adherence to the proposed State Conditions of Certification, issued by the State of Florida, requiring the continuous monitoring for the presence of manatees during construction activities and the requirement to halt construction should manatees approach the construction zone. Therefore, potential adverse effects on manatees will be avoided.

7.0 Conclusions

Meeting the CWA Section 404(b)(1) LEDPA requirement for issuance of a USACE 404 permit, was considered from the earliest stages of the project alternatives search through the site layout and design phases of the project development effort. The following list presents the reasons why PEF believes LEDPA test requirements have been met for the LNP and a Section 404 permit should be issued for the LNP site:

- Alternative Site Selection Process

The LEDPA process thoroughly considered aquatic ecology criteria and the avoidance or minimization of impacts to the aquatic environment. The finalist sites from the COLA site selection process were evaluated in this analysis. The LNP site was determined to be the LEDPA site

- Practicable Alternative Infrastructure

The water-dependent project infrastructure at the LNP site includes a closed-cycle cooling water system and CWIS that meets each of the BTA requirements of the CWA 316(b) Phase I regulations to minimize cooling water requirements and minimize potential impingement and entrainment impacts on protected aquatic species. The proposed construction techniques and continuous visual monitoring for endangered West Indian (Florida) manatees during the proposed in-water construction activities for the barge slip and the blowdown pipeline crossing of the CFBC will eliminate adverse impacts to protected aquatic species.

- No Unacceptable Adverse Impacts to the Aquatic Ecosystem

The overall effects of the proposed project to special aquatic sites will not cause unacceptable adverse impacts. As stated in Subsection 4.1.6.1, the wetlands on the LNP site are not considered to represent ARNI wetlands. The wetlands are not the kind that will support long-term fish habitat or aquatic insect communities; serve as water sources for municipal or private water supplies; support recreational or commercial fisheries; or support water-related recreation.

A review of the public interest review factors (as defined in 33 CFR 320) reinforces the selection of the LNP site as the LEDPA site. The other three alternative sites have greater impacts to the factors analyzed and summarized in Table 5.0-4.

PEF will comply with all environmental, licensing, and permitting requirements applicable to this proposed project, including the LEDPA requirements of the Section 404(b)(1) guidelines. The location and design of the proposed CWIS is expected to improve conditions in the upper CFBC for aquatic species. Measures to configure the project to avoid wetlands and minimize potential impacts have been incorporated into the site design. The major plant components, ancillary facilities, and infrastructure corridors have been sited to minimize or avoid impacts to wetlands.

- While not a specific consideration of the LEDPA test, the adversely affected wetlands will be fully mitigated following collaboration with the USACE and Florida state agencies.

The fundamental precept of the Section 404(b)(1) guidelines is that discharges of dredged or fill material into waters of the United States, including wetlands, should not occur unless it can be demonstrated that such discharges, either individually or cumulatively, will not result in unacceptable adverse effects on the aquatic ecosystem. PEF believes that the project, as proposed, will not result in unacceptable adverse effects on the aquatic ecosystem.

In the following list, PEF describes how it has complied or will comply with the four conditions in the guidelines of 40 CFR 230, Section 404(b)(1), Subpart B.

1. *Except as provided under Section 404(b)(2), no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge that would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences.*

There are no practicable alternatives to the proposed discharge that would have less adverse impact on the environment. The LNP site is the only site with access to an unlimited, relatively low-quality source of cooling water from the Gulf of Mexico. The other alternative sites considered have more adverse environmental consequences than the LNP site.

2. *No discharge of dredged or fill material shall be permitted if it contributes to violation of any applicable state water quality standard; violates any applicable toxic effluent standard; or adversely impacts listed species, their critical habitat, or any marine sanctuary.*

The LNP project will comply with all applicable state water quality and toxic effluent standards. No adverse impacts to listed species, their critical habitat, or any marine sanctuary will occur as a result of the LNP.

3. *Except as provided under Section 404(b)(2), no discharge of dredged or fill material shall be permitted that will cause or contribute to significant degradation of the waters of the United States.*

The LNP project will comply with all applicable state and federal water standards and will not result in significant degradation of the waters of the United States. PEF will conduct wetland and groundwater monitoring programs in accordance with federal permit conditions and proposed State of Florida SCA Conditions of Certification to ensure the protection of aquatic resources.

