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Originator:	Rick Zeroka Name/Position	6/25/2009 Date
	Signature	
Reviewer	William T. Marsh/Task Manager Name/Position	6/25/2009 Date
	Signature	
Project Manager:	Lorin Young/Project Manager Name/Position	6/25/2009 Approval Date
	Signature	

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

Prepared for

Progress Energy Florida, Inc.

Prepared by

CH2MHILL

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Acronyms and Abbreviations

ac.	acre
APE	Area of Potential Effect
ARNI	Aquatic Resources of National Importance
BMP	best management practice
BRA	Biological Research Associates, Inc.
BTA	best technology available
CERP	Comprehensive Everglades Restoration Plan
CFBC	Cross Florida Barge Canal
CFR	Code of Federal Regulations
CO_2	carbon dioxide
COLA	Combined License Application
CPVRR	cumulative present value revenue requirements
CREC	Crystal River Energy Complex
CWA	Clean Water Act
CWIS	cooling water intake structure
DOE	U.S. Department of Energy
DSM	demand-side management
EPRI	Electric Power Research Institute
ER	Environmental Report
ERP	Environmental Resource Permit
ESRP	Environmental Standard Review Plan
FDEP	Florida Department of Environmental Protection
FDOH	Florida Division of Administrative Hearings
FLUCCS	Florida Land Use Cover and Forms Classification System

Acronyms and Abbreviations, Continued

fps	foot per second
FPSC	Florida Public Service Commission
gCO2eq/kWh	grams of carbon dioxide equivalent per kilowatt hour
GEIS	Generic Environmental Impact Statement
GIS	geographic information system
ha	hectare
IGCC	integrated gasification-combined cycle
IRP	Integrated Resource Plan
km^2	square kilometer
kWe	kilowatts electric
LDR	land development regulation
LEDPA	least environmentally damaging practicable alternative
LNP	Levy Nuclear Plant Units 1 and 2
$mi.^2$	square mile
MSW	municipal solid wastes
MW	megawatts
MWe	megawatt electric
MWh	megawatt hours
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act
NOx	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NREL	National Renewable Energy Laboratory

Acronyms and Abbreviations, Continued

NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
OFW	Outstanding Florida Waters
PEF	Progress Energy Florida, Inc.
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
TCLP	Toxicity Characteristic Leaching Procedure
TYSP	Ten-Year Site Plan
UMAM	Uniform Mitigation Assessment Methodology
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WMD	Water Management District
WRCA	Water Resource Caution Area

This document supports the response to Request for Additional Information (RAI) U.S. Army Corps of Engineers (USACE) 11 (U.S. Nuclear Regulatory Commission [NRC] Letter No. ML090500782, dated February 25, 2009). This document is intended to respond 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), and is not intended to be a substitute for the whole body of evidence relating to "special aquatic sites" and 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. While this response is directed specifically to addressing the issue of alternatives to potential impacts on special aquatic sites, including wetlands, and supplements the previously submitted alternatives analysis, the results of these analyses should be considered in the context of the entire body of submitted information. Progress Energy Florida (PEF) incorporates into this response ER Chapter 9, Alternatives to the Proposed Project.

PEF's alternatives review in ER Chapter 9 was performed in accordance with the NRC's NUREG-1555, Environmental Standard Review Plan (ESRP) 9.3, for identification and comparison of alternatives to the proposed site for the construction and operation of the LNP. As noted in Section 2.2, 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 alternatives selection and review process.

1.0 Project Purpose

The following section summarizes the project purpose and need. This information is discussed in greater detail in the SCA and the ER, as well as the Florida Public Service Commission (FPSC) final order determining the need for the project, issued on August 12, 2008 (FPSC, 2008a).

1.1 Basic Purpose

As noted in the USACE permit notice for the LNP project, the basic purpose of the LNP is to meet the public's need for electric energy and 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 the USACE's guidelines. Therefore, PEF will need to rebut the presumption that there is a less environmentally damaging practicable alternative that will meet its project purpose.

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[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).

While the basic purpose may not be water-dependent, several elements of the proposed nuclear power plant project are. The same needs for water would also be required for any of the potential alternative baseload electric generation technologies that could meet the LNP project purpose, which include natural gas-fired and coal-fired generating 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 discussed 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 and operation and maintenance costs. The U.S. Environmental Protection Agency (USEPA) has rejected dry cooling as 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" (USEPA, 2001a). In that analysis, the USEPA 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 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, with associated environmental impacts.

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

Based on the LNP configuration and size, the once-through cooling alternative would not support the cooling requirements for the LNP. Once-through cooling would pose risks of thermal effects and have the potential to damage aquatic organisms. Therefore, this alternative is subject to the requirements of the 316(b) Phase I rules governing new power generating facilities. USEPA regulations (40 Code of Federal Regulations [CFR] 125) governing CWIS under Section 316(b) of the CWA make the use of once-through cooling systems difficult for steam power generating facilities. As a result, once-through cooling water would require approval from the USEPA Regional Director (USEPA, 2001b).

Another water-dependent activity for the proposed nuclear power plant is the ability to dispose of LNP wastewater (that is, blowdown and other process water). As discussed in ER Subsection 9.4.2.1.3 and ER Table 9.4-5, a careful review of wastewater disposal alternatives showed that disposal of the LNP wastewater into the existing Crystal River

Energy Complex (CREC) discharge canal was the preferred alternative with the least impact to the aquatic environment. To reach the CREC discharge, it will be necessary to cross the Cross Florida Barge Canal (CFBC) and the impacts of this CFBC crossing will be minimized to the maximum extent practicable by selecting a crossing location in an area of the CFBC with limited benthic aquatic resources and where sediments are not contaminated. Recent analysis of aquatic benthic organisms and sediment quality in the proposed crossing area show that the location meets both selection criteria.

Another water-dependent activity at the proposed LNP site is construction of a barge slip in the upper portion of the CFBC to allow ocean-going barges to transport heavy equipment from manufacturing locations through the Gulf of Mexico and up the CFBC to offload 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 proposed design of the barge slip is also intended to minimize impacts to the aquatic environment.

These water-dependent elements of the project dictate plant location near water bodies that can meet these important needs; these elements are important to the selection and evaluation of potential sites.

1.2 Overall Purpose

The overall purpose of the LNP is to meet the public's need for increased electrical baseload generating capacity in the Central Florida area by producing reliable electric power. The overall purpose provides the basis for determining the practicability and geographic scope of alternatives.

The LNP is proposed to meet the demonstrated and approved need for reliable baseload power. The choice of nuclear energy as the source for producing steam to turn the turbines to produce the electric energy for the PEF service area was approved by the FPSC in August 2008. Testimony provided on behalf of the applicant 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, and 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, gas, and oil (Crisp, 2008; FPSC, 2008a). 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 Crist opposes coal and has said he 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 Section 3.2 of this document.

1.3 Definitions

1.3.1 Practicable Alternatives

No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge, which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences.

From "Memorandum to the Field, Appropriate Level of Analysis Required for Evaluating Compliance with the Section 404(b)(1) Guidelines Alternative Requirements (1993)":

> When it is determined that there is no identifiable difference in adverse impact on the environment between the applicant's proposed alternative and all other practicable alternatives, then the applicant's alternative is considered as satisfying the requirements of Section 230.10(a).
>
> Practicable alternatives include, but are not limited to:
>
> (i) Activities which do not involve a discharge of dredged or fill material into the waters of the United States or ocean waters;
>
> (ii) Discharges of dredged or fill material at other locations in waters of the United States or ocean waters;
>
> An alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.

1.3.2 Special Aquatic Sites

The evaluation of alternatives under the 404(b)(1) guidelines focuses on potential impacts to "special aquatic sites." Since the evaluation of the impact of the LNP and other candidate sites on special aquatic sites and a consideration of alternative sites and actions are critical to the issuance of a permit, the definition of "special aquatic site" is important.

Special aquatic sites are defined in 40 CFR 230.3 (q-1) and Subpart E as "geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values. These areas are generally recognized as significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region."

The USEPA identifies and defines six categories of special aquatic sites in Parts 230.40 through 230.45 of Subpart E of Section 404(b)(1) guidelines as follows:

- **Sanctuaries and refuges**: Areas designated under state and federal laws or local ordinances to be managed principally for the preservation and use of fish and wildlife

resources. Designated critical habitat for protected species, including federally protected endangered aquatic species, are covered under the sanctuaries and refuges definition.

- **Wetlands**: Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.
- **Mudflats**: Broad flat areas along the sea coast and in coastal rivers to the head of tidal influence and in inland lakes, ponds, and riverine systems. When mud flats are inundated, wind and wave action may re-suspend bottom sediments. Coastal mud flats are exposed at extremely low tides and inundated at high tides with the water table at or near the surface of the substrate. The substrate of mud flats contains organic material and particles smaller in size than sand. They are either unvegetated or vegetated only by algal mats.
- **Vegetated shallows**: Permanently inundated areas that under normal circumstances support communities of rooted aquatic vegetation, such as turtle grass and eelgrass in estuarine or marine systems, as well as a number of freshwater species in rivers and lakes.
- **Coral reefs**: Skeletal deposit, usually of calcareous or silicaceous materials, produced by the vital activities of anthozoan polyps or other invertebrate organisms present in growing portions of the reef.
- **Riffle and pool complexes**: Sometimes characterizes steep gradient sections of streams. Such stream sections are recognizable by their hydraulic characteristics. The rapid movement of water over a coarse substrate in riffles results in a rough flow, a turbulent surface, and high dissolved oxygen levels in the water. Pools are deeper areas associated with riffles. Pools are characterized by a slower stream velocity, a steaming flow, a smooth surface, and a finer substrate. Riffle and pool complexes are particularly valuable habitat for fish and wildlife.

2.0 Compliance with Guidelines

The applicant 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. In the case of PEF's proposed project at the Levy site, impacts to the aquatic environment in terms of wetlands alone are estimated to be 410 acres (ac.) on the plant site, blowdown pipeline, and barge slip and an additional estimated 355 wetland ac. for the transmission lines.

The following section discusses the applicable guidelines and presumptions pursuant to Section 404 of the CWA.

2.1 Applicable Guidelines and Presumptions

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 in order 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.

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.
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.
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.
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.

The LNP project also 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. Although no 404 permit can be issued unless compliance with the 404(b)(1) guidelines is demonstrated, the 404(b)(1) evaluation is conducted as an integral part of the public interest review (PIR) set forth at 33 CFR 320.4(a). The PIR factors that the USACE considers in its PIR prior to making a final determination include the following: conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, flood plain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership, and in general, the needs and welfare of the people. These PIR factors are presented and discussed further in Section 3.3 of this Alternative Analysis.

Similar to the 404(b)(1) evaluation, the objective of PEF's alternatives evaluation is to verify that there is no practicable alternative with less damaging impact on aquatic sites. Although the PEF alternatives evaluation presented in the ER complies with NUREG-1555 and follows EPRI guidance, the PIR factors listed above are also addressed, where appropriate, through this alternatives evaluation process. The detailed alternatives evaluation is included in the company proprietary siting study that has been made available to the USACE (PEF, 2007). Additionally, PEF has provided extensive information in the COLA ER and the State of Florida SCA and supplied additional supplemental permitting information directly to the USACE, the NRC, the FDEP, and other state agencies.

3.0 Alternatives Analysis

3.1 No Action Alternative

The no-action alternative scenario in which the LNP site is either not licensed or constructed was also considered and is discussed further in ER Section 9.1 and should be reviewed for this purpose. The no-action alternative would result in no facility being built. This would mean that the electrical capacity to be provided by the project would not be available to the public in the service area and would result in a reduced ability to maintain state-mandated electrical generating reserve margins and to supply lower-cost power to PEF's customers in Florida. 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 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 LNP is a carbon-neutral, baseload generating facility, which would add fuel diversity to PEF's generating system. The LNP seeks to avoid carbon emissions from new electrical generating facilities, in line with Florida's goal to reduced carbon emissions during the expected life of the LNP (State of Florida, 2007). The LNP also adds to the diversity of fuel sources for electrical generation, thereby preventing an over-reliance on any particular fuel source, including those 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.

The LNP site allows PEF to use existing electrical transmission line rights-of-way (ROWs) to provide power to PEF's customers. 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 not requiring new power generating capacity, such as energy conservation and demand-side management (DSM), were considered by PEF in ER Subsection 9.2.1 of the Alternatives Analysis and the FPSC during its need determination proceeding for the LNP. Such programs, however, cannot offset the need for additional generation units to meet the demands of PEF's customers 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 additional energy conservation (or DSM) measures, including 39 new measures that were recently approved by the FPSC. PEF anticipates that the implementation of these new DSM programs and measures will significantly increase the DSM penetration in the future and result in avoiding the construction of an additional 512-megawatts (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 the DOE's 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 utilities' 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 2400 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 Levy Units 1 and 2 (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 2400 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 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.

Generation alternatives to the LNP that were 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 (MSWs), wood waste/biomass, energy crops, integrated gasification-combined cycle (IGCC), wave, and petroleum, natural gas, and coal.. Each electrical generating alternative is discussed 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 discussion and evaluation.

Potential land use impacts from an onshore wind power generating facility could be significant. It was estimated that to produce the 2200 megawatt electric (MWe) of LNP baseload output, approximately 648 hectares (ha) (1600 ac.) of land would be needed, which is more than five times the land area needed to produce 2200 MWe of nuclear generation. 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. 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) website, wind by itself is not considered a firm source of baseload capacity. 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 website, Florida is not a candidate for geothermal energy and could not produce the proposed 2200 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.

There are no planned hydropower units due to the absence of a feasible location or adequate resource, as Florida's flat terrain does not lend itself to hydroelectric power. A hydropower generating facility is estimated to require flooding more than 900,000 ha (2.20 million ac.) of land to produce a baseload capacity of 2200 MWe, resulting in a large impact on land use. In addition, operation of a hydropower generating facility alters aquatic habitats, potentially impacting aquatic species. 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 1 ha to 4.9 ha/MWe (2.5 to 12 ac./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 2200-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 2200-MWe baseload capacity needed to meet the project purpose. 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 (NOx), 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. This would not meet the proposed 2200-MWe baseload capacity. Construction of a wood waste power generating facility would have similar environmental impacts to that of a coal power generating facility, which are comparable to or greater than a baseload nuclear-fueled 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.

In addition to wood and MSW fuels, 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 2200 MWe. 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. Therefore, a generating facility using energy crops 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 carbon dioxide and other greenhouse gases, can be removed from the gas stream prior to combustion. At present, 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 2200-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 development of 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.

Petroleum costs have risen significantly, increasing by approximately 90 percent from 2002 to 2006 and by 51 percent from 2004 to 2005. Although economic conditions in late 2008 and early 2009 have resulted in reductions in the price of petroleum products, prices are still higher than they were 5 years ago and are expected to continue to increase (DOE/EIA, 2009). In the NRC's Generic Environmental Impact Statement (GEIS), NRC staff estimated that construction of a 1000-MWe oil power generating facility would require approximately 50 ha (120 ac.) 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, which are comparable to or greater than a baseload nuclear-fueled 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. Due to 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 ahead of coal and fuel oil plants because it is an inherently cleaner source of fuel. 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 45 ha (110 ac.) for a 1000-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 of Ten-Year Site Plan (TYSP) 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 due to severe storms and hurricanes (FPSC, 2008b). The FPSC also considered a natural gas-fired alternative during the State'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 vagaries of cost and supply. 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 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 1000-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 700 ha (1700 ac.) would be needed for such a plant, and this could amount to the loss of about 8 square

kilometers (km^2) (3 square miles [$mi.^2$]) 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, NOx, 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 its 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 2200 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, least environmentally damaging, and the most reliable long-term source to satisfy the projected PEF electric energy needs 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 viable 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.

3.3 Alternative Sites

3.3.1 Site Alternatives Selection Process

Special aquatic sites can be minimized by selecting a site with a reduced presence of special aquatic sites and then locating facility infrastructure to avoid and minimize impacts. This section of the LEDPA deals with the selection of alternative sites.

Having eliminated other power generating alternatives, PEF initially evaluated 20 potential power plant sites within its service area to identify those that could meet specified criteria for the siting, licensing, permitting, and operation of two nuclear power electric generating units. The EPRI Siting Guide (EPRI, 2002) guided 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 evaluation (includes site reconnaissance, topographic data collection) 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 (PEF, 2007).

The Region of Interest (ROI) begins with the PEF service territory. The ROI was derived from PEF's fundamental business decisions on the economic viability of a nuclear power generating facility, the market for the facility's output, and the general geographic area where the facility should be deployed to serve PEF's customers (PEF, 2007). The PEF service territory covers approximately 51,800 km^2 (20,000 $mi.^2$) and includes the densely populated areas around Orlando, Clearwater, and St. Petersburg (PEF, 2007). PEF expanded the ROI by one additional county around the periphery of its service territory in Florida in order to identify viable sites within a reasonable distance of the service territory and allow additional flexibility in considering siting tradeoffs (PEF, 2007).

The site selection process began with a geographic information system (GIS)-assisted screening process that initially eliminated sites not meeting basic site selection criteria. The following exclusionary criteria for the preliminary screening of potential sites in the ROI are described in detail in the PEF siting study (PEF, 2007):

- Lack of adequate volumes of water
- Population restrictions
- Federal or state parks
- Unacceptable geologic features

Next, the following avoidance criteria were applied to the remaining sites to develop a smaller pool of candidate sites:

- Water use moratoriums
- Cultural or historical limitations
- State or local governmental restrictions
- Presence of wetlands

Candidate sites were then ranked and scored by applying and evaluating numerous weighted suitability criteria based upon the following considerations:

- Health and safety
- Environmental
- Socioeconomic
- Engineering and cost

Finally, the following considerations were applied to the final candidate sites to decide on a preferred site:

- Business strategic considerations
- Transmission modeling and analysis

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 6000 ac. in size, although favorable sites as small as 2000 ac. were considered (PEF, 2007). The nominal 6000-ac. siting area allowed a standardized basis for comparisons between siting areas, provided for reasonable flexibility in plant configuration and design, and recognized both the need for an exclusionary area around the plant and the potential for difficulties in land acquisition.