4. *Except as provided under Section 404(b)(2), no discharge of dredged or fill material shall be permitted unless appropriate and practicable steps have been taken that will minimize potential adverse impacts of the discharge on the aquatic ecosystem.*

LNP has been designed, located, and configured to avoid and minimize adverse effects on the environment.

Section 230.10(a) of the guidelines states that the amount of information needed to make a determination and the level of scrutiny required is commensurate with the severity of the environmental impact (as determined by the functions of the aquatic resource and the

nature of the proposed activity) and the scope/cost of the project. PEF has supplied extensive analyses of the aquatic environment, including analyses of wetlands that PEF believes is commensurate with the size and complexity of the proposed project. As previously noted, this body of information has been submitted in the COLA ER, the State of Florida SCA, and additional supplemental permit information supplied directly to the USACE, the NRC, the FDEP, and other state agencies.

The guidelines clearly contemplate that reasonable discretion should be applied based on the nature of the aquatic resources and potential impacts of a proposed activity in determining compliance with the alternatives test. Such an approach encourages effective decision-making and fosters a better understanding and enhanced confidence in the Section 404 program. PEF believes that it has met the LEDPA test requirements under the Section 404(b)(1) guidelines and that a permit from the USACE should be issued allowing the construction of the LNP.

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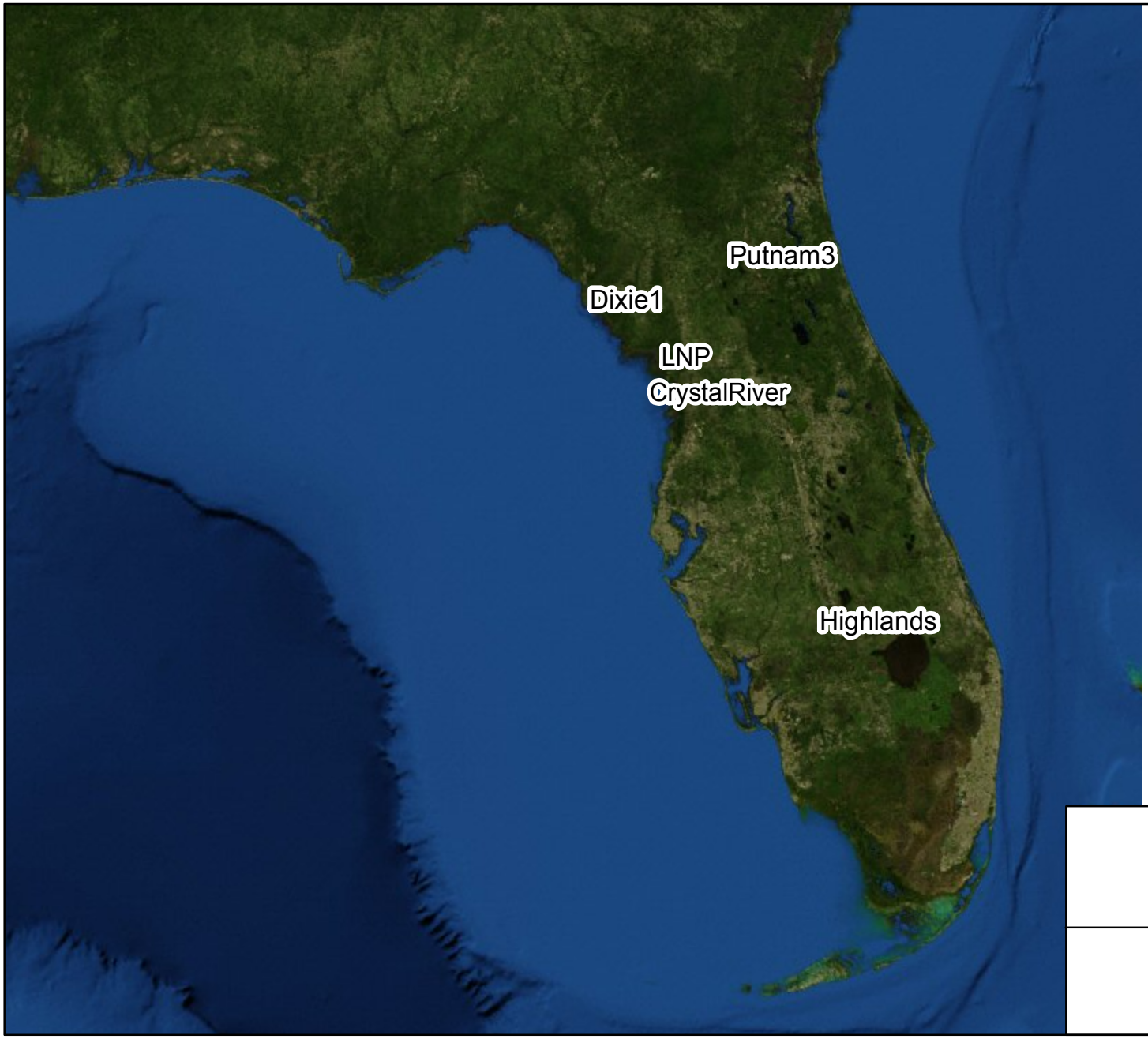