The potential sites that were reviewed and evaluated included 19 greenfield sites and 1 location with an existing operating nuclear power plant. These 20 sites were initially chosen based on 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. PEF evaluated these 20 sites for land acquisition potential, local topography, future area development plans, and parcel ownership. This evaluation provided insights into the overall site suitability trade-offs inherent in the available sites within the PEF ROI and were designed to take advantage of data available at this stage of the site selection process. The number of candidate sites was further reduced to eight sites.

The objective of the next component of the site selection process was to evaluate the eight candidate sites further and select a smaller set of alternative sites for detailed evaluation and ultimate selection of the preferred site for the PEF COL. These eight sites were then evaluated with 40 additional weighted criteria parameters, reducing the number of candidate sites to five. In addition to inclusion of several of the top-rated sites, this set of five candidate sites represents a good cross-section of siting trade-offs available within the ROI, including a variety of water sources, locations, and transmission connection strategies. 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 screening process. Details of the sites evaluated and the overall site selection process is provided in greater detail in PEF's proprietary Evaluation of Florida Sites (Florida Siting Study) (PEF, 2007). This proprietary document has been made available to the USACE.

The five final candidate sites were:

- Dixie site, located in Dixie County on the Suwannee River
- Highlands site, located in Highlands County on the Kissimmee River
- Crystal River site, located in Citrus County on the Gulf of Mexico
- Levy site, located in Levy County near the CFBC/Gulf of Mexico
- Putnam site, located in Putnam County on the St. Johns River

The five final candidate sites were subjected to additional evaluation and studies that would allow for comparison of scores, resulting in the selection of a preferred site. Additional research of each of the five sites conducted at this point in the evaluation included transmission evaluations, geotechnical studies, on-the-ground environmental surveillance, reliability studies, and land acquisition potential. An ecological site reconnaissance was conducted to determine if ecological resources or conditions were present that would

indicate the potential for significant impacts or that would indicate significant differences in suitability between the alternate sites.

Each of these five sites was previously disturbed via farming, mining activity, and/or silvicultural activities. Based upon National Wetlands Inventory maps, all sites contain wetland areas, although at the time of the survey, very little standing water was present at any of the sites. The observed wetland and potential wetland areas were characterized by depressed areas, which tend to be wet due to surface water runoff and aquifer surface discharge, except during drought conditions, and typically exhibit vegetation characteristic of wetlands.

Except for the Highlands site, which was largely sod and dairy farmland, each of the greenfield sites exhibited land cover typical of open forested pineland. There was considerable existing farming on and near the Highlands site, very typical of Highlands County, where 88 percent of the land is in crop or pasture land.

The Levy site was being actively used for silviculture, with large areas of extensively logged and furrowed wetland areas.

The Crystal River site was characterized by industrial development with both fossil fuel and nuclear power plants and associated facilities present, although areas that could form the site for new nuclear units were ecologically similar to the greenfield sites (other than the Highlands site).

3.3.2 Technical Factors and Logistics

Each final candidate site is located near special ecologically protected areas (within 1 to 5 mi.) and lies within an area where threatened or endangered species may occur on-site or in likely infrastructure corridor routes. Non-ecological key differentiators among the sites included:

- **Geotechnical**: Based on the preliminary subsurface on-site investigations, the most suitable greenfield site was the Levy site. The Highlands and Putnam sites were considered least suitable for a nuclear power plant because of thick soil deposits and the approximately 100-foot depths to bedrock, which means significant foundations would be required. The Dixie site was considered less suitable than the Levy site due to the presence of numerous sinkholes, depressions, voids, and cavities encountered during coring activities for site characterization.

- **Reliability**: 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 hurricane, tornado, or storm surge flooding. Because the loss of total generation at Crystal River would create a major electrical disruption for the PEF service area as well as the entire state, a qualitative reliability analysis of the alternative 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. The reliability analysis carefully 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 prevent any loss of capability to protect the public.

For outages initiated by a single weather event, the greater the distance from Crystal River, the less likely a single-event outage would be. Any separation from Crystal River would provide a significant decrease in risk that all units could be taken offline by a single event, but additional distance provides additional risk mitigation. Both the Highlands and Putnam sites are located relatively far from the coast and, therefore, are expected to provide significant redundancy relative to the storm surge risk, compared with locating two new units at CREC. Of the two sites, Highlands is considered more favorable due to its higher elevation and because of the potential for tidal run-up from the Atlantic Ocean on the St. Johns River at the Putnam site. Both the Dixie and Levy sites are located farther from the coast than Crystal River; site elevation at Levy is greater than the elevation at Dixie and, therefore, would be expected to provide additional protection from storm surge flooding. Comparatively, the Crystal River site was considered to have a lower reliability/greater vulnerability rating since 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 9362 MW. Approximately 57 percent of PEF's total generating capacity will be represented by the proposed LNP units (2200 MW) and the generating capacity at the CREC (3148 MW).

Additional reliability concerns exist for the Highlands Site. Access to adequate cooling water and the siting of a CWIS at this site are problematic. The nearest cooling water source would be the southerly reach of the channelized Kissimmee River, also known as the C-38 canal. This stretch of the river will be affected by the proposed Kissimmee River Restoration Plan that is planned to convert much of the channelized C-38 canal back to the original Kissimmee River bed and to create approximately 27,000 ac. of additional wetlands. While not necessarily an unavoidable obstacle to obtaining cooling water for the site, any 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. In addition, 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. 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 eliminating the Highlands site from selection as the preferred site.

- **Water**: Given the consumptive water use pressures on Florida aquifers in the vicinity of the candidate sites and the uncertainty of future groundwater supplies and groundwater regulations, groundwater was considered an unavailable and/or unreliable source for the large quantities of cooling water. Potential surface water sources in the vicinity of the candidate sites include the use of existing freshwater rivers or Gulf of Mexico. Access to the CFBC to draw a volumetrically unrestricted water supply from the Gulf of Mexico was a major advantage of the Levy site. The CWIS for the Levy 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 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.
- **Land Acquisition**: Land would be available at the Crystal River, Levy, Highlands, and Putnam sites. The Dixie site ranked lower because land could not be readily acquired.

3.3.3 Potential Impacts

The following section considers potential impacts of each of the five alternative sites on the physical and biological characteristics of the environment and on special aquatic sites. The evaluation conducted specifically addresses the potential impact categories and factors identified in the 404(b)(1) Guidelines (subparts C through G).

3.3.3.1 Physical and Chemical Characteristics

Substrate

The development of this project would be expected to impact substrates within the development footprint in a similar way for each of the alternative sites considered. The area of site development would be similar at each site while impacts along the transmission system would be expected to be roughly proportional to the distance covered. The relative distances of the transmission systems associated with each alternative can be estimated from the distances calculated from each site to the project load center (PEF, 2007). Transmission distances are equivalent for Levy and Crystal River sites and are increased for the Dixie, Highlands, and Putnam sites by factors of 1.64, 1.29, and 1.57, respectively. Based on the land affected by both site and transmission system disruption, impacts to substrates would be least for the Levy and Crystal River sites and higher for the Highlands, Putnam, and Dixie sites.

Potential impacts on wetlands and wetland substrates are addressed in ER Subsection 3.3.3.1.3.

Suspended Particulates/Turbidity

There are no expected long-term effects of suspended particulates or turbidity associated with any of the alternatives considered. All construction and operation activities at any site

would be managed to avoid and minimize potential impacts of particulates and turbidity on aquatic systems.

Water Quality

No adverse impacts to water quality constituents would be expected at any of the alternative sites. At any of the sites, the plant would be constructed and operated within approved Environmental Resource Permit (ERP) and National Pollutant Discharge Elimination System (NPDES) permit conditions and would be required to meet state water quality standards. No site-specific modifications to plant construction or operation procedures would be expected to have substantially different effects at any of the five sites.

Current Patterns and Water Circulation

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 Florida Siting Study 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, Highlands, and Putnam 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 would be much more in confined riverine systems with a much greater relative impact on flows than would be expected at a site using marine waters. As discussed in ER Subsection 5.2.1.3, intake from the CFBC will cause a very slight increase in current and should improve water quality in the upper reaches of the CFBC. Potential changes are also discussed in a 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 LNP discharge at the CREC will result in no significant changes to existing conditions at the CREC (CH2M HILL, 2009b).

Salinity Gradients

Changes to salinity gradients are not expected for any of the alternatives considered. Due to increased cycles of concentration in the circulating cooling water systems anticipated for sites using freshwater (Dixie, Highland, Putnam), these sites would be expected to have a larger increase in the relative concentration of salts, as reflected in conductivity, than the LNP or CREC alternatives.

As discussed above 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 discussed 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
Normal water fluctuations will not be substantially altered for any of the alternative sites considered. Development of the project at any of the five sites will need to comply with applicable State regulations that are designed to ensure that offsite runoff is not increased after construction and that normal hydroperiods are maintained. Discussion of how water level fluctuations will be addressed at the LNP site is included in the ERP application included as Appendix 10.4 to the SCA (PEF, 2008) and in ER Subsection 5.2.1.

3.3.3.2 Potential Impacts on Biological Characteristics

Threatened and Endangered Species
The potential presence of protected species, both terrestrial and aquatic, was an important evaluation criterion for site selection. The PEF Florida Siting Study identified federally listed species, both aquatic and terrestrial, that were known or considered likely to occur in the vicinity of the five alternative project sites (PEF, 2007). The following modifications were made to the Siting Study findings:

- In the Siting Study, the American alligator (*Alligator mississippiensis*) was listed for the Highlands County site only. Because its listing is based on a similarity in appearance to the crocodile and because the alligator would be expected to be found in the vicinity of all sites, it was not included in the listings below.

- The Smalltooth sawfish (*Pristis pectinata*) was not originally identified in the Siting Study, and since it is believed to occur only in waters located far south of any of the project sites on the Gulf, it was not added to the listings.

- The Gulf sturgeon (*Acipmser oxyrinchus desotoi*) is believed to occur only in the vicinity of the Dixie site due to its presence in the Suwannee River. Since suitable habitat for this fish is not present near the Levy or Crystal River sites, it was removed from those lists.

The following lists summarize the potential for occurrence of protected species at the five final candidate sites.

- **Dixie Site**: A total of 11 federally listed threatened and endangered species are documented as occurring in Dixie County. Six federally listed protected aquatic species are found in the county.

TABLE 1
Threatened and Endangered Species in Dixie County

Common Name	Federal Status
Bald Eagle (*Haliaeetus leucocephalus*)	Threatened
Florida Scrub Jay (*Aphelocoma coerulescens*)	Threatened

TABLE 1
Threatened and Endangered Species in Dixie County

Common Name	Federal Status
Wood Stork (*Mycteria americana*)	Endangered
Red-cockaded Woodpecker (*Picoides borealis*)	Endangered
Eastern Indigo Snake (*Drymarchon corais couperi*)	Threatened
West Indian (Florida) Manatee (*Trichechus manatus*)	Endangered
Green Sea Turtle (*Chelonia mydas*)	Endangered
Leatherback Sea Turtle (*Dermochelys coriacea*)	Endangered
Loggerhead Sea Turtle (*Caretta caretta*)	Threatened
Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)	Endangered
Gulf Sturgeon	Threatened

The Dixie site is located on the Suwannee River in an area designated as Critical Habitat for the threatened Gulf sturgeon. The deep water and pool and riffle habitat present at the Dixie 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 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. 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 states of Georgia and Florida and the federal government have identified the Suwannee River as "an ecosystem in need of protection" and the FDEP has classified the waterway as an Outstanding Florida Water (OFW).

- **Highlands Site**: Thirty federally listed protected species, including 20 listed as endangered, occur in the vicinity of the site. 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.

TABLE 2
Threatened and Endangered Species in Vicinity of Highlands Site

Common Name	Federal Status
Florida Panther (*Felis concolor coryi*)	Endangered
Bald Eagle	Threatened

TABLE 2
Threatened and Endangered Species in Vicinity of Highlands Site

Common Name	Federal Status
Everglade Snail Kite (*Rostrhamus sociabilis plumbeus*)	Endangered
Florida Scrub Jay	Threatened
Wood Stork	Endangered
Red-cockaded Woodpecker	Endangered
Eastern Indigo Snake	Threatened
Florida Grasshopper Sparrow (*Ammodramus savannarum*)	Endangered
Audubon's Crested Caracara (*Polyborus plancus audubonii*)	Threatened
Sand Skink (*Neoseps reynoldsi*)	Threatened
Bluetail Mole Skink (*Eumeces egregious lividus*)	Threatened
Wireweed (*Sida acuta*)	Endangered
Snakeroot (*Argertina spp.*)	Endangered
Short-leaved Rosemary (*Conradina brevifolia*)	Endangered
Scrub Plum (*Prunus geniculata*)	Endangered
Scrub Mint (*Dicerandra frutescens*)	Endangered
Scrub Buckwheat (*Eriogonum longifolium var. gnaphalifolium*)	Threatened
Scrub Blazing Star (*Liatris ohlingerae*)	Endangered
Sandlace (*Polygonella myriophylla*)	Endangered
Pygmy Fringe-tree (*Cionanthus pygmaeus*)	Endangered
Pigeon Wings (*Clitoria fragrans*)	Threatened
Papery Whitlow-wort (*Paronychia chartacea*)	Threatened
Lewton's polygala (*Polygala lewtonii*)	Endangered
Highland's Scrub Hypericum (*Hypericum cumulicola*)	Endangered
Florida Ziziphus (*Ziziphus celata*)	Endangered
Florida Perforate Cladonia (*Cladonia perforate*)	Endangered
Florida Bonamia (*Bonamia grandiflora*)	Threatened
Carter's Mustard (*Warea carteri*)	Endangered
Britton's Beargrass (*Nolina brittoniana*)	Endangered
Avon Park Harebells (*Crotalaria avonensis*)	Endangered

- **Crystal River Site**: Eleven federally listed protected species occur in Citrus County. Five federally listed protected aquatic species have the potential to occur in Citrus County waters in the vicinity of the Crystal River site—one mammal species, four turtle species, and two fish species.

TABLE 3
Threatened and Endangered Species in Citrus County

Common Name	Federal Status
Bald Eagle	Threatened
Florida Scrub Jay	Threatened
Wood Stork	Endangered
Red-cockaded Woodpecker	Endangered
Eastern Indigo Snake	Threatened
Everglade Snail Kite	Endangered
West Indian (Florida) Manatee	Endangered
Green Sea Turtle	Endangered
Leatherback Sea Turtle	Endangered
Loggerhead Sea Turtle	Threatened
Kemp's Ridley Sea Turtle	Endangered

- Levy Site: Ten federally listed protected species occur in Levy County. The same five species of federally-listed protected aquatic species for the Crystal River site potentially exist in the vicinity of the Levy site, since the Levy and Crystal River sites are close geographically. Due to the historical use of the Levy 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; Florida Division of Administrative Hearings [FDOH], 2009). The CFBC is not ideal manatee habitat due to its shallow depth, lack of accessible vegetation, and steep, straight banks. However, any 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 (Bruzek, 2009). The CFBC does not serve as significant habitat for endangered fish species, such as the Gulf sturgeon or smalltooth sawfish (FDOH, 2009).

TABLE 4
Threatened and Endangered Species in Levy County

Common Name	Federal Status
Bald Eagle	Threatened
Florida Scrub Jay	Threatened
Wood Stork	Endangered
Red-cockaded Woodpecker	Endangered
Eastern Indigo Snake	Threatened
West Indian (Florida) Manatee	Endangered
Green Sea Turtle	Endangered
Leatherback Sea Turtle	Endangered
Loggerhead Sea Turtle	Threatened
Kemp's Ridley Sea Turtle	Endangered

- **Putnam Site**: Eight 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.

TABLE 5
Threatened and Endangered Species in Putnam County

Common Name	Federal Status
Bald Eagle	Threatened
Florida Scrub Jay	Threatened
Wood Stork	Endangered
Red-cockaded Woodpecker	Endangered
Eastern Indigo Snake	Threatened
Etonia Rosemary	Endangered
West Indian (Florida) Manatee	Endangered
Shortnose Sturgeon	Endangered

Recreational fishing in the St. Johns River, which abounds with largemouth bass (*Micropterus salmoides*), speckled perch (*Pomoxis nigromaculatus*), striped bass

(*Morone saxatilis*), catfish (*Suluriformes spp.*), and bluegill (*Lepomis macrochirus*), is important. Some 40 or more fishing camps exist along the banks of the river.

Fish, Crustaceans, Mollusks and Other Aquatic Organisms

Potential impacts to aquatic organisms associated with each of the alternative sites were considered in the Florida Siting Study (PEF, 2007). Each site is unique, and while some differences between the sites were noted, none was considered to be a strong differentiator.

It should be noted that additional information developed after the Florida Siting Study was conducted affects the evaluations presented in that document. In the Florida Siting Study, the Highlands site was rated slightly higher on this factor than the other four sites based on the absence of the shortnose sturgeon and Gulf sturgeon, respectively. Currently, it is understood that the Gulf sturgeon species is only present in the vicinity of the Dixie site. Also, the Florida Siting Study 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 offshore or coastal outfall location and reduces the potential for impact to fish, crustaceans (*Crustacea spp.*), mollusks, and other aquatic organisms. Based on these considerations, all sites are considered equivalent.

On December 18, 2001, the USEPA promulgated the NPDES Final 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 due to 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 discussed in the SCA and presented in additional detail in a supplemental 316(b) analysis (CH2M HILL, 2009c), the proposed project at this site would not adversely affect recreational or commercial fisheries. There is the potential for minor short-term impacts to recreational boat traffic use of the CFBC due to barge traffic during construction. There is no other water-related recreation anticipated that would be adversely impacted by activities at the Levy site.