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Sources
Imagery: ESRI, 2009

0 50 100
Kilometers
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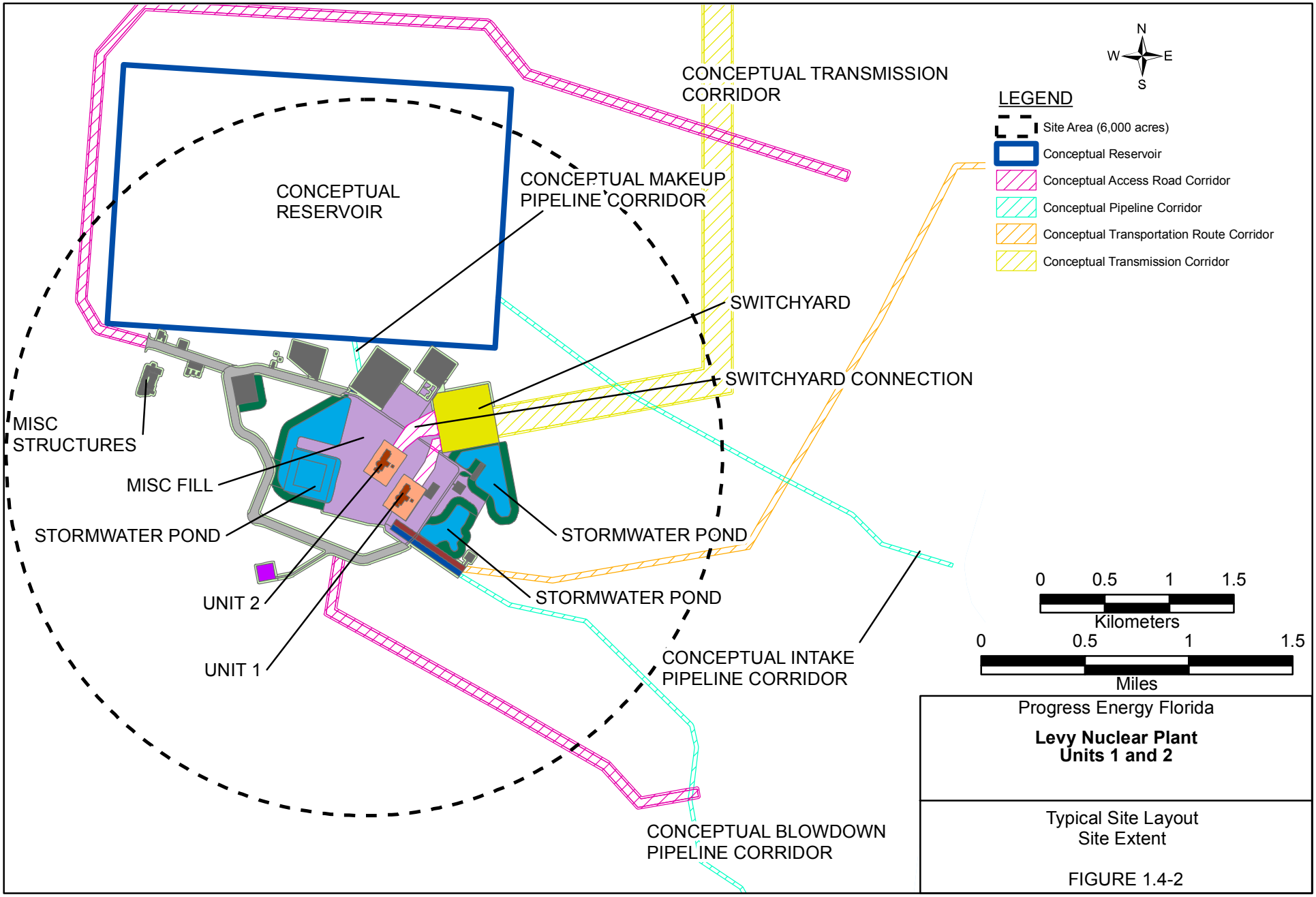
Miles