Other Wildlife

Potential impacts to non-aquatic species were also considered in the Siting Study (PEF, 2007). This study concluded that none of the alternative sites should be excluded or avoided based on these ecological criteria. Based on a consideration of federally listed species, the Siting Study assigned the Dixie, Putnam, CREC, and LNP sites equivalent ratings on these criteria. The Highlands site was given a lower rating due to the presence of a large number of federally listed species in the vicinity.

3.3.3.3 Potential Impacts on Special Aquatic Sites

This section presents the potential effects of the alternative candidate sites and the selected preferred alternative site, the LNP site, on special aquatic sites. This section discusses the types, number, and location of special aquatic sites on or near the five final candidate 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 five candidate sites. Only one of the sites, Crystal River, directly intersects an aquatic sanctuary (Crystal River National Wildlife Refuge [NWR]), though all of the sites may be considered to have some proximity to sanctuaries, refuges, and/or endangered species habitat. As shown in Table 6, each of the candidate 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 sites (Crystal River, Levy) and may also be present at sites that could require river access (Dixie, Highlands, Putnam). Riffle and pool complexes are only associated with the Suwannee River in the vicinity of the Dixie site. Coral reefs and mudflats are not present at any of the sites.

The presence of special aquatic sites within the alternative site or within likely infrastructure corridors is specified in Table 6.

TABLE 6
Special Aquatic Sites Present within the Alternative Site or within Likely Infrastructure Corridors

Site Name	Sanctuaries/Refuges/Endangered Species Habitat	Wetlands	Vegetated Shallows	Riffle/Pool Complexes
Dixie	No	Yes	No	Yes
Highlands	No	Yes	No	No
Crystal River	Yes	Yes	No	No
Levy	No	Yes	No	No
Putnam	No	Yes	No	No

In addition to these special aquatic sites, the State of Florida has designated certain waters within the state as 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 site on the Suwannee River.

Sanctuaries, Refuges, 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 most important for linking existing conservation areas and protecting wildlife corridors for wide-ranging species, such as the Florida panther and Florida black bear but are also threatened by imminent development pressure. The Crystal River site is the only candidate site that intersected a critical linkage polygon in the GIS database associated with the Florida Ecological Greenways Network. The Chassahowitzka-Annutteliga Hammock-Green Swamp-designated habitat linkage covered most of the Crystal River site (5243.63 ac.). No other designated habitat linkages were shown in the database as intersecting the remaining four candidate sites.

Strategic Habitat and Conservation Areas are important to flora, fauna, and natural communities as determined by the Florida Fish and Wildlife Conservation Commission. The areas identify the particular species of wildlife predicted to occur for that location. Only two candidate sites intersected the Strategic Habitat Conservation Areas dataset: Crystal River and Highlands. According to the dataset, the Crystal River site contains bald eagles, Scott's seaside sparrow (*Ammodramus maritimus*), and wading birds. There are several areas on that site where the bald eagle and Scott's seaside sparrow habitats overlap. According to the dataset, the Highlands site contains Audubon's crested caracara and the mottled duck (*Anas fulvigula*). Again, there are a few areas where these two species habitats are predicted to overlap. No Strategic Habitat and Conservation Areas are shown to exist at the Levy, Dixie, or Putnam sites.

The federal 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:

- Class I Potable Water Supplies: 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 five final candidate sites intersect the boundaries of these two highest protected categories. The commercial shellfishing area, approximately 20 nautical miles north of the Levy and Crystal River sites near the Cedar Keys National Wildlife Refuge, is the closest Class II water to any candidate site.

Endangered species are addressed in Subsection 3.3.3.2 of this document.

Wetlands

The total estimated wetland acreages for each of the five final candidate sites are specified in Table 7.

TABLE 7
Total Estimated Wetland Acreages for Each of the Five Final Candidate Siting Areas

SITE	USFWS NWI (acres)	WMD FLUCCS (acres)
Dixie	547.72	601.41
Highlands	922.92	1157.75
Crystal River	1168.97	1324.10
Levy	1742.38	1691.96
Putnam	2173.15	2163.73

Notes:
USFWS = U.S. Fish and Wildlife Service
FLUCCS = Florida Land Use Cover and Forms Classification System
NWI = National Wetlands Inventory
WMD = Water Management District

It should be noted that although the wetland acreage cited above may be considered roughly proportional to the wetland acres present on each site, it is an inaccurate measure of total wetland functional loss for the following reasons:

- Wetland acreage numbers do not reflect avoidance and minimization strategies in siting specific facilities at each alternative location.
- Wetland acreage numbers do not reflect the quality of the wetlands impacted. For instance, wetlands on the Levy site have been extensively logged, and wetlands have been cleared and bedded to support planted slash pine.

While not reflecting functional qualities, an estimate of the relative wetland acreage losses associated with each candidate site can be derived by using the estimated wetland losses at LNP as a basis and assuming that wetland losses at the other alternative sites will be relatively proportional to the wetlands present, assuming similar avoidance strategies can be implemented (FLUCCS data are considered to be most accurate and were used in this analysis). In a similar fashion, the relative wetlands impacts from transmission systems can be estimated from relative distances calculated from each site to the project load center (PEF, 2007). Transmission distances are equivalent for LNP and the CREC and are increased for the Dixie, Highlands, and Putnam alternative sites by factors of 1.64, 1.29, and 1.57, respectively. Values used for the Levy site are for on-site development and do not include a projected 42 ac. of impacts associated with the pipeline corridor and barge slip, since all sites would have associated facilities, leaving no basis for comparing these impacts with those that would occur at other sites. The results of this analysis are presented in Table 8.

TABLE 8
Relative Wetland Acreage Losses Associated with Each Final Candidate Site

Site	Site Wetlands Impacted (acres)	Transmission Wetlands Impacted (acres)	Total Wetlands Impacted (acres)
Dixie	131	582	713
Highlands	252	458	710
Crystal River	288	355	643
Levy	368	355	723
Putnam	471	557	1028

The existing CREC had the lowest projected overall wetland acreage impact. Overall wetlands impacts associated with the Dixie, Highlands, and Levy sites were very similar, varying by less than 2 percent. Highest wetlands acreage impacts were associated with the Putnam site.

Wetlands on the portion of the CREC that would be available for development have not been subject to the high level of agricultural/silvicultural management as the greenfield sites. In addition, these CREC wetlands abut sensitive coastal systems and lie close to the Crystal River NWR. It should also be noted that upland impacts and habitat fragmentation would be expected to be proportional to transmission line length and would be highest for the Dixie, Putnam, and Highlands sites, while the Levy and Crystal River sites would have the least impact on these non-wetland resources.

The wetlands on the Levy site do not represent Aquatic Resources of National Importance (ARNI). The wetlands on the Levy 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 previously discussed, they also do not support a unique or diverse wildlife population. Additionally, FDOH (2009) found that the LNP is not anticipated to adversely affect the value or functions provided to fish and wildlife and listed species, including any aquatic and wetland species or other related-water resources.

Site-specific information collected for the Levy site shows that natural wetland functions have been diminished. As discussed in ER Subsection 2.4.1.1.1.1, the natural functional values of on-site wetlands such as surface water retention, nutrient cycling and wildlife habitat have been altered and diminished over several decades of silviculture operations at the LNP property. Wetland soils have been disturbed through bedding, road construction and compaction, and cypress trees have been logged and slash pine planted within wetland boundaries. Average scores for on-site 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), 2008). No unique or rare habitats or habitats with priority for protection were identified on-site, including on-site wetlands (ER Subsection 2.4.1.1.5.1). It should also be noted that the proposed Wetland Mitigation Plan, discussed further in Section 3.4, 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 (Durban, 2009).

While impacts resulting from cooling water makeup and blowdown pipelines, and facilities to support heavy equipment delivery, can not be determined quantitatively for all of the alternatives, these facilities would be required at any site. 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.

Vegetated Shallows

Marine vegetated shallows (seagrass beds) were located in the near-shore waters of the Gulf of Mexico at both the Levy and Crystal River sites. 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 potential 9-mile path of the offshore intake pipeline. The decision to route the LNP blowdown lines across the CFBC near the U.S. Highway 19 bridge crossing to the CREC discharge canal, rather than along a similar offshore route, also avoided potential construction impacts to seagrass beds to construct an offshore 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 Levy site.

The addition of the 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 the LNP wastewater. The addition of the LNP wastewater to the CREC discharge will not affect any of the flora or fauna in the adjacent Gulf of Mexico, including seagrasses (Blancher, 2009).

Riffle and Pool Complexes

The Dixie 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. Since the Dixie site was eliminated as a candidate site because land acquisition could not occur in a timeframe to support the project, no site-specific habitat or fisheries field studies were conducted at that site; therefore, the presence or absence of sturgeon spawning and rearing areas at the Dixie site remains speculative.

3.3.3.4 Potential Effects on Human Use Characteristics

The specific PIR factors discussed in this section include water supply and conservation, economics, aesthetics, historic properties, recreational and commercial fish and water recreation, flood hazards and flood plain values, land use and wildlife and recreational areas, energy needs, geologic suitability (site safety), air quality, food and fiber production, mineral needs, and considerations of property ownership.

Municipal and Private Water Supplies and Conservation
Water usage in all source waters is governed by individual water management districts in Florida and approval for proposed water usage is required by the respective water management district.

Water resource caution areas (WRCAs) identified by Florida water management districts 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 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. None of the other three sites (Levy, Crystal River, and Dixie) are located in a WRCA.

The primary water supply for the Dixie 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. It should also be noted that 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).

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 Highlands due to a planned restoration project for the Kissimmee River that includes conversion of the channelized C-38 canal back to a large portion of the original Kissimmee River bed and creation of approximately 27,000 ac. of wetlands.

The Crystal River site is located near the Gulf of Mexico; therefore, adequate cooling water is available and a reservoir would not have to be constructed (ER Subsection 9.3.3.1.3).

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. 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).

There may be water access difficulties at the Putnam site in light of the regulatory unknowns associated with the St. Johns River. The St. Johns River Alliance in coordination with the

SFWMD and the FDEP is developing a 4.6 billion dollar 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.

Water supplies for a facility at the Dixie site will also likely need to account for regulatory complexities associated with minimum flow levels set by the Suwannee River Water Management District on the Suwannee River (PEF, 2007).

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 includes 10 years prior to commercial operation of the LNP, when work to site, permit, design and construct the units will be accomplished, and 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 they could 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 an all natural gas generation reference plan in the majority of the CPVRR scenarios, even without accounting for 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 in operation today. This means relatively lower construction and operation costs for the Westinghouse AP1000 nuclear reactor than plants currently operating. The more efficient design for the Westinghouse AP1000 nuclear reactor also means greater reliability is expected compared to the nuclear plants currently operating (Crisp, 2008).

Transmission connection costs would be in the range of $560 to 725 million (M) at the northwestern sites (Dixie, Crystal River, Levy) and would be greater than $1 billion at Putnam ($1,013 M) and Highlands ($1,370 M). Much of the additional cost at the latter two 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 two-unit nuclear plant is injected into the system (ER Subsection 9.3.2.1.6).

The impact on area employment from construction and operation of the proposed nuclear power generating facility at the five alternative sites is considered equivalent because the sites are located near or within reasonable proximity of population centers and densely populated areas. The overall population levels for the five sites are sufficiently large that the impact on study area employment from construction of two new units would be low at each site. In general, all five sites are 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).

There are no significant health and safety impacts identified or expected from reactor construction and operation; consequently, there will be no environmental justice concerns, regardless of the percentage of minority or low-income populations found within the surrounding communities. There is no basis for differentiation between sites from an environmental justice perspective, despite differences in the percentages of minority and low-income populations found within the surrounding communities of each site. All sites are found to be equally and highly suitable (PEF, 2007).

All sites are located near suitable roads, which provide main access to the area; some construction of local access roads may be required at Dixie, Highlands, Levy, and Putnam. However, it is anticipated that there would be minor impacts to transportation on local roads during construction and operation activities at any of the sites. Mitigation measures for Dixie, Highlands, and Putnam are discussed in ER Section 9.3 and in ER Subsections 4.2.2 and 5.2.2 for the Levy site.

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.

Aesthetics

No adverse aesthetic environmental consequences are anticipated for the five alternative sites. Because the new reactors would be sited behind a substantial buffer of vegetated land controlled by PEC, construction and operational activities will not be visible to nearby residences, no changes in existing aesthetics of nearby aquatic ecosystems would be expected. There may be minimal impacts for some nearby residences at the five alternative sites to construction activities and there may be temporary impacts to aesthetic views during site clearing.

Historic Properties

The National Historic Preservation Act (NHPA) requires that projects subject to federal permitting 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 (NRHP). The Area of Potential Effect (APE) for such an evaluation of a proposed project is determined in consultation with the State Historic Preservation Officer (SHPO). Investigation would be required before siting a new nuclear power generating facility at any of the five alternative

sites. Appropriate mitigation measures would be put in place before construction and operation.

The following historic sites are located in the Dixie site vicinity: City of Hawkinsville (shipwreck) – Suwannee River, Old Town, and Garden Patch Archaeological Site at Horseshoe Beach (PEF, 2007).

There are no NRPH sites in the Highlands site vicinity.

The known NRHP sites in the Crystal River site vicinity are: Citrus County Courthouse, Old Building, and the Fort Cooper site in Inverness; the Yulee Sugar Mill Historic Site in Homosassa; Mullet Key Site and the Crystal River State Archaeological Site/Indian Mounds (2 mi. northwest of Crystal River on U.S. Highway19-98), a paved interpretive trail around a ceremonial mound complex built more than 2,500 years ago, encompassing four cultural periods in Florida's history.

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 Levy 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).

The known NRHP sites in the Putnam site vicinity include: Palatka: Bronson Mulholland House (also known as Judge Isaac Bronson House); Central Academy; Old A.C.L. Union Depot; Palatka North Historic District (see also Bronson-Mulholland Home and St. Mark's Episcopal Church); Palatka Ravine Gardens Historic District (also known as Ravine State Gardens); the Palatka South Historic District (bounded by St. Johns River, Oak, South 9th and Morris Streets); and St. Marks Episcopal Church (PEF, 2007).

Recreational and Commercial Fisheries and Water Related Recreation

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 bycatch. The increased volume of cooling water necessary to operate the new reactors at the five 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.

The Dixie site is in an area considered a pristine area, and development is highly dispersed. This region is a frequently visited recreational area, and much of the economy is dependant on aquatic and terrestrial ecotourism. In addition, large tracts of federal- and state-owned lands are located along the Suwannee River (PEF, 2007).

As stated above, 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. Lake Okeechobee supports commercial and sport fishing.

The CFBC, near the Levy and Crystal River sites, is a protected green belt corridor surrounded by a public park system. There are a number of boat launches, public and private parks and resorts in the vicinity (PEF, 2007). A deep water intake would be needed at the Crystal River site to have a minimal effect on entrainment of larval and the impingement of adult fish (ER Subsection 9.3.3.1.5).

The St. Johns River, near the Putnam site, is 1 of only 14 rivers designated an American Heritage River (top fishing spots covering 70 $mi.^2$ or river and lakes). In addition, there is a warm-water fish production resource, specifically a fish hatchery, downstream from the Putnam site (PEF, 2007).

Flood Hazards and Floodplain Values

The Dixie site, located on the Suwannee River, is at an elevation of about 23 feet and may be within or near the 100-year floodplain zone. The Suwannee River has a normal flow depth of about 4 feet and a 10-foot flood stage (PEF, 2007). The river elevation is tidally influenced by the Gulf of Mexico and, therefore, is susceptible to hurricane surge flooding (ER Subsection 9.3.2.1.6).

The elevation at the Highlands site is about 25 feet and Lake Okeechobee, the closest water body, is at elevation 14 feet. The site is located near isolated marsh lands west of the Kissimmee River and is located in a 100-year flood zone.

The Crystal River site is at 9-foot elevation and the site is relatively flat. The Gulf of Mexico tidal influence is approximately +/- 2 feet. The Crystal River site is located within a 100-year flood zone (PEF, 2007).

The elevation at the Levy site is approximately 44-feet and the area is relatively flat. The nearest water body is Lake Rousseau at an elevation of approximately 33 feet. The Levy site is located near 100-year flood zone boundaries.

The Putnam site is at an elevation of 20 feet and near the St. Johns River, which is normally at about 10 feet (PEF, 2007). Although the Putnam site is not located in 100-year flood zone, the site has the potential for tidal run-up from the Atlantic Ocean on the St. Johns River (ER Subsection 9.3.2.1.6).

Land Use and Recreational Areas

The Dixie 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 consistent for 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. Both land use change and

zoning change would be required. Large public ownerships in Dixie County include the Lower Suwannee National Wildlife Refuge and Nature Coast State Trail (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. Both land use change and zoning change would be required. The Brighton Indian Reservation, the Highlands Hammock, and Lake June Scrub State Parks, as well as 18 county parks and 95 lakes, are located in Highlands County (PEF, 2007).

Crystal River is characterized by industrial development, with both nuclear and fossil power plants and associated support facilities present, although areas that would be newly disturbed in adding to new units at Crystal River are ecologically similar to the greenfield sites. However, there are many special public ownership features around the site, including Withlacoochee State Forest Crystal River and Chassahowitchka NWR, Fort Cooper State Park, Homosassa Springs State Park, and the Withlacoochee State Trail (PEF, 2007).

The Levy 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). Large public ownerships in Levy County include Cedar Keys NWR, Goethe State Forest, Manatee Springs State Park, and Cedar Key Scrub State Preserve (PEF, 2007). PEF filed applications with Levy County for a comprehensive plan amendment and special exception zoning approval for the LNP. 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, 2009).

Land use surrounding the Putnam site is mostly agricultural. 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). Large public ownerships in Putnam County include the Ocala National Forest (portions) and the Ravines Garden State Park (PEF, 2007).

Navigation

No adverse impacts to river and ocean navigation are anticipated for the five final candidate sites.

Energy Needs

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. PEF's 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 in order 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. This IRP process in Florida 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, 2184 megawatts (MW) for summer net capacity and 2240 MW for winter net capacity are identified as "planned, prospective, or committed project" (see ER Tables 8.1-6 and 8.1-7). These planned additions for 2016 and 2017 will need to be baseload capacity. 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, as compared to 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 discussion on the need for power is provided in ER Chapter 8.0.