Progress Energy Florida

Levy Nuclear Plant
Units 1 and 2

Overview Map

FIGURE 1.4-1



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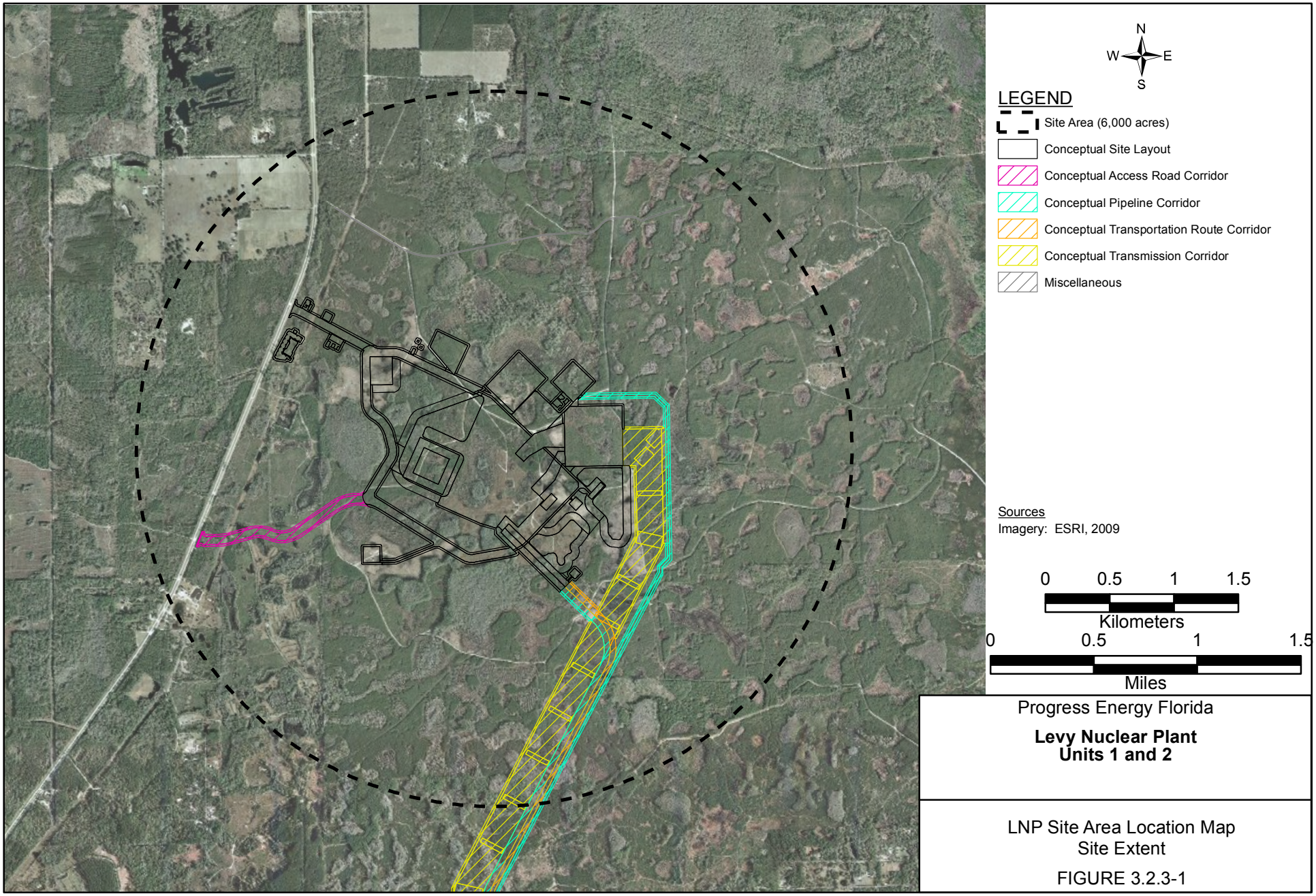
Levy Nuclear Plant
Units 1 and 2