Geologic Suitability (Site Safety)

Geotechnical suitability is an important characteristic that affects both the costs and the safety associated with site development. Site-specific investigations were conducted to determine the suitability of each site to support the development of a nuclear generating station.

The Dixie site is primarily rock; however, the limestone rock is of variable quality and is subject to solution activity and the formation of surface and subsurface sinkholes (karst areas). No surface faulting or deformation is known to occur near the site (ER Subsection 9.3.3.2.1).

The geology of the Highlands site consists of undifferentiated sediments consisting primarily of sands and silty clays. Under this layer is Hawthorn Group sediments consisting predominately of sands, clays, limestone, and dolostone. The Hawthorn sediments are underlain by the Suwannee and Ocala Limestones. No surface faulting or deformation is known to occur at the site. The site is located in an area of potential solutioning and sinkhole formation (ER Subsection 9.3.3.3.1).

The Crystal River site is underlain by Ocala Limestone and Avon Park Limestone. Therefore, this site is considered to be rock. Possible geologic hazards associated with this site include the potential for solution cavities within the limestone. Additionally, the site is located adjacent to the Gulf of Mexico and, therefore, is subject to seismic and other induced water waves and floods. No surface faulting or deformation is known to occur near the site (ER Subsection 9.3.3.1.1).

The Levy site area is underlain by less than 20 feet of unconsolidated sediments (sand, silt, clay) followed by the Ocala Limestone. Therefore, this site is considered to be a rock site. However, the limestone rock is of variable quality, some of it is poorly indurated, and it is subject to solutioning and sinkhole formation.

The geology of the Putnam site consists of undifferentiated sediments consisting primarily of sands and silty clays, which are underlain by Hawthorn Group sediments consisting predominately of sands, clays, limestone, and dolostone. The Hawthorn sediments are underlain by Ocala Limestones. No surface faulting or deformation is known to occur at the site. The site is located in an area of potential limestone solution and sinkhole formation (karst development) (ER Subsection 9.3.3.4.1).

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 five final candidate 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 expected to not be significant. In addition, these potential impacts can be minimized with the use of drift eliminators on the cooling towers (PEF, 2007). The LNP will not have an adverse or discernible impact on ambient air quality at the LNP site, or at any location, for any regulated air pollutant. Operation of the LNP cooling towers will not cause discernible impacts on any natural resources, including surface waters or wetlands (Howroyd, 2009).

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

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 greenfield sites exhibit land cover typical of open forested pineland. There is considerable existing farming activity on and near the Highlands site (that is, dairy and cattle) (PEF, 2007).

Mineral Needs

There are no known mineral resources of economic significance on the five final candidate sites. Quarries are limited in the vicinity of the Levy site.

Considerations of Property Ownership

The schedule for plant development required to meet projected customer needs and PEF business objectives for the new units does not allow for 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 to identify parcels of adequate size at each of the sites and to make initial contact with landowners to arrange for site access for on-site geotechnical investigation and to assess availability of the property for sale (ER Subsection 9.3.2.1.6).

Construction of the Dixie site would require that the land be purchased and improved; however, acquisition of land at the Dixie site by PEF would not be feasible in the required time frame (PEF, 2007).

Land would be available at the Crystal River (adjacent to the existing site), Levy, Highlands, and Putnam sites. However, at the Highlands site, coordination of water supply strategy with ongoing water resources plans of regional water management districts at that site would likely preclude development of new units on the schedule required.

3.3.4 Evaluation of Dredged or Fill Materials

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 rigorous best management practices (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 are considered non-hazardous (CH2M HILL, 2009d).

3.4 Actions to Minimize and Mitigate Adverse Impacts of LNP

As noted in Subsections 3.3.3.3 and 3.4 of this document, the LNP COLA ER, and the State of Florida SCA, the preferred Levy 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 not intersecting with these areas and committing to use technologies and construction techniques that will minimize the potential that adverse impacts will not occur. These are discussed further in Subsections 3.4.1 and 3.4.2.

While the preferred site will impact wetlands, these impacts have been avoided or minimized to the extent practicable using alternative on-site locations for power plant infrastructure components and corridor infrastructure routing and where wetland avoidance is not possible, PEF has proposed a landscape level wetlands mitigation plan for those impacts.

Section 4.0 summarizes the location and technology alternatives applied to the Levy site and the work to avoid environmental impacts to special aquatic sites, thus meeting the LEDPA test under the provisions of CWA Section 404(b)(1).

3.4.1 Marine Sanctuaries and Refuges

None of the proposed water-dependent project elements (CWIS, barge slip, or blowdown pipeline crossing) intersect with established marine sanctuaries or refuges.

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 Levy site have led to the conclusion that only the West Indian (Florida) manatee, an endangered species, will likely use locations in the CFBC potentially affected by the water dependent project elements discussed in Subsection 1.1. These study results are presented in detail in Technical Memorandum 338884-TMEM-087: "Aquatic Ecology Sampling Report" (CH2M HILL, 2009e). 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.

3.4.2 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. 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 there are seagrasses in the Gulf of Mexico in the area 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).

3.4.3 Wetlands

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

The Levy site is a silvicultural site that has been used for many decades for the production of pine. The clearing of native vegetation has altered the site from a natural Florida landscape into a monotypical landscape in both upland and wetland areas, with reduced functional attributes. Most of the forested wetlands in the footprint of development have been cleared of trees. There are no open water bodies or streams on the Levy site. While there are some flow-way connections between some of the wetlands, they are not of a kind

that will support long-term fish habitat or aquatic insect communities (Durbin, 2009; BRA, 2008).

The maximum anticipated wetlands impacts for the entire project, including the Levy site, transmission corridors, blowdown pipelines, and barge slip, are estimated to be less than 765 ac. The impacts can be broken down into: 13.3 ac. of open water, 638.4 ac. of forested wetlands, and 113.0 ac. of herbaceous wetlands. Less than one-half (368.0 ac.) of the wetlands impacts are expected to occur on the Levy site and the remainder (396.7 ac.) are expected to occur off-site. The 765-ac. wetland impact is a conservative estimate, including long-term and short-term impacts that are the result of direct dredging and filling, as well as temporary disturbance. The actual wetland impact will likely decrease as the routing is refined within corridors and on the Levy site itself (BRA, 2008; Durbin, 2009).

Alternatives to impacting these wetland areas were carefully considered during the site development planning activities, and the locations of major plant components, ancillary facilities, and infrastructure corridors have been located to the extent possible to avoid or minimize impacts to wetlands. To the extent practicable, PEF avoided wetlands in making these engineering decisions. For example, the routes of the heavy haul road and permanent site access road are not straight, but instead the roads follow paths designed to avoid wetlands to the extent practicable (Durbin, 2009).

PEF will offset impacts caused by the construction and operation of the project through wetlands mitigation. The amount of wetlands mitigation required for the conservatively estimated 765-ac. impact is determined through the application of the Florida Uniform Mitigation Assessment Methodology (UMAM). The UMAM is used to quantify the degree of functional loss for all areas to be impacted, based on their characteristics (BRA, 2008). The UMAM process allows for the establishment of a quantitative value representing the function of a given wetland. This value depends on three factors: (1) location and landscape; (2) community structure; and (3) water environment. The combination of scores on these three factors forms the UMAM score for the individual wetland (Durbin, 2009). The impacted wetland is then evaluated as having UMAM loss units (BRA, 2008; State of Florida, 2009).

The UMAM loss units associated with the project total approximately -411 loss units. Well under one-half of the loss units will occur on the Levy site (-183.4) and the remainder (-227.5) are expected to occur off-site (BRA, 2008). This UMAM scoring indicates that, on average, the wetlands being impacted have approximately one-half of the functional ecological value that an ideal wetland system would have, largely due to the silviculture activity on the site (State of Florida, 2009). This UMAM analysis further confirms that the onsite wetlands are not ARNIs.

On January 12, 2009, PEF submitted to FDEP a Wetlands Mitigation Plan for the PEF Levy Nuclear Plant and Associated Transmission Lines (WMP). 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).

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 clear availability of more than ample available mitigation to offset LNP impacts to wetlands through a variety of options (BRA, 2008). The proposed mitigation for the LNP will achieve greater offset of wetlands impacts from a regional perspective and is expected to provide significant long-term ecosystem benefit. 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 would provide a large wildlife corridor, a natural habitat corridor that will be enhanced through mitigation activities (Durbin, 2009). Final wetland mitigation plans will be developed in consultation with the USACE and FDEP and will be in accordance with all applicable federal and state regulations.