Typical Site Layout
Site Extent

FIGURE 1.4-2



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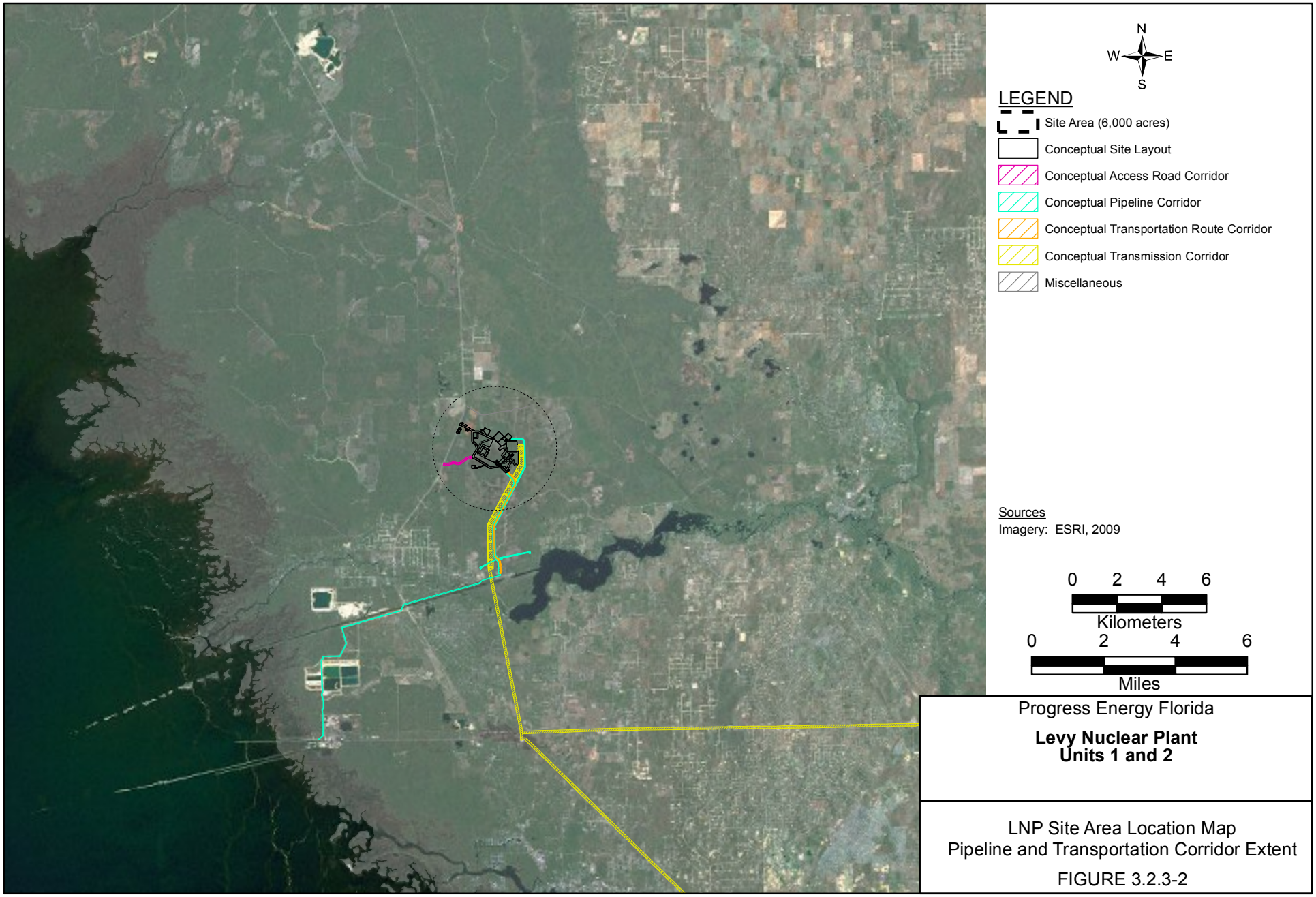
Levy Nuclear Plant
Units 1 and 2

LNP Site Area Location Map
Site Extent

FIGURE 3.2.3-1



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Levy Nuclear Plant
Units 1 and 2

LNP Site Area Location Map
Pipeline and Transportation Corridor Extent

FIGURE 3.2.3-2