A rigorous avoidance and minimization strategy was implemented throughout Levy 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. Again, the Levy site does not have an extensive amount of very high quality wetlands (Durbin, 2009). As shown in Attachment 1 to the WMP, the UMAM scoring indicates that, on average, the wetlands being impacted have approximately one-half of the functional ecological value that an ideal wetland system would have (State of Florida, 2009). In addition, PEF looked at ways to reduce and eliminate wetland impacts at several levels, including site selection, routing of roadways, and commitments through discussions with state agencies to further reduce impacts as transmission line routes are selected within the transmission corridors (Durbin, 2009). 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.
- On-site wetlands were characterized in accordance with the UMAM, 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 transmission lines to be constructed to integrate the LNP to the transmission system are collocated with or within existing ROW. This minimizes the amount of new ROW needed and allows for the use of existing access roads where they exist.

- Where new ROW is needed exiting the LNP, PEF proposes to collocate all four 500-kV transmission lines in one corridor, thus reducing the amount of ROW needed, and if necessary to construct only one access road to serve all four transmission lines.
- Wetlands will be protected throughout construction and operation through the implementation of BMPs, such as using swamp mats to avoid soil compaction and silt fencing to reduce sedimentation. Groundwater and wetland monitoring will be conducted so that if any adverse impacts from the project to the remaining systems are observed, corrective action can be taken.

3.4.4 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 entering and reaching the location of the CWIS in the upper end of the CFBC. Manatees are known to be 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 for 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.

4.0 Summary of LEDPA Analysis

PEF has evaluated both design and site alternatives for providing electric customers within their service area with reliable baseload electrical generation. The No Action alternative was also considered but rejected because it would not meet the project's basic purpose or need. Nuclear generation was determined to be the preferred and practicable design alternative based on cost, technology, logistics, and environmental considerations in light of the need to meet the overall project purpose.

A large number of alternative sites were also considered and a list of five candidate sites identified for detailed evaluation. These sites were located in Dixie County, Highlands County, Putnam County, Citrus County, and Levy County. All the sites were greenfield sites except the Citrus County site, which was located on the site of the existing PEF CREC. Table 9 provides the primary reasons why the evaluation process resulted in the selection of the Levy site as the preferred site for the LNP. Details regarding the alternatives evaluation

are included in the PEF proprietary siting study that has been provided to the USACE (PEF, 2007).

TABLE 9
Summary of Results of Environmental Criteria Evaluation for the Final Candidate Sites

Final Candidate Sites*	Environmental Criteria (*Non-Environmental Selection Criteria*)
Dixie	Estimated 713 ac. of wetland impacts (not including impacts associated with makeup water supply and discharge pipelines and heavy equipment delivery). The Dixie site is located near the Suwannee River and would use the river for water supplies in an area designated as Critical Habitat for the threatened Gulf sturgeon. In addition, the states of Georgia and Florida and the federal government have identified the Suwannee River as "an ecosystem in need of protection" and the FDEP has classified the waterway as an OFW. Adult Gulf sturgeon pass by the site on their way to proven upstream spawning grounds and juvenile sturgeon must pass by the site during out-migrations to the Gulf. 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 to a BTA designed CWIS would likely be required to assure minimization of impacts to migrating sturgeon. *(Geologic conditions unacceptable due to numerous sink holes, depressions, voids and cavities encountered during site coring. Transmission system distances, impacts, and costs are higher than those for the Levy site. There are also potential site acquisition issues.)*
Highlands	Estimated 710 ac. of wetland impacts (not including impacts associated with makeup water supply and discharge pipelines and heavy equipment delivery); 30 federally protected species occur in the site vicinity. The stretch of the Kissimmee River adjacent to the site, which is the potential source of cooling water, will be affected by the proposed Kissimmee River Restoration Plan, which would convert much of the channelized C-38 canal back to the original Kissimmee River riverbed and create approximately 27,000 ac. of additional wetlands. Future use of waters would have to be coordinated with the USACE and the SFWMD and be consistent with each agency's efforts to implement the CERP as well as the Kissimmee River Restoration Plan. The area incorporating the Highlands site has been designated part of a Critical Water Supply Problem Area under SFWMD Rule 40E-23.021(2). The anticipated difficulties in obtaining groundwater allocation approvals and the unknown future effects of the two area restoration programs on surface water supply and CWIS location were major factors in eliminating the Highlands site from being selected as the preferred site. *(Geologic conditions are also difficult due to deep soil deposits and 100-foot depth to bed rock. This site and the Putnam site were considered least suitable of the alternatives from a geotechnical perspective. The site is located in a WRCA. Transmission system distance, impacts, and costs are higher than those for the Levy site.)*

TABLE 9
Summary of Results of Environmental Criteria Evaluation for the Final Candidate Sites

Final Candidate Sites*	Environmental Criteria (*Non-Environmental Selection Criteria*)
Crystal River	Estimated 643 ac. of wetland impacts (not including impacts associated with makeup water supply and discharge pipelines and heavy equipment delivery). Located adjacent to the Crystal River National Wildlife Refuge. The Chassahowitzka-Annutteliga Hammock-Green Swamp designated as a Florida Ecological Greenways Network and Critical Linkages covered most of the candidate Crystal River site. This site is located in a Strategic Habitat and Conservation Area and is considered important to flora, fauna, and natural communities as determined by the Florida Fish and Wildlife Conservation Commission. (*Crystal River was considered to be the least reliable site in terms of potential storm damage due to its low elevation and location directly on the coastline. An important reliability decision was made not to concentrate new nuclear generating units at a site with higher potential for storm event damage than LNP site offers.*)
Putnam	Estimated 1,028 ac. of wetland impacts (not including impacts associated with makeup water supply and discharge pipelines and heavy equipment delivery). The protected Shortnose Sturgeon is present in St. Johns River in the site vicinity and the extent of the spawning area for this species is unknown. The placement of a CWIS in this portion of the St. Johns 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 to a BTA designed CWIS would likely be required to assure minimization of impacts to migrating sturgeon. There is high public interest associated with recreational fishing in the St. Johns River and some 40 or more fishing camps exist along the banks of the river. The entire site is located in a WRCA, considered by the St Johns River WMD to be a potential *priority* WRCA. *(Geologic conditions difficult due to thick soil deposits and 185 foot depth to bed rock. This site and the Highlands site were considered least suitable of the alternatives from a geotechnical perspective. Transmission system distance, impacts, and costs are higher than those for the Levy site.)*

TABLE 9
Summary of Results of Environmental Criteria Evaluation for the Final Candidate Sites

Final Candidate Sites*	Environmental Criteria (*Non-Environmental Selection Criteria*)
Levy	Estimated 723 ac. of wetland impacts (not including an additional 42 ac. associated with makeup water supply and discharge pipelines and heavy equipment delivery). **The site was selected as the preferred site**. Factors recommending this site included an abundant and reliable cooling water supply and a favorable elevation and distance from coast to buffer the site from storm event effects. Wetlands on-site have been disturbed by silviculture activities. The cooling water intake location at head of CFBC is unlikely to cause adverse impacts to protected species and likely to improve poor water quality conditions now existing in upper CFBC. (*Acceptable geologic conditions. Transmission distances and associated impacts and costs are less than those projected for the Dixie, Highlands, and Putnam sites.*)

*Validation Note: This is a summary table from the other LEDPA sections.

Based on the analysis detailed in the body of this response and summarized in Table 9, the following site selection matrix has been prepared, presenting the findings of this LEDPA analysis.

TABLE 10
Site Selection Matrix

Criteria	Dixie	Highlands	Crystal River	Putnam	Levy
Practicable, considering cost, logistics, and technology	No	No	No	No	Yes
Available to the applicant	No	Yes	Yes	Yes	Yes
Less impact on the aquatic environment	No	No	No	No	N/A
Other significant environmental impacts	Yes	Yes	Yes	Yes	No
Meets the applicant's overall purpose	Yes	Yes	No	Yes	Yes

The requirement of meeting the CWA 404(b)(1) LEDPA requirement for issuance of a USACE 404 permit, including the PIR factors listed under 33 CFR 320.4(a), have been 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 why PEF believes a Section 404 permit should be issued for the LNP site:

- Alternative Site Selection Process

  The PEF site selection process included consideration of aquatic ecology criteria that seriously considered the avoidance and/or minimization of impacts to the aquatic environment. Twenty sites were initially considered as a potential location for this nuclear power plant project and five final candidate sites were carefully evaluated. The Levy site was selected as the preferred site because it was judged to best meet the applied selection criteria.

- Practicable Alternative Infrastructure

  The water-dependent project infrastructure at the Levy 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 to 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 proposed heavy equipment delivery barge slip and the blowdown pipeline crossing of the CFBC will assure that adverse impacts to protected aquatic species will not occur.

- 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 3.3.3.3, the wetlands on the Levy 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.

  The applicant will comply with all environmental, licensing, and permitting requirements applicable to this proposed project, including the LEDPA requirements of the 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 mitigated appropriately following negotiations with the USACE and Florida state agencies.

  The fundamental precept of the 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.

With respect to the four conditions that must be satisfied in order to comply with the guidelines of 40 CFR.230 (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.

   The Levy and Crystal River sites are the only sites with access to an unlimited, relatively low-quality source of cooling water from the Gulf of Mexico via the CFBC. None of the other alternative sites considered has fewer adverse environmental consequences than the Levy 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 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 impacts to 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 analysis 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 resource 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 404(b)(1) guidelines and that a permit from the USACE should be issued allowing the construction of the LNP.

